

Retention of Mild Asthmatics in the Navy (REMAIN): A Low-Risk Approach to Giving Mild Asthmatics an Opportunity for Military Service

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ABSTRACT Objective: Rising U.S. asthma prevalence will be reflected in military applicants. We studied retaining mild asthmatics on active duty. Methods: A cohort study at Great Lakes Naval Training Center from 2000 to 2002 compared recruits diagnosed during basic training with mild asthma to matched comparison recruits on outpatient visits, hospitalizations, and discharge through August 2003. Results: A total of 136 asthmatic and 404 control subjects were enrolled. Overall attrition was greater among the asthma cohort ($p < 0.01$), largely during training. Asthmatics used more health care than controls during training (0.1 vs. 0.004 per person-month). No asthma-related hospitalizations or deaths occurred during the study. Conclusions: Although attrition during recruit training was higher in mild asthmatics, nearly 40% of recruits were retained on active duty without significant risk of hospitalization or excessive outpatient treatment after recruit training. These findings argue for consideration of a trial on active duty for recruits with mild asthma.

INTRODUCTION

Asthma is a chronic disease affecting both children and adults which has increased dramatically in U.S. prevalence and public health burden over the last several decades. From 1980 to 1996, the estimated 12-month prevalence of asthma in the United States increased nearly 74% to 14.6 million persons, with an overall lifetime prevalence rate of nearly 10%.¹ Recognized as a leading cause of chronic childhood disease among children <18 years of age, the overall prevalence of ever being diagnosed with asthma is 12.5%, with a prevalence of nearly 15% among 12- to 17-year olds.² A recent report from the Youth Risk Behavior Survey revealed a self-reported asthma prevalence of 18.9% among high school students with 16.1% reporting current asthma.³

The increasing prevalence of asthma, particularly among children and youth, suggests that the U.S. military will likely see a parallel increase in the number of applicants reporting a history of asthma. Historically, asthma has significantly impacted U.S. military expenditures and negatively impacted end strength.⁴⁻⁷ Currently, ~1,000 recruits are discharged annually for asthma within their first 6 months of service,⁸ thereby inhibiting military readiness and costing the Department of Defense (DoD) more than \$18 million per year in recruiting and accession costs (W.L. Moore, unpublished data). It is estimated that >50%

of military recruits receiving an early discharge for asthma enter the service without revealing their disease during initial medical screening and examination.⁸

Efforts to reduce the number of early discharges for asthma have historically focused on screening out high-risk applicants. Before 2004, a history of asthma at any age was disqualifying for military service.⁹ Applicants disqualified because of a history of asthma may request a waiver from the service waiver authority to allow that individual accession into the military. This approach was justified by the recognition that one-third to two-thirds of asymptomatic individuals with a history of childhood asthma are at greater risk of developing overt asthma in the future.^{10,11} Given the rising prevalence of asthma among the recruit population, however, it also potentially disqualifies a large percentage of military applicants.

The asthma accession standard was made more lenient in 2004 by stipulating disqualification for asthma (either symptomatic or requiring treatment) only if diagnosed after the 13th birthday.⁹ This decision was largely based on results from a cohort study of 587 recruits who entered the service with a waiver for a remote history of childhood asthma and 1,761 fully qualified matched controls. Findings revealed that those with a past history of childhood asthma did not pose a significant occupational liability in terms of future asthma-related hospitalization or early military attrition.⁷

Based on these data and the fact that asthma is generally considered a manageable disease in the civilian population^{12,13} and in the military outside of training and deployed environments, the Navy requested a study of retaining on active duty mild asthmatics diagnosed during training and providing them with standard-of-care medical treatment to include inhaled medications and patient education based on the current national asthma guidelines.^{12,13} The impact of this

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program was measured in terms of acute, episodic visits for respiratory complaints, clinic visits for asthma, hospitalization for asthma, and overall attrition. This evidence-based outcome data will enable policy makers to determine the best course of action vis-à-vis further changes to DoD asthma accession standards for recruits with mild asthma.

METHODS

A prospective study was conducted at Great Lakes Naval Training Center (NTC) with Navy recruits diagnosed with mild asthma who previously would have received an early discharge (existing before service (EPTS)) from the service. Fully qualified controls were selected from the same recruit population and matched 3:1 on age (± 1 year), sex, race, and date of entry (± 1 month) into the service. Controls had to be on active duty on the day of the case's diagnosis thus controlling for lead time differences (time to diagnosis of asthma). Enrollment occurred between July 26, 2000 and July 25, 2002. Study subjects were followed until August 31, 2003.

All recruits with symptoms suggestive of asthma were referred to a designated asthma clinic where they were evaluated by a board certified internist via a self-administered asthma history form, physical examination, and pulmonary function tests. Patients with a forced expiratory volume in 1 second (FEV_1) $\geq 80\%$ of predicted were administered a methacholine challenge test. The methacholine challenge test was considered positive if the patient's FEV_1 decreased $\geq 20\%$ after an inhaled concentration of < 8 mg/ml.

Mild asthma was defined as having symptoms of asthma during the day that did not occur daily (unless associated with exercise), symptoms of asthma during the night less than four times a month, having a $FEV_1 \geq 80\%$ predicted, and one of the following: (1) demonstrated reversibility of FEV_1 of $> 12\%$ with bronchodilators, (2) a positive methacholine challenge, or (3) a nondiagnostic methacholine challenge test with a strong history for asthma after other causes were ruled out. This definition is generally consistent with the guidelines from the National Asthma Education and Prevention Program second expert panel, 1997,¹⁴ the exception being daily symptoms which could occur during the mandatory exercise requirement for all recruits. All recruits with $FEV_1 < 80\%$ diagnosed with moderate or severe asthma were discharged from the Navy in accordance with DoD Instruction 6130.4.⁹

After completion of initial entry training, recruits diagnosed with mild asthma were not eligible for special duty, such as diving, submarine, or flight, which have special physical qualifications due to their unique operational environments and associated health risks, but were otherwise worldwide deployable. After initial evaluation, diagnosis, appropriate asthma medication, and patient education, the recruits were expected to fully participate in unrestricted recruit training using their prescribed medication as needed.

Both cases and controls were asked to complete a self-administered questionnaire that included baseline data on smoking, previous asthma symptoms, family history of asthma, known allergies, and presence of inciting factors that worsen asthma symptoms such as cold, heat, or exercise. Study subjects gave informed consent to allow access to clinical data. The entire cohort was followed for medical care utilization and discharge from the service.

Outcome data were obtained from a variety of sources: EPTS records from the Military Entrance Processing Command and additional service loss from the Defense Manpower Data Center, Standard Training Activity Support System, and Great Lakes NTC's personnel outprocessing station. The U.S. Army Medical Command Patient Administration System and Biostatistics Activity Standard Outpatient Data Record and Standard Inpatient Data Record were accessed to obtain outpatient and inpatient records, respectively. The protocol was approved by the Institutional Review Board and Human Use Committee of the Walter Reed Army Institute of Research and was funded by the Chief, Bureau of Medicine and Surgery.

STATISTICAL ANALYSIS

Initial analyses centered on attrition during recruit training. The first endpoint was defined as discharge from the service for any reason, including a nonmedical reason. Secondary endpoints included an asthma-related discharge for a condition that existed before service, a disability discharge for asthma, outpatient visits for asthma, or a hospitalization for asthma.¹⁵ A recruit with a disqualifying illness that was pre-existing and that manifested during the first 6 months of service most likely will be given an EPTS discharge; however, individuals are discharged on a case-by-case basis. All losses were weighted equally in this analysis.

Secondary analyses started with the study population who graduated from recruit training. The 3:1 matching could not be maintained for the recruit training graduate analysis due to losses in the control population; therefore, we used 2:1 matching for all secondary analyses. Variable follow-up times were accounted for in the analyses using the Kaplan-Meier model and tested by log-rank, likelihood ratio, and Wilcoxon tests at the 0.01 level of significance. All losses were weighted equally in this analysis.

Questionnaire data were evaluated by χ^2 analysis comparing cases and controls and cases that received early discharge from cases that remained on active duty. No attempt was made to control for potential under-reporting bias due to questionnaire nonresponders. Data analyses were performed with SAS version 9.1 (Cary, North Carolina) or STATA version 8.0 (Statacorp LP, College Station, Texas). All reported p values are two sided.

RESULTS

In total, 136 recruits were diagnosed with mild asthma and given a trial on active duty as part of this study. The full complement of 3 control subjects could not be found for a

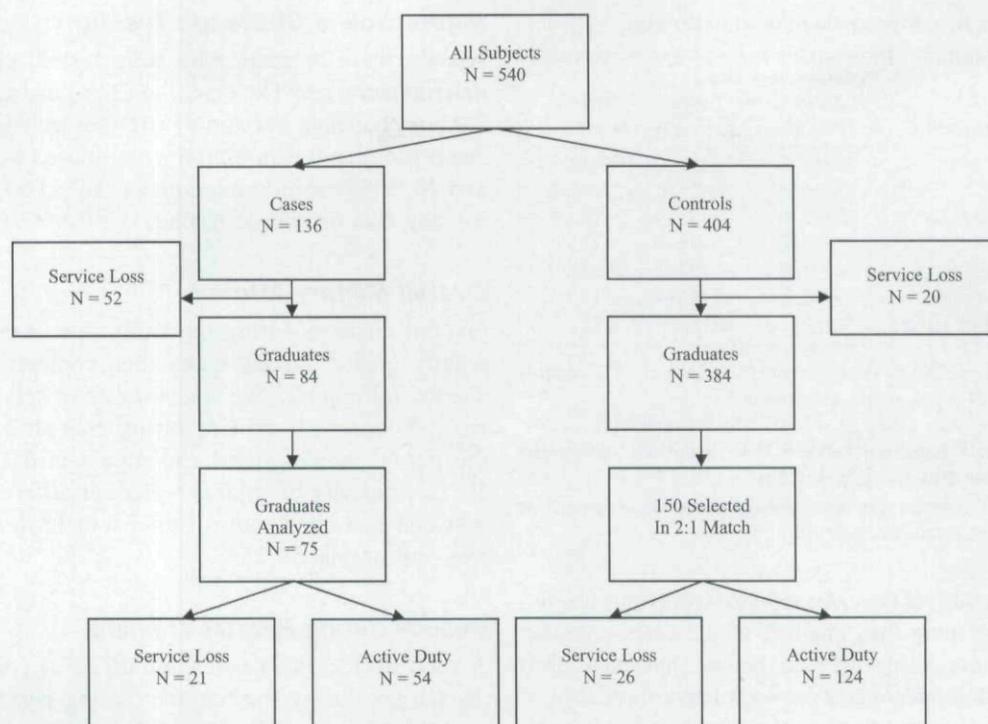


FIGURE 1. Population diagram of study subjects.

few of the cases, resulting in a total of 404 controls, a ratio of controls to cases slightly less than the prescribed 3:1. Figure 1 illustrates the population of subjects included in the study from study enrollment through basic training and either service loss or continuation on active duty. Cases and controls were mostly young (71% <19 years), male (>70%), and Caucasian (>50%) (Table I). Mean time on active duty in months was 14.0 (SD = 12.6) for cases and 22.7 (SD = 10.1) for controls. Females and African Americans were overrepresented in the study population compared to the entire population of recruits who entered Navy basic training around the study time frame ($p < 0.01$ in both comparisons). A majority of subjects were single, had a high school degree or GED equivalent, and had no previous military service.

Questionnaire Data

The questionnaire collected baseline data on smoking, asthma symptom history, previous diagnosis or treatment for asthma, family history of asthma, known allergies, and presence of inciting factors that worsen symptoms such as cold, heat, or exercise (Table II). Ninety-six percent (131 of 136) of cases and 87% (355 of 408) of controls completed the self-administered questionnaire. Forty percent of mild asthmatics had a family history of asthma, 60% gave a history of childhood asthma, and 48% reported having asthma symptoms within the last year. It is noteworthy that only 5 (1.4%) controls reported a history of asthma symptoms during the past year. Cases diagnosed with mild asthma and discharged from mil-

TABLE I. Demographics of the REMAIN Study Population

Demographics	Mild Asthma, <i>n</i> = 136 (%)	Controls, <i>n</i> = 404 (%)
Age (years)		
17-29	98 (72)	282 (70)
20-24	35 (26)	111 (27)
25+	3 (2)	11 (3)
Gender		
Male	98 (72)	292 (73)
Female	38 (28)	110 (27)
Race		
Caucasian	79 (58)	237 (59)
African American	38 (27)	113 (28)
Other	19 (14)	52 (13)
Education level		
Less than high school	5 (4)	11 (3)
High school	82 (63)	244 (69)
Some college	25 (19)	60 (17)
College	1 (0.8)	0 (0)
GED	18 (14)	39 (11)
Marital status		
Married	12 (9)	16 (5)
Single	119 (91)	336 (95)
Prior service		
Yes	2 (2)	1 (0.3)
No	129 (98)	354 (99.7)

REMAIN, Retention of Mild Asthmatics in the Navy.

itary service were just as likely to respond positively to each of the baseline history questions as mild asthmatics that remained on active duty.

TABLE II. Asthma Questionnaire Results

Question Category	Nondischarged		Controls (N = 355)
	Cases (n = 59)	Cases ^a (n = 72)	
Smoking history (ever)	31 (52.5)	36 (50.0)	176 (49.6)
Recent smoker	18 (30.1)	18 (25.0)	122 (34.4)
Family history of asthma	25 (42.4)	28 (38.9)	34 (9.6) ^b
Allergies	7 (11.9)	8 (11.1)	4 (1.1)
Precipitating factors ^c	54 (91.5)	67 (93.1)	79 (22.2)
Asthma within past year	27 (45.8)	36 (50.0)	5 (1.4)
Previous diagnosis of asthma	34 (57)	47 (66)	7 (2)

Represents 96% (131 of 136) of the cases and 87% (355 of 408) controls who completed the self-administered questionnaire.

^a Compared with active duty cases; χ^2 , $p > 0.05$ for all categories.

^b Statistically significant difference between mild asthmatics (discharged and nondischarged) and controls; χ^2 , $p < 0.001$.

^c Defined as reported current problems breathing during vigorous or moderate activity or in certain environments.

Approximately 60% of the cases reported a previous diagnosis of asthma with more than one-half of the cases reporting symptoms of asthma during the year before enlistment. Two percent⁴ of controls also reported a previous diagnosis of asthma. There was no significant difference between those cases who remained on active duty at the time of this analysis and those who left early.

Methacholine Challenge Testing

Among the 124 cases who were tested and for whom a determination could be made, 47 (38%) had a positive methacholine challenge test and 77 (62%) were negative. Of these same 124, there were 82 (66%) diagnosed as mild persistent and 26 (21%) as mild intermittent; 16 (11%) of subjects had missing data or refused testing.

Overall Military Attrition

Overall attrition during the study time period was significantly greater among cases than controls ($p < 0.01$) as shown in Figure 2. The steepest rate of service loss among cases, however, is evident during the first 2 to 3 months of the period which would encompass initial entry training for the majority of subjects. The net difference in attrition between cases and controls after 6 to 12 months of service was approximately 25%.

Results during Recruit Training

A total of 52 (38%) cases and 20 (5%) controls received discharges during the recruit training period. Cases were significantly more likely to be discharged during recruit training (relative risk = 7.721; 95% confidence interval [CI], 4.79–12.45). Discharges for persistent asthma symptoms (27 of

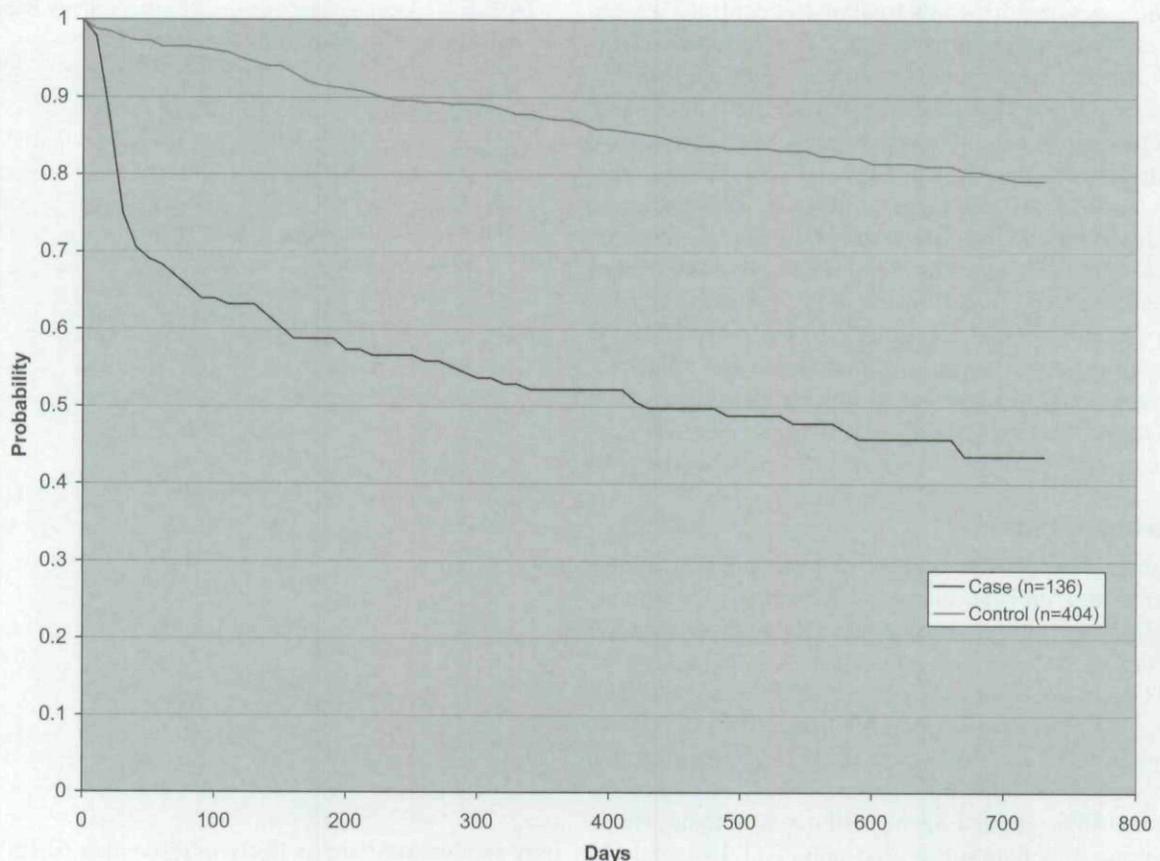


FIGURE 2. Attrition during the Retention of Mild Asthmatics in the Navy (REMAIN) study period. Retention probability of Navy enlistees: mild asthmatics vs. matched controls (follow-up through Aug 31, 2003), $p < 0.01$.

TABLE III. ELMS during Basic Combat Training (BCT)

BCT Discharge Diagnosis	Case Discharges ^a	Control Discharges
	(n = 52)	(n = 20)
	No. (%)	No. (%)
Asthma ^a	27 (51.9)	0 (0)
Psychiatric	7 (13.4)	3 (15)
Medical	4 (7.6)	1 (5)
Alcohol and drug abuse or dependence	4 (7.6)	4 (20)
Orthopedic ^a	3 (5.7)	7 (35)
Other	7 (13.4)	5 (25)

^a χ^2 , $p < 0.05$ for proportion of total ELMS discharges and discharges for asthma or orthopedic conditions among cases vs. controls.

136) and mental health diagnoses (7 of 136) account for the higher discharge rate during the basic training period among cases (Table III).

The probability of receiving outpatient care for asthma among cases and controls using the first asthma-related health care visit as the endpoint was also examined. Cases were significantly more likely to receive outpatient care for asthma than controls ($p < 0.01$). There were no inpatient hospitalizations for a primary diagnosis of asthma during the study period among cases or controls.

All cause visit rates per person-month were higher for cases than controls (3.1 vs. 1.5, risk ratio = 2.1; 95% CI, 1.9–2.4). Health care utilization patterns were similar between mild asthmatics and controls but rates of visits were higher for cases than controls in nearly all categories of visit type (Fig. 3). As would be expected, the greatest rate difference was for asthma-related visits (0.1 vs. 0.004). The mean number of asthma visits per case was 1.4 (SD = 1.5) with one case requiring 7 asthma-related visits. Among controls, the mean number of asthma visits was 0.08 (SD = 0.85). Of note, two controls each required 12 asthma-related health care visits.

Results after Recruit Training

Seventy-five recruit training graduates among the mild asthma group were matched 2:1 on sex, age, race, and date of

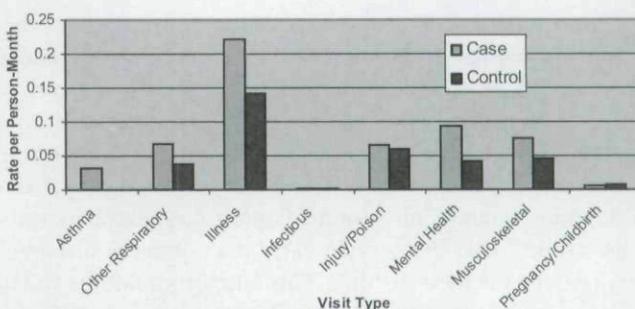


FIGURE 4. Health care utilization post-basic training by visit type. Outpatient visit rates for basic training graduates.

training (Fig. 1) for the secondary analyses. Nine cases were dropped because their matched controls were not among the population of graduates.

As of August 2003, the end of the study period, 72% (54 of 75) of the graduating cases and 83% (124 of 150) of the matched controls remained on active duty (Fig. 1). Cases who graduated from recruit training were still more likely to be discharged than controls, but the magnitude of the difference was much lower than during the basic training period (relative risk = 1.6; 95% CI, 0.98, 2.67) compared to a relative risk of 7.6 during basic training. Of the discharges, only two were for entry level medical separation (ELMS) conditions: one case was discharged for preexisting plantar fasciitis and one control received an ELMS discharge for asthma.

Among cases who graduated from recruit training, 25% had an outpatient asthma-related visit during the succeeding 6 months. Nearly 50%, however, had no outpatient asthma visits during the remainder of the study period. Seven participants required hospitalization during the study period. Two cases accounted for three admissions, one of which listed asthma as a secondary discharge diagnosis. Five controls were admitted during the study, none for asthma. All cause visit rates per person-month were similar for cases and controls (0.89 vs. 0.63, relative risk = 1.4; 95% CI, 0.9–0.6). Health care utilization patterns were similar between mild asthmatics and controls (Fig. 4).

DISCUSSION

In this study, 64% of recruit training graduates diagnosed with mild asthma were retained on active duty without adverse consequence up to 3 years after entering active duty. Mild asthmatics as a group experienced higher rates of service discharge than their nondiagnosed counterparts with the greatest difference occurring during the recruit training period. Although health care utilization is clearly greater among mild asthmatics than controls, most of this difference was observed during recruit training and was accounted for by asthma-related visits. After completing recruit training, the mild asthmatic group had similar retention rates and health care utilization rates and nearly 50% required no further asthma follow-up.

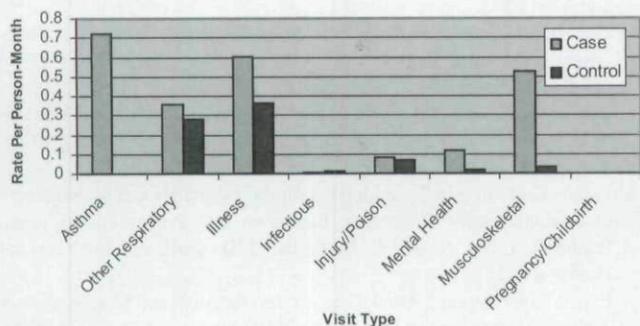


FIGURE 3. Health care utilization during basic training by visit type. Outpatient visit rates during basic training.

Questionnaire data confirmed previous studies that many asthmatics diagnosed during recruit training had a previous diagnosis of asthma before coming on active duty.^{7,16} More than 50% of the cases diagnosed with mild asthma had asthma symptoms within a year of entering active duty. Questionnaire data have very limited predictive value because no group of questions could identify who would leave the service early once granted a temporary waiver for their asthma. This supports findings found in other studies that survey data do not correlate well with clinical testing, nor does reporting of symptoms correlate with presence of mild asthma.^{17,18}

This study was limited by several factors. First, the diagnosis of asthma was made during one clinical encounter. This encounter, however, consisted of a focused asthma evaluation including pre- and postbronchodilator pulmonary function tests and, if normal, methacholine challenge tests. Second, recruits could be classified as having mild asthma based on a history of frequency and timing of symptoms alone with normal clinical findings. Historically, asthma symptoms were used to receive a discharge from military service. Based on the data available in this study, we cannot determine how many of the mild asthmatics misrepresented a history of asthma. However, during the study, all recruits processed through the Great Lakes NTC were told that a diagnosis of mild asthma would no longer result in discharge. The finding that nearly 50% of mild asthmatics who graduated from basic training required no outpatient follow-up during the study period suggests that some amount of overdiagnosing still occurs.

Additionally, study subjects were not followed long enough to determine the impact retaining mild asthmatics has on health and job performance in deployed settings. Finally, the small cohort size for basic training graduates limited the power for subsequent subgroup analyses such as by gender or age groups.

The British have also studied the implications of asthma for British Army recruitment. In a 4-year retrospective review, the British Army averaged 50 medical discharges for asthma per year, which was 6.3% of discharges from all medical causes. On average, these soldiers had 20 noneffective days before discharge. Fifty-seven percent were 20 years old or younger and 47% had <2 years of service.¹⁹ This illustrates a recurring theme that those who are discharged with a diagnosis of asthma typically leave the military early in their career. A study of 897 medical discharges from the British Army in 1988 showed that the most common reason for medical discharge was for conditions of lower limbs and back at 54.5% of discharges, while asthma was the reason for 9.6% of medical discharges.²⁰

Mild asthmatics retained on active duty as part of this observational study were at increased risk of attrition and outpatient health care utilization during recruit training, but not after initial entry training up to the first 3 years of service compared to matched controls. These findings sup-

port the policy of allowing a trial on active duty for recruits diagnosed with mild asthma at recruit training. The rising prevalence of asthma among children and adolescents in the United States will decrease the number of individuals who qualify for military service if mild asthma remains a disqualifying condition. If a trial on active duty with a standard-of-care medical treatment policy similar to the one followed in this study was implemented, the Navy would retain an estimated 40% of individuals who normally would be disqualified before accession or during recruit training. From a force structure perspective, the concept of retaining recruits diagnosed with mild asthma appears to have merit. Those who are unable to complete their term of service generally fail soon after diagnosis, resulting in little additional lost training. Those who are not discharged soon after diagnosis have attrition and health care usage patterns similar to those of nonasthmatic recruits.

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