

Association of Weight at Enlistment With Enrollment in the Army Weight Control Program and Subsequent Attrition in the Assessment of Recruit Motivation and Strength Study

MAJ Sheryl A. Bedno, MC USA*; MAJ Christine E. Lang, MC USA†; William E. Daniell, MD, MPH‡; COL Andrew R. Wiesen, MC USA†; Bennett Datu, PhD, MPH*; COL David W. Niebuhr, MC USA*

ABSTRACT The ongoing obesity epidemic has made recruiting qualified Army applicants increasingly difficult. A cohort of 10,213 Army enlisted subjects was enrolled in the Assessment of Recruit Motivation and Strength (ARMS) study from February 2005 through September 2006. Overweight recruits obtained a waiver for enlistment ($n = 990$) if they passed a screening physical fitness test. Recruits were evaluated for enrollment into the Army Weight Control Program (AWCP) and discharged during the 15 months following enlistment. Enrollment was higher among overweight recruits than recruits who met entrance standards (men: adjusted OR = 13.3 [95% CI: 10.3, 17.2]; women: adjusted OR = 3.6 [3.3, 3.9]). Although the discharge frequency was higher in the waiver group than in those who met standards (25.4% versus 19.9%, $p < 0.001$), there were only 10 (0.5% of total) discharges directly attributed to weight. Granting overweight waivers through the ARMS program increases enrollment to the AWCP but has little effect on weight-related attrition.

INTRODUCTION

Obesity has become a significant problem over the past several decades. Nearly two-thirds of adults in the United States are either overweight or obese.¹ This epidemic has made it more difficult to attract qualified recruits to military service. In fiscal year 2007, there were 160,000 nonprior service enlistments into the U.S. military and 62,896 Army active components.² Of adults 18–29 years old, the age group especially targeted for military recruitment, 19.1% were considered obese in 2007—up from 10% in 1995.^{3,4} As the percentage of overweight and obese applicants has steadily risen over the past two decades, the percentage of recruits who meet the military's age-specific weight for height accession standards has declined.^{5,6} Such standards have been used by the military for years as a proxy for physical fitness and a requirement for successful service.⁷ Failure to meet weight standards is the top reason for medical disqualification for service, with approximately 10,000 enlisted applicants disqualified for this reason in 2007.⁸

The Assessment of Recruit Motivation and Strength (ARMS) study piloted the use of preaccession fitness screening (ARMS test) of Army enlisted applicants.^{9,10} All Army applicants who processed at the six military entrance processing stations (MEPS) were required to take the ARMS test, to include those who met weight standards and were fully qualified (FQ) (from May 2004) and those who exceeded Army

accession standards for weight and body fat (OBF) (from February 2005) in the ARMS study. Overweight applicants were granted a waiver for enlistment if they passed the ARMS physical fitness test. The ARMS study determined that attrition in the first 180 days of service did not differ between those who exceeded body fat standards and those who were fully qualified. A recent British Royal Navy study found that those who completed a prejoining physical fitness test were more likely to complete their first phase of training.¹¹

The U.S. Army uses a modified body mass index (BMI) as part of its standard screening, with an acceptable weight for height that is adjusted for age and gender.¹² Soldiers who exceed this standard must have a determination of their body fat percentage.^{12,13}

Those soldiers who are above allowable body fat percentage limits are enrolled into the Army Weight Control Program (AWCP). This program consists of an individualized intensive exercise program, a medical evaluation, and dietary and nutritional counseling. Soldiers in the AWCP are required to weigh-in on a routine basis, with a weight loss of 3–8 pounds per month as a goal.¹⁴ Once a soldier is within body fat standards, they are released from the AWCP. However, if satisfactory progress is not made within 6 months in the AWCP, the soldier may be processed for separation from the Army.

The primary objective of this study was to determine whether overweight recruits who pass the ARMS fitness test are more likely than fully qualified recruits to enroll in the AWCP. The study secondarily examined whether having a waiver for exceeding weight and body fat standards was associated with increased attrition from the Army.

METHODS

This prospective cohort study identified all Army recruits who enrolled in the ARMS study at any of six participating MEPS

*Division of Preventive Medicine, Walter Reed Army Institute of Research, 503 Robert Grant Road, Silver Spring, MD 20910.

†Public Health Residency, Madigan Army Medical Center, ATTN: MCHJ-PV, Tacoma, WA 98431.

‡Department of Environmental and Occupational Health Sciences, School of Public Health, Box 357234, University of Washington, Seattle, WA 98195-7234.

The views expressed are those of the authors and should not be construed to represent the positions of the Department of the Army or Department of Defense.

from February 2005 through September 2006. The outcome of interest was enrollment in the AWCP or separation from the Army within 15 months after military entry. AWCP enrollment can only occur after a weight measurement, which typically happens twice a year in conjunction with the Army Physical Fitness Test (APFT). The 15-month follow-up period allowed each cohort member at least two opportunities to be weighed at the time of the APFT and to be subsequently enrolled in the AWCP.

ARMS Study

The ARMS study was conducted by the Accession Medical Standards and Research Activity (AMSARA) and was approved by the Walter Reed Army Institute of Research Institutional Review Board (IRB). This study was also approved by the IRBs of Madigan Army Medical Center and the University of Washington. Informed consent for participation was obtained from all subjects.

Overweight applicants were granted a waiver for enlistment if they passed the ARMS physical fitness test. The fitness test used in this study consisted of a minimum number of pushups (15 for men and 4 for women) and a modified Harvard 5-minute step test (which has been shown to differentiate among groups with varying levels of fitness).¹⁵ Subjects were asked to step up and down on a standard platform set at a height of 12 inches for women and 16 inches for men for a period of 5 minutes at a pace of 30 steps per minute. One "step" was defined as up and down for both legs. Passing was defined by completing 5 minutes at the defined pace and having a 1-minute postexercise heart rate of less than 180.

Data Sources

All data were de-identified for analysis. Demographic and ARMS data were collected at MEPS. The U.S. Army Medical Command provided information regarding AWCP enrollment.

Study Sample

Potential subjects were all men and women 18 years or older who enlisted in the Army and enrolled in the ARMS study from February 2005 through September 2006 ($n = 10,213$). Those who exceeded Army accession standards for weight and body fat but were able to pass the ARMS fitness test were given a waiver for accession. Individuals were excluded if there were no data on ARMS waiver status.

Data Analysis

The SAS system (SAS Institute, Cary, NC; version 9.1) and SPSS (SPSS Inc, Chicago, IL, version 14.0) statistical data analysis software were used for data management and analysis.

The primary predictor variable was ARMS waiver status and the outcome variable was AWCP enrollment. Other variables of interest included age, race, BMI, gender, and tobacco

use. A secondary analysis examined whether waiver status affected discharges within 15 months after military entry; longer follow-up is still in progress. The Pearson χ^2 test and the independent samples *t*-test assuming unequal variance were used for bivariate comparisons.

Specification of Levels for Predictor Variables

Age was categorized as: 18–20, 21–27, and 28–39, consistent with the Army's age-based weight standards. Smoking status was grouped into three categories: none, 1–10 cigarettes per day, and >10 cigarettes per day. Deployment status within the first 15-months of military service was a dichotomous variable (deployed: yes/no).

Race was initially separated into four categories (White, Black, Asian, or Native origin). Because of small numbers among some categories, race was ultimately combined into a dichotomous category: White and other. Ethnicity information was not available.

BMI was calculated by dividing weight by height squared (kg/m^2). To obtain BMI categories with sufficient number of subjects as well as AWCP enrollment events, BMI was also assessed as a dichotomous variable (overweight vs. not overweight) based on BMI scores of higher than 28.4 and 26.6 for males and females, respectively. This was used to represent the top 25th percentile of the participants in the ARMS study, which approximates the current accession BMI standard by gender.

Logistic Regression

Logistic regression was used to calculate crude (bivariate) and adjusted (multivariate) odds ratios for the analysis of the dichotomous outcome, AWCP enrollment. Independent variables were included in logistic regression models on the basis of the findings of bivariate analyses, stepwise forward selection, improvement of overall model robustness (log likelihood and pseudo-*R*-squared statistics), a priori knowledge about individual variables, and interpretability. The stepwise forward procedure used a hierarchical method requiring the inclusion of a set of main effects before the inclusion of interactions within that set and furthermore, allowed the entry and removal of only a single covariate in each step. The entry and removal criterion used for each variable or interaction was the likelihood ratio test (χ^2 ; 2 degrees of freedom; entry, $p < 0.10$; removal, $p > 0.15$).

Potential multicollinearity was assessed with Pearson correlation coefficients, the variance inflation factor, and the tolerance statistic. The Hosmer-Lemeshow test was used to assess goodness of fit. Because of the small number of events among individuals who were not overweight or obese ($\text{BMI} < 25$), and the lack of individuals who received an ARMS waiver who were also not overweight or obese, BMI and ARMS waiver status could not be studied simultaneously. Instead the effects of these two predictors were investigated in separate ARMS waiver or BMI logistic regression models. BMI was treated as a dichotomous variable (overweight or not overweight) as defined previously.

RESULTS

Cohort Demographics

A total of 990 subjects received overweight waivers and 7,218 were fully qualified (Table I). Nearly half (47%) of recruits from both study groups were overweight or obese on the basis of their BMI and two-thirds (66%) of recruits were able to meet the Army's accession standards for BMI. Among females, nonsmoking status was over-represented in the waived compared to the fully qualified groups.

AWCP Enrollment

Twenty-three percent of subjects with waivers were enrolled in the AWCP compared to 3% of those who were fully qualified ($p < 0.001$). AWCP enrollment was twice as high for women than men who were fully qualified (4.6% and 2.3%, respectively), but the reverse pattern was seen among women compared to men with waivers (15% vs. 24%).

AWCP Enrollment: Logistic Regression

Covariate-adjusted odds ratios for entry into the AWCP within 15 months of accession were calculated through multivariable logistic regression in which the effects of waiver status, gender, age, smoking status, race, and deployment status were exam-

ined (Table II). The total sample in the multivariate model was smaller ($n = 7,110$) because of the exclusion of missing variables. ARMS waiver status and gender were found to be highly significant predictors of entry into the AWCP within 15 months of accession. Deployment, nonwhite race, and smoking (1–10 cigarettes/day) were found to be protective of enrollment. The crude odds ratios for entry into the AWCP for waived vs. nonwaived and for female vs. male were 11.0 (95% CI: 8.9, 13.7) and 1.4 (95% CI: 1.1, 1.9), respectively. There was significant interaction between waiver status and gender; therefore, these two variables were combined in the multivariate model. Waived males were nearly 13.3 times more likely to enter the program and waived females were 3.6 times more likely.

Because of a policy change made effective April 2007 that extended the minimum time between enlistment and first possible AWCP enrollment from 6 months to 12 months, an additional bivariate logistic regression analysis was performed to determine whether recruits potentially impacted by this policy change might have lower AWCP enrollments. Recruits accessioned in or after May 2006 (e.g., subjects who had less time vulnerable to the AWCP in their first year) had a lower odds of AWCP enrollment at 15 months than those accessioned earlier (OR = 0.75; 95% CI: 0.60, 0.95). The inclusion of this

TABLE I. Characteristics of the ARMS Study Population by Overweight Waiver Versus Fully Qualified

	Total n (%) ^a (n = 8208)	Fully Qualified n (%) (n = 7218)	Overweight Waiver n (%) (n = 990)	P value ^b
Gender				
Male	6,990 (85.2)	6,250 (86.6)	740 (74.7)	<0.001
Female	1,218 (14.8)	968 (13.4)	250 (25.3)	
Age (mean ± SD, years)	20.8 ± 3.3	20.9 ± 3.4	20.7 ± 2.9	0.15
BMI on Accession (mean ± SD)				
Male	25.4 ± 4.5	24.6 ± 3.8	32.8 ± 2.7	<0.001
Female	24.1 ± 3.2	23.2 ± 2.8	27.9 ± 1.8	<0.001
Met BMI Standards				
Yes	5,388 (65.6)	5,377 (74.5)	11 (1.1)	<0.001
No	2,817 (34.3)	1,838 (25.5)	979 (98.9)	
BMI Group (on Accession)				
Underweight	230 (2.8)	230 (3.2)	0	<0.001
Normal	4,106 (50.0)	4,088 (56.6)	18 (1.8)	
Overweight	2,610 (31.8)	2,320 (32.1)	290 (29.3)	
Obese	1,259 (15.3)	577 (8.0)	682 (68.9)	
Missing	3 (0.0)	3 (0.0)	0	
Smoking Status				
None	6,136 (74.8)	5,355 (74.2)	781 (78.9)	<0.05
1–10 Cigarettes/Day	1,503 (18.3)	1,350 (18.7)	153 (15.5)	
>10 Cigarettes/Day	440 (5.4)	402 (5.6)	38 (3.8)	
Missing	129 (1.6)	111 (1.5)	18 (1.8)	
Race				
White	5,791 (70.6)	5,086 (70.5)	705 (71.2)	<0.05
Black	1,092 (13.3)	976 (13.5)	116 (11.7)	
Asian	168 (2.0)	158 (2.2)	10 (1.0)	
Native Origin	178 (2.2)	152 (2.1)	26 (2.6)	
Missing	979 (11.9)	846 (11.7)	133 (13.4)	
Deployment in First 15 Months	2,419 (29.5)	2,140 (29.6)	279 (28.2)	0.34

ARMS, Assessment of Recruit Motivation and Strength; BMI, body mass index.

^aValues represent counts (and percentages in parentheses), except where they are designated to be mean and standard deviations (SD). ^bSignificance was determined by the Pearson χ^2 test and the *t*-test of means for independent samples.

TABLE II. The Effect of ARMS Waiver Status (Waived or Fully Qualified) on the Odds of Enrollment in the Army Weight Control Program

Variable	Summary of Subjects Eligible for Analysis			Multivariable ^a		
	Total	AWCP	No AWCP	OR	95% CI	
Waiver Status (Male)	FQ	5,444	126	5,318	1.00	
	Waiver	619	151	468	13.27	(10.26, 17.17)
Waiver Status (Female)	FQ	826	38	788	1.00	
	Waiver	221	33	188	3.58	(3.30, 3.89)
Race	White	5,709	299	5,410	1.00	
	Nonwhite	1,401	49	1,352	0.68	(0.49, 0.95)
Deployed	No	5,052	279	4,773	1.00	
	Yes	2,058	69	1,989	0.59	(0.45, 0.79)
Age (Years)	18-20	4,242	198	4,044	1.00	
	21-27	2,450	137	2,313	1.17	(0.92, 1.48)
	28-39	418	13	405	0.89	(0.50, 1.60)
Cigarettes	None	5,376	278	5,098	1.00	
	1-10 Cig/Day	1,339	49	1,290	0.71	(0.51, 0.98)
	≥10 Cig/Day	395	21	374	1.10	(0.68, 1.80)

ARMS, Assessment of Recruit Motivation and Strength; AWCP, Army Weight Control Program; FQ, fully qualified.

^aCovariate adjusted odds ratios (OR) and 95% confidence interval (95% CI) obtained by multivariate logistic regression, including all of the listed variables in one model. Sample in multivariate model is smaller ($n = 7,110$) because missing values were excluded.

variable did not alter the association between waiver status and AWCP entry.

For reasons cited above, BMI and ARMS waiver status could not be studied simultaneously. The effect of BMI on AWCP enrollment was investigated in a separate logistic regression model in which the influences of gender, race, age, deployment, and smoking status were controlled (Table III). There was significant interaction between BMI and gender; therefore, these two variables were combined in the multivariate model. The risk of enrollment of males and females who were overweight on accession compared to those who were not overweight was significant but the strength of the association was nearly fivefold stronger in males than females. The adjusted odds ratios for deployment, race, age, and smoking status in the BMI model were similar to those calculated in the ARMS waiver model.

Attrition

Attrition was examined as a secondary outcome. Overall, 1,993 subjects (21%) were discharged within 15 months after military entry. Discharge frequency was much higher among women than men (36.5% vs. 17.4%, respectively; $p < 0.001$) and somewhat higher in the waiver group than in the FQ group (25.4% vs. 19.9%; $p < 0.001$). Overall, the most common reason for discharge was poor initial performance (men, 8.0%; women, 7.7%), although the most common reason among women was pregnancy or parenthood (women, 11.7%; men, 0.2%). The waiver group showed slightly higher frequency of discharge than the FQ group for several reasons: physical

conditions diagnosed since military entry (6.2% vs. 3.6%, $p < 0.001$), conditions existing before entry (4.7% vs. 3.3%, $p = 0.02$), and weight control failure (0.4% vs. 0.1%, $p < 0.001$). It is noteworthy that only 10 (0.5% of total) discharges were directly attributed to weight-control failure, including 5 each in the waiver and FQ groups; all these discharges were men.

DISCUSSION

The ARMS study was designed and conducted to ascertain how well recruits who exceeded body fat limits but who could pass the ARMS preaccession fitness test fared in terms of attrition, musculoskeletal injuries, heat illnesses, and achieving and maintaining acceptable levels of body fat. This study focused on enrollment into the AWCP and these analyses indicate that those who exceed the body fat limits at enlistment are at much higher risk of being enrolled in the AWCP within 15 months of entering military service. Overweight men were more than 10 times more likely to be enrolled in the program, whereas overweight women were more than 3 times more likely. In addition, men whose BMI level was at the 75th percentile or higher of the study subjects, regardless of ARMS waiver status, had more than 25 times the odds of AWCP enrollment, whereas women in that percentile had more than 5 times the odds. On the other hand, it is important to note that 77% of recruits who enrolled with a waiver did not enter the AWCP within 15 months, and presumably achieved an acceptable weight.

Although not a primary focus of this study we did consider attrition and reasons for attrition. Among men, those with

TABLE III. The Effect of Accession Body Mass Index in the ARMS Study Population on the Odds of Enrollment in the Army Weight Control Program: Model Summary

Variable		Summary of Subjects Eligible for Analysis			Multivariable ^a	
		Total	AWCP	No AWCP	OR	95% CI
Overweight Status						
Male ^b	Not Overweight	4,546	34	4,512	1.00	
	Overweight	1,517	243	1,274	25.50	(17.69, 36.73)
Overweight Status						
Female ^b	Not Overweight	786	29	757	1.00	
	Overweight	261	42	219	5.26	(3.19, 8.68)
Deployed	No	5,052	279	4,773	1.00	
	Yes	2,058	69	1,989	0.61	(0.46, 0.80)
Cigarettes	No	5,376	278	5,098	1.00	
	1-10	1,339	49	1,290	0.70	(0.51, 0.97)
	>10	395	21	374	1.07	(0.65, 1.74)
Age	18-20	4,242	198	4,044	1.00	
	21-27	2,450	137	2,313	1.01	(0.80, 1.28)
	28-39	418	13	405	0.50	(0.27, 0.89)
Nonwhite	No	5,709	299	5,410	1.00	
	Yes	1,401	49	1,352	0.59	(0.42, 0.81)

ARMS, Assessment of Recruit Motivation and Strength; AWCP, Army Weight Control Program.

^aOdds ratios (OR) and 95% confidence interval (95% CI) obtained by logistic regression. ^bBMI was grouped into two categories on the basis of gender-specific 75th percentile cutoffs. Males over a BMI of 28.4 were considered overweight whereas females over a BMI of 26.6 were classified as overweight.

waivers were slightly more likely to leave the service early, but were most likely to leave for poor performance in basic combat training. It should be noted that there were only five weight control failures among each group. It is conceivable that being overweight could have been a contributing factor in discharges (within 15 months) that were attributed to other reasons—physical conditions diagnosed after military entry or pre-existing conditions—both of which were slightly more common in the waiver group. Together, these two categories accounted for about 4% additional discharges in the waiver group, beyond the observed frequency of 20% in the fully-qualified group. It is not possible to assess what fraction of these incremental cases might truly be weight related, without reviewing individual records, and this 4% figure is probably a conservative overestimate of waiver effect. Regardless, this estimated increment is still relatively small compared to all other causes of attrition.

Several changes occurred in Army policy and regulations during the course of this study. Although these changes might have resulted in subject misclassification, it seems unlikely that the changes would have substantially biased study findings in one direction or another. In July 2005, a change allowing an increase by 2% in the maximum allowable body fat for both men and women in the youngest age category (17-20 years) was enacted. This change took effect 5 months after first enrollment of overweight subjects in the ARMS study, and study subjects recruited after this change were therefore more likely categorized as "met standards" than previously. There were also changes in allowable retention weight for height and body fat standards 9 months before the end of follow-up in the

study. Retention BMI was increased for women at that time and the method for assessing body fat was changed. Though a small number of women who met the old standards exceeded the new ones, this was balanced by a nearly equal and small number who did not meet the old standards but did meet the new ones. Another policy change was the length of time between enlistment and when retention weight/body fat standards apply; therefore, the time for potential AWCP enrollment increased from 6 months to 12 months.

A major strength of this study was its design as a large prospective cohort study, which provided sufficient statistical power and an adequate length of follow-up to detect a significant difference between the primary groups of subjects. Height, weight, and body fat on overweight applicants were recorded at the time of the ARMS fitness testing, providing objective data beyond what is usually available in Army applicant databases.

The National Academies of Science Committee on Youth Population and Military Recruitment recommended that BMI not be used as a proxy for fitness as it is less predictive of injury and attrition.⁷ Longitudinal tracking of physical fitness, body composition, and AWCP compliance would further enable evaluation of attrition and injuries, and other military relevant outcomes.¹⁶

Expanding the allowable body fat limits for those who can pass screening physical fitness tests will lead to an increase in AWCP enrollment. This change will result in a challenge: ensuring new recruits meet current retention standards within 1 year while avoiding punitive actions and the potential for mandatory discharge associated with AWCP enrollment.

Although rates of enrollment in the AWCP are much higher in overweight recruits, discharge for weight control failure is extremely low, suggesting that many soldiers are able to lose weight while in the AWCP and remain on active duty. Continued outcome follow-up over the first enlistment tour of duty and a detailed cost-benefit analysis of all military relevant outcomes including occupational qualification, deployability, morbidity, promotion, and re-enlistment, is necessary. This additional research will contribute to the evaluation of the effectiveness of the ARMS program and potential value of policy changes to allow accession of physically fit overweight individuals with higher than currently allowed body fat percentages.

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