CRC 341

MARINE CORPS ENLISTED ATTRITION

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This analysis is an examination of the attrition of Marine Corps recruits during initial recruit training. Shortly after the implementation of the all-volunteer armed force concept, Marine Corps recruit attrition began to increase. The difference in attrition rates at the two Recruit Training Depots increased also, with the rate higher at Parris Island and lower at San Diego. This analysis shows that the increase as well as the depot differences in recruit attrition were associated with changing characteristics of the recruit population, such as education and aptitude test scores, rather

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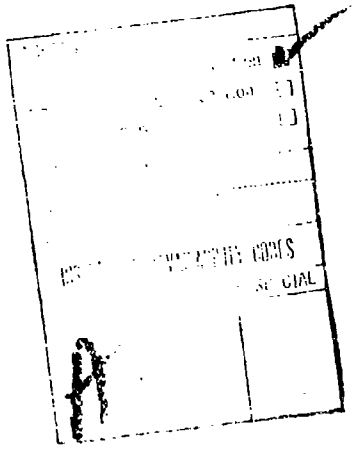
than with Marine Corps policy or local depot circumstances.



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Ref: (a) Headquarters, U.S. Marine Corps, Memorandum for the Commandant, Subj: "Marine Corps Missions and Force Structure Study (U)," Secret, 26 Mar 1976
(b) CNA Memorandum (CNA)3128-75, "17-Year-Old Non-High School Graduates," 12 Nov 1975
(c) CNA Memorandum (CNA)76-3040, "Analysis of Motivation and Correctional Custody Platoon Training," 12 Apr 1976
(d) CNA Study 1100, "Quality of Marines: Test Scores, Personnel Data and Performance," September 1977
(e) Briefing for the Assistant Secretary of Defense for Manpower and Reserve Affairs, Conference on DoD Manpower Management for the Iron and Steel Institute, (CNA)76-3153, "Attrition of First-Term Enlisted Marines: Rates and Reasons," 5 Jan 1977
(f) Briefing presented at the DoD Conference on Enlisted Attrition, (CNA)76-3126, "A Method of Screening Applicants for Marine Corps Enlistment," 7 Apr 1977

Encl: (1) CRC 341, "Marine Corps Enlisted Attrition," by Warren T. Matthews, January 1977

1. Enclosure (1) is provided as a matter of possible interest.

2. Preliminary results from the analysis reported in this Research Contribution were used in support of the Marine Corps Study of Manpower Quality and Force Structure (reference a). Preliminary results were briefed to Headquarters, Marine Corps in November 1975 and to major FMF commands in December 1975 and January 1976. The data for the analysis was also used to analyze the issues of enlisting 17-year-old nonhigh school graduates (reference b) and remedial recruit training (reference c).

3. This analysis of enlisted Marine Corps attrition is based on the attrition of FY 1974 recruits within two years of enlistment. The data was used in concurrent analysis of Marine Corps enlistment standards (reference d) and the results have been used as the Marine Corps contribution to two Department of Defense manpower conferences (references e and f).

4. Research Contributions are distributed for their potential value in other studies and analyses. They do not necessarily represent the opinion of the U.S. Marine Corps or the Department of the Navy.

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I. INTRODUCTION

BACKGROUND

Marine Corps recruit training has been traditionally a challenging experience. The vigorous nature of recruit training is, in part, responsible for the reputation of the Marine Corps as the most demanding of the military services in terms of discipline, physical fitness, and general military bearing. The training environment is one in which the recruit is under constant pressure to perform and there have been some incidents of physical and mental overexertion. Approximately 10 percent to 25 percent of entering recruits fail to complete recruit training. The reasons for failure include injury, discovery of fraudulent enlistment, disqualifying medical condition, substandard performance or inability to learn. The rate of failure, or attrition, at recruit training increased from 9 percent in July 1972 to 18 percent in July 1975.

Figure 1 shows the recent trends in recruit attrition for each of the two Marine Corps Recruit Depots. The attrition rates at the two depots and the difference between attrition rates at the two depots increased from 1972 through mid-1976. The fiscal year 1975 attrition rate at Parris Island was 20.2 percent, approximately twice the rate of San Diego which was 10.9 percent (see reference 3).

Attrition rates of first term enlisted Marines after recruit training also are a matter of concern. Of the male recruits enlisted during fiscal year 1974, 11 percent failed during recruit training and 18 percent passed recruit training but failed to serve at least twenty-four months of their initial enlistments. This analysis of recruit attrition and subsequent attrition during the initial enlistment will provide some understanding of the differences in attrition rates at the two depots and will suggest methods for controlling attrition.

OBJECTIVES

This analysis was requested by the Deputy Chief of Staff for Manpower, USMC (see reference 5). The objectives of the analysis include:

1) Analysis of the differences in recruit depot attrition rates to include the amount of difference and the causes of differences,
2) Examination of the validity of the current method of assigning recruits to a depot, and
3) Exploration of methods of early identification of substandard recruits.

Source: HQMC, Director of Personnel Procurement, Code MMPE-8

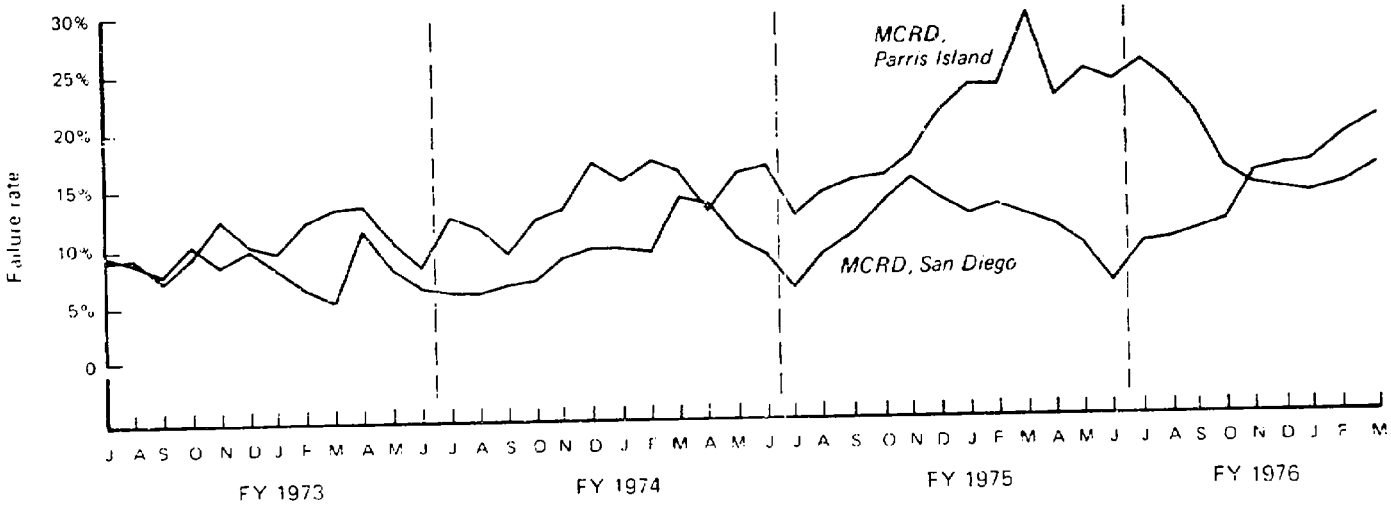

FIG. 1: RECRUIT TRAINING FAILURE RATES BY MONTH TRAINING BEGAN (REGULAR, MALE ONLY)

II. METHODOLOGY

The method of analysis used here is step-wise multiple linear regression with individual (nongrouped) data. The variables related to attrition and other measures of manpower quality will be identified. Results will be expressed as regression equations which predict values of the dependent variable (such as the attrition rate) as a linear function of independent variables.

An alternative model considered for this analysis was linear regression with grouped data. Such a method predicts the value of a dependent variable not for individuals but for groups of individuals. Since a part of the variance in the dependent variable is lost by grouping, the portion of remaining variance explained by the regression equation is larger than that achieved with individual data. The results of analysis with grouped data are consistent with but not as useful as results from the individual data model. The grouped data model and results comparable to the results produced with individual data are discussed in appendix A.

DATA

The data for this analysis were collected from the Manpower Management System (MMS) at Marine Corps Headquarters. The data describe the performance and personal characteristics of all regular, male recruits who reported for active duty during fiscal year 1974. Their performance on active duty was monitored through the first twenty-four months of service. The data considered are listed at table 1.

The selection of the fiscal year 1974 recruits for this analysis is based on three considerations. First, this group of recruits entered the Marine Corps in an all-volunteer environment. Draft calls were terminated in December 1972 and these men reported for duty after June 1973. Second, a sample of recruits entering during a full twelve-month period should eliminate seasonal problems associated with the traditionally heavy influx of high school graduates in the summer. Third, these recruits have completed training and are serving in the Fleet Marine Force. By monitoring these men for twenty-four months, they can be evaluated in terms of on-the-job performance rather than only by test scores and demographic characteristics.

The variables available to measure quality of service include superior recruit training performance, recruit training attrition, desertion, rank achieved within twenty-four months of entry, and attrition from the Marine Corps during the first twenty-four months of service.

The explanatory or independent variables available for the analysis include personal characteristics and aptitude test scores. The personal characteristics include such items as education, age, marital status, rural or urban background, and recruit training site. The test scores available are from two test batteries. During fiscal year 1974,

TABLE 1

LIST OF VARIABLES

Variable	Name of variable	Possible values		
Race	Race	= 0 if non white		= 1 if white
Educational level	HS	= 0 if not high school graduate or if holds a GED		= 1 if high school graduate with diploma
Medical remedial enlistee	MR	= 0 if no		= 1 if yes
AFQT entrance test-overall score	AFQT	1 - 100	average	= 56.9
Area aptitude test scores (ACB-61):				
verbal	VE	40 - 160		
arithmetic	AR	40 - 160		
pattern analysis	PA	40 - 160		
classification inventory	CI	40 - 160		
mechanical aptitude	MA	40 - 160		
clerical speed	ACS	40 - 160		
radio code	ARC	40 - 160		
general information	GIT	40 - 160		
shop mechanics	SM	40 - 160		
automotive	AI	40 - 160		
electronics	ELI	40 - 160		
Site of recruit training	MCC	= 6 if MCRD, Parris Island		= 7 if MCRD, San Diego
Enlistment guarantee (non-money)	GUAR	= 0 if no guarantee or if cash guarantee		= 1 if guarantee (non-cash)
Deserter one or more times	DES	= 0 if never deserted		= 1 if never deserted

TABLE 1 (CONT'D)

Variable	Name of variable	Possible values	
Cash enlistment guarantee	GUARBUKS	= 0 if no cash guarantee	= 1 if cash guarantee
Location of home of record			
Center of large city	LOC1	= 0 if no	= 1 if yes
Large urban area (not LOC1)	LOC2	= 0 if no	= 1 if yes
Smaller city or town	LOC3	= 0 if no	= 1 if yes
other rural area	(not used) LOC5	= 0 if no	= 1 if yes
Age when reporting for duty	AGE	= 0 if less than 21	= 1 if age 21 or more
Marital status	MS	= 0 if single	= 1 if not single
Employment status prior to enlistment	DOT	= 0 if unemployed prior to enlistment	= 1 if employed prior to enlistment
Fail recruit training	BCATTR	= 0 if not fail recruit training	= 1 if did fail recruit training
Post-recruit training attrition	PBCATTR	= 0 if graduate from recruit training and not discharged from service	= 1 if graduated from recruit training and discharged from service
Total Non-EAS attrition	OVATTR	= 0 if still on active duty	= 1 if separated from active duty
Recycled during recruit training	RECY	= 0 if never recycled	= 1 if recycled during recruit training
General Technical (GT) score from ACB-61	ACBGT	40 - 160	
Mental group	MG	1 - 7 (MG1 corresponds to highest ACBGT score)	
Promotion to E2 at MCRD	E2BC	= 0 if not promoted at MCRD	= 1 if promoted at MCRD

the aptitude test used for Marine Corps enlistment screening was the Armed Forces Qualification Test (AFQT). The mental group score from the AFQT, based on the verbal, arithmetic, and pattern analysis tests, is available for each man in the sample. Until August 1976, the Marine Corps administered a classification test to recruits arriving at each recruit depot. That test, the Army Classification Battery (ACB-61) is composed of eleven area aptitude scores which are also recorded for the men in this sample. These test batteries have parallel subtests and area aptitude scores in the test now used for enlistment screening and classification, which is the Armed Services Vocational Aptitude Battery (ASVAB).

Because the men entering the Marine Corps were required to achieve an AFQT mental group score at or above the 21st percentile, the mental group distribution of the sample was restricted. The data have been corrected for range restriction by normalizing the mental group distribution to that of the mobilization population. The normalization is based on the general classification test score (GCT) from the ACB-61. The procedure is presented at appendix B.

The coefficients of correlation between each pair of variables, corrected for range restriction, are shown at appendix C. The regressions presented in this report are based on these correlation coefficients. The range-corrected means and standard deviations are shown at appendix D.

THE MODEL

The statistical procedure used in this analysis is step-wise multiple linear regression. The model assumed to describe the data is:

$$Y = \alpha_1 X_1 + \alpha_2 X_2 + \ldots + \alpha_n X_n + \alpha_o$$

where

Y = value of dependent variable

α_i = regression coefficient of explanatory variable i

X_i = explanatory variable i $(i=1, 2, \ldots, n)$

α_o = constant.

The dependent variables used in this analysis are attrition during recruit training, desertion one or more times, attrition prior to completion of the first twenty-four months of the enlistment, superior recruit training performance, and rank achieved in twenty-four months.

The independent or explanatory variables are the test scores and personal characteristics shown at appendix D. The regression procedure identifies the linear relation between each dependent variable and the explanatory variables in terms of the regression coefficients and other statistics. Using these results, Marine Corps applicants can then be compared in terms of their predicted performance. The explanatory variables identified as important in predicting performance are the variables that can then be used to compare the two depots and to screen applicants for enlistment to minimize attrition.

III. REGRESSION RESULTS

The results of this analysis are based on the regression model described above and the fiscal year 1974 data. Periodic updating of the data and verification of the model are required to maintain an understanding of the issues discussed here.

The analysis of recruit training depots and recruit assignment policy will be presented first. These results are based on regression analysis of recruit attrition rates, considering recruit depot as one of the explanatory variables. The analysis of methods to identify marginal candidates is based on regression analysis of several measures of quality of service. These measures are based on performance both on and off the job and will be described below.

ATTRITION DIFFERENCES AT THE RECRUIT DEPOTS

Regression analysis was used to identify the variables related to attrition, both during recruit training and during the first two years of service. Table 3 shows the regression of recruit training attrition of fiscal year 1974 enlistees on test scores and personal characteristics. The two best predictors of recruit training attrition are the tests' classification inventory (CI) and pattern analysis (PA). The CI test is a psychological test of interests thought to be related to military service. The PA test is a nonverbal test of reasoning ability which forms a part of the traditional mental group score. Age, education, race, and recruit training depot attended are also statistically significant correlates of recruit attrition.

The signs of the coefficients indicate the direction of each effect with respect to recruit attrition. The negative coefficients of the test scores, race, education, and depot indicate that lower values of these variables are associated with higher recruit attrition rates. (See table 1 for values of variables.)

The cumulative R^2 value is shown for each step of the step-wise regression procedure. The R^2 value is a measure of the percentage of the variation in the dependent variable (such as recruit attrition) that is explained by the independent variables in the regression equation at each step. Although the variables identified as correlates of attrition are highly significant, the R^2 values appear to be relatively low. The level of the R^2 values is due in part to the nature of the model and data. The record of each man in the sample is considered separately, so that the actual attrition value for each man is either zero or one. The predicted attrition ranges from zero to one and would virtually never be exactly correct in predicting the attrition outcome for a given recruit. This apparent problem can be overcome by grouping the men according to common test scores and other characteristics. Such a model based on grouped data has been computed with these data. The results are consistent with the results presented here and the R^2 values were in the range from .75 to .85. The higher R^2 values simply demonstrate that it is much easier to predict the percentage of failures from a large group of similar men than it is to predict the attrition outcome

TABLE 3

REGRESSION RESULTS: RECRUIT TRAINING ATTRITION

Variable	Coefficient	Cumulative R^2
CI	- .0014	.038
PA	- .0014	.049
Age	+ .0990	.056
Education	- .0400	.061
Race	- .0568	.065
ACS	- .0009	.066
Recruit depot	- .0275	.068
(Constant)	+ .7319	
	F = 542	
	N = 45,948	

Variables considered but not selected:

Marital status

Enlistment guarantee

VE

AR

MA

ARC

CIT

SM

AI

ELI

for a single man. Appendix A provides a discussion of the grouped data regression model and comparable results. Additional details are given in reference 7.

Recruit depot attended enters the step-wise equation as a significant predictor of attrition, although its coefficient (-.0275) is relatively low. The interpretation of this coefficient is that the difference between the probability of attrition for FY 1974 recruits of the same education, test scores, and other measured characteristics who are assigned to two depots differs by about 2.8 percentage points. The negative sign indicates that higher attrition is expected at Parris Island. This figure is an estimate of the "depot effect," or the difference in recruit attrition due solely to unmeasured personal characteristics and the depot training environment adjusted for measured recruit input quality. The actual FY 1974 recruit attrition rates were 15.1 percent at Parris Island and 9.9 percent at San Diego, and the difference in recruit attrition at the the two depots was 5.2 percentage points. The "depot effect" accounts for 2.75 percentage points of the difference, and the difference in education, test scores, and other measured personal characteristics of the recruits accounts for the remaining 2.45 percentage point difference.

It is important to note that the measured personal differences in the group of recruits assigned to each depot explains approximately half of the total difference between depot attrition rates. In order to illustrate the differences in recruit input to the two depots, the mean values of selected quality variables for the FY 1974 recruits assigned to each depot are shown by table 4. Note that the mean value of every variable identified by table 3 as correlated with recruit attrition is more favorable (i.e., associated with lower attrition) for the recruits assigned to San Diego than for those assigned to Parris Island for training. Tables 5 and 6 show the distribution of each cohort group based on age, education and two ACB-61 subtest scores (CI and PA). The test scores are grouped into three ranges that each include approximately one-third of the men in this sample. It is clear from tables 5 and 6 that the San Diego recruits have more desirable test scores and other characteristics most highly related to recruit training attrition.

While no statistical analysis can prove the causes of personnel performance or attrition, this analysis does reveal the variables most highly associated or correlated with attrition. Efforts to manage attrition must be based on an understanding of these variables and continued analysis of recent attrition data.

RECRUIT DEPOT ASSIGNMENT PROCEDURES

An objective of this analysis is to investigate the current procedures for assigning male enlistees to one of the recruit training depots at Parris Island, S.C. or San Diego, California. (All female recruits are trained at Parris Island.)

TABLE 4

MEAN VALUES OF SELECTED VARIABLES[a]
BY RECRUIT TRAINING DEPOT COHORT
(FY 1974)

	MCRD, Parris Island	MCRD, San Diego	Total
Percent white race	70%	83%	77%
Percent high school graduate	44%	48%	46%
AFQT	56.5	57.3	56.9
ACB-61 scores:			
VE	95.7	102.0	98.8
AR	91.7	96.2	94.1
PA	102.3	106.6	104.6
CI	88.4	101.1	95.2
Percent age 21 or more	9.4%	8.8%	9.0%
Percent assigned remedial training	21.6%	16.3%	18.8%
Percent recruit attrition	15.1%	9.9%	12.3%

[a]Mean values prior to correction for range restriction.

The policy of the Marine Corps is, in general, to assign recruits to the depot nearest their home. During fiscal year 1975, 96 percent of enlistees from the three Marine Corps Districts on the east coast (First, Fourth, Sixth) were assigned to MCRD, Parris Island. The twelfth Marine Corps District, in the far west, sent all but two of its enlistees to MCRD, San Diego. The Marine Corps Districts in the midwest (Ninth) and southwest (Eighth) sent 85 percent of local enlistees to MCRD, San Diego. Of all regular and reserve (male, non-prior service) enlistees who reported to recruit training during fiscal year 1975, 49.7 percent were trained at San Diego and 50.3 percent were assigned to Parris Island for recruit training (see reference 3).

TABLE 5

PERCENTAGE COMPOSITION OF REGULAR,
FY 1974 RECRUIT INPUT MCRD, PARRIS ISLAND

	High School Graduate Classification Inventory Score (CI)				Non-High School Graduate Classification Inventory Score (CI)				Total All Education All CI
	109+	82-108	1-81	Total CI HSG	109+	82-108	1-81	Total CI Non-HSG	
Age less than 21									
Pattern Analysis Score (PA):									
115+	8.1%	5.1%	2.6%	15.9%	4.2%	4.2%	4.0%	12.4%	28.3%
95-114	4.7	5.2	4.1	14.1	4.1	7.0	8.7	19.8	33.8
1-94	1.5	3.1	4.2	8.8	1.9	5.9	11.9	19.8	28.6
Total PA Age < 21	14.4	13.4	11.0	38.7	10.2	17.2	24.6	52.0	90.7
Age 21 or more									
Pattern Analysis Score (PA):									
115+	.9%	.4%	.2%	1.5%	.3%	.2%	.2%	.7%	2.1%
95-114	.7	.6	.5	1.7	.4	.5	.6	1.4	3.1
1-94	.3	.5	1.0	1.8	.2	.5	1.5	2.3	4.0
Total PA Age ≥ 21	1.9	1.5	1.6	5.0	.9	1.2	2.3	4.4	9.3
Total: all ages all PA	16.3%	14.9%	12.5%	43.7%	11.0%	18.4%	26.9%	56.3%	100.0%

TABLE 6

PERCENTAGE COMPOSITION OF REGULAR,
FY 1974 RECRUIT INTUT MCRD, SAN DIEGO

	High School Graduate Classification Inventory Score (CI)				Non-High School Graduate Classification Inventory Score (CI)				Total All Education All CI
	109+	82-108	1-81	Total CI HSG	109+	82-108	1-81	Total CI Non-HSG	
Age less than 21									
Pattern Analysis Score (PA):									
115+	13.2%	5.8%	2.2%	21.2%	8.2%	5.6%	2.7%	16.5%	37.7%
95-114	6.6	5.1	2.6	14.2	7.2	7.1	4.5	18.7	32.9
1-94	2.4	2.8	2.2	7.5	3.3	5.0	4.9	13.2	20.6
Total PA Age < 21	22.2	13.6	7.1	42.9	18.6	17.7	12.1	48.4	91.3
Age 21 or more									
Pattern Analysis Score (PA):									
115+	1.5%	.6%	.2%	2.3%	.6%	.2%	.1%	.9%	3.2%
95-114	.9	.6	.3	1.7	.5	.5	.2	1.1	2.9
1-94	.4	.5	.4	1.3	.4	.5	.5	1.3	2.7
Total PA Age ≥ 21	2.8	1.6	.9	5.3	1.4	1.2	.9	3.4	8.7
Total: all ages all PA	25.0%	15.3%	8.0%	48.2%	20.0%	18.8%	13.0%	51.8%	100.0%

The recruit assignment policy can be evaluated by determining whether the depot assignment of a particular recruit affects his chances of completing recruit training. If the depot of assignment materially affects the chances of success of a recruit after considering education, test scores, and other relevant variables, then the reasons for the effect should be investigated. Possible reasons for a differential depot effect could be differences in training standards, weather, attitude of drill instructors, or characteristics of the recruits which are not measured adequately by the available test score and other personal data.

The regression results shown by table 3 show the relative importance of the depot effect and other factors associated with recruit training success. The depot effect can explain 2.75 percentage points of the 5.2 percentage point difference in recruit training failure rates at the two depots. The remainder of the difference in recruit attrition rates which can be explained is due to the test score, education, age, and race variables shown by table 3. If recruits were assigned to the depots so as to equalize the education, age, test score, and racial profiles of the recruits at each depot, then the failure rate would fall by 1.4 percentage points at Parris Island and the recruit failure rate would increase by 1.8 percentage points at San Diego.

The actual recruit attrition rates for men assigned to each depot in fiscal year 1974 have been computed and organized by the first four variables identified by table 3. The results are shown by tables 7 and 8. The consistently higher Parris Island attrition rate is clear.

If a Marine Corps goal is to achieve nearly identical recruit attrition rates at each recruit depot without external controls, then there is clearly a method of doing so. That method is to balance the recruit input quality to each depot by the key variables found to be associated with recruit attrition. Such a Marine Corps goal is not recommended since the predicted effect of such a policy change would seem to offer no advantages for the Marine Corps.

EARLY IDENTIFICATION OF SUBSTANDARD APPLICANTS

The third objective of this analysis is to provide a method of early identification of men unlikely to serve satisfactorily in the Marine Corps. This analysis is based on the fiscal year 1974 enlistees monitored for two years of active duty. As outlined above, the fiscal year 1974 cohort group was selected for this analysis for three reasons. This group includes all regular male enlistees who began service over a twelve-month period so that no seasonal effects should complicate the analysis. These men enlisted in an all-volunteer era. And this is the only twelve-month, all-volunteer group for which two years of performance data are available. These data permit analysis of the factors of Marine manpower quality based on a large sample of recent volunteers who have served in the Fleet Marine Force.

TABLE 7

RECRUIT TRAINING FAILURE RATES BY EDUCATION, AGE, CI AND PA, MCRD, PARRIS ISLAND
(FY 1974 Regular Recruit Input)

	High School Graduate Classification Inventory Score (CI)				Non-High School Graduate Classification Inventory Score (CI)				Total All Education All CI
	109+	82-108	1-81	Total CI HSG	109+	82-108	1-81	Total CI Non-HSG	
Age less than 21									
Pattern Analysis Score (PA):									
115+	5.0%	6.1%	10.8%	6.3%	9.8%	14.6%	19.7%	14.6%	10.0%
95-114	5.6	7.4	11.4	8.0	11.6	12.4	18.5	14.9	12.0
1-94	5.6	8.4	18.2	12.6	13.5	17.3	26.9	22.7	19.6
Total PA Age < 21	5.3	7.1	13.9	8.4	11.2	14.6	22.8	17.8	13.8
Age 21 or more									
Pattern Analysis Score (PA).									
115+	10.6%	13.9%	25.0%	13.2%	30.0%	25.0%	34.3%	29.6%	18.2%
95-114	14.7	17.4	32.2	20.3	34.3	27.1	37.8	33.2	26.2
1-94	17.2	19.2	31.7	25.6	30.4	30.9	46.7	41.4	34.5
Total PA Age ≥ 21	13.2	17.1	31.1	20.1	31.9	28.3	43.4	36.9	28.0
Total: all ages all PA	6.2%	8.1%	16.1%	9.7%	12.8%	15.5%	24.5%	19.3%	15.1%

TABLE 8

RECRUIT TRAINING FAILURE RATES BY EDUCATION, AGE, CI AND PA, MCRD SAN DIEGO
(FY 1974 Regular Recruit Input)

	High School Graduate Classification Inventory Score (CI)				Non-High School Graduate Classification Inventory Score (CI)				Total All Education All CI
	109+	82-108	1-81	Total CI HSG	109+	82-108	1-81	Total CI Non-HSG	
Age less than 21									
Pattern Analysis Score (PA):									
115+	2.8%	5.5%	7.8%	4.1%	7.2%	9.3%	13.2%	8.9%	6.2%
95-114	4.3	4.8	8.5	5.2	8.0	9.6	15.3	10.4	8.2
1-94	5.4	9.0	17.2	10.3	10.9	14.4	27.5	18.4	15.5
Total PA Age < 21	3.5	6.0	11.0	5.6	8.2	10.8	19.8	12.1	9.0
Age 21 or more									
Pattern Analysis Score (PA):									
115+	10.5%	9.3%	20.4%	11.2%	18.7%	18.4%	19.4%	18.7%	13.3%
95-114	13.5	9.2	28.8	14.4	16.5	23.8	26.5	21.3	17.2
1-94	25.3	21.0	29.8	25.2	19.0	29.6	37.3	29.6	27.4
Total PA Age ≥ 21	13.7	12.6	27.2	15.7	18.0	25.2	31.6	23.9	18.9
Total: all ages all PA	4.7%	6.7%	12.9%	6.7%	8.8%	11.7%	20.6%	12.8%	9.9%

It is important that manpower quality be judged by performance in the Fleet Marine Force. The measures of Fleet Marine Force performance available for this analysis include both positive and negative measures. The positive measures are superior recruit training performance (as recognized by promotion at the end of training) and rank achieved within twenty-four months of enlistment. The negative measures are attrition and desertion during the first twenty-four months of service. Regression analysis has been used to identify the explanatory variables most highly correlated with each of these measures of manpower quality. Table 9 shows a summary of the results. The complete regression results are shown in appendix E.

TABLE 9

SUMMARY OF REGRESSION RESULTS:
FOUR MEASURES OF PERFORMANCE

Measure of performance:	Recruit training success	Rank achieved	Attrition	Desertion
Best predictor variables:	CI	education	education	education
	ARC	AR	CI	AR
	education	CI	PA	VE
	PA	PA	age	marital status
	race	age	GIT	PA

Graduation from high school is an important favorable indicator for each of these four measures of performance. Education has been found to be a key correlate of quality in many military manpower studies (see reference 1). Education is the best single indicator for rank achieved, attrition, and desertion. Analysis of the general equivalency diploma as a separate educational level revealed it to be no more desirable than the eleventh grade educational level. Other important indicators of these performance measures include the CI, PA, AR and VE test scores.

A composite measure of performance has been selected for the remainder of this analysis. The variable selected is the combination of attrition and desertion. Any man in the sample who ever deserted or was discharged from the Marine Corps during the first twenty-four months of his enlistment was classified as a substandard performer. Regression analysis of this quality variable on the available data is shown in table 10. A high school diploma is the single best indicator of high quality. Several test scores from the Army classification test (ACB-61) and age at time of enlistment are also significant predictors of quality of service.

TABLE 10

REGRESSION RESULTS: QUALITY[a] OF SERVICE

Variable	Coefficient	Cumulative R^2
Education	-.1879	.067
PA	-.0016	.095
CI	-.0016	.106
Age	+.1076	.110
GIT	-.0011	.112
AR	-.0007	.112
(Constant)	+.9057	

F = 969
N = 45,948

Variables considered but not selected:

Race
Marital status
VE
MA
ACS
ARC
SM
AI
ELI

[a]Quality as measured by either attrition or desertion during the first twenty-four months of service.

A measure of manpower quality presently used by the Marine Corps is mental group score, which is used as a criterion for enlistment. Mental group score is based on an equal weighting of verbal (VE), arithmatic (AR) and pattern analysis (PA) tests, and each of these three test scores appeared as statistically significant predictors of several performance measures (table 9). In order to determine if a regression including a combined equal weighting of these tests would provide as good a fit to the data, the regression shown by table 11 was prepared. In this regression the scores VE, AR and PA of each man in the sample were replaced by the general classification test (GCT) score. GCT is parallel to a mental group score since it is composed of equal weights of VE, AR and PA. As shown by table 11, the portion of variance in the quality variable (as measured by the cumulative R^2 value) is virtually the same as that provided by the model of table 10. Since the model of table 11 is consistent with the convention of using a mental group score to describe manpower quality, it will be adopted for predicting quality of service for this analysis.

TABLE 11

REGRESSION RESULTS: MANPOWER QUALITY[a] WITH SELECTED VARIABLES

Variable	Coefficient	Cumulative R^2
Education	-.1870	.067
GCT	-.0029	.098
CI	-.0017	.105
Age	+.1090	.110
(Constant)	+.8694	
	F = 1,413 N = 45,948	

[a]Manpower quality as measured by either desertion or attrition during the first twenty-four months of the enlistment.

The regression equation shown by table 11 is:

$$\text{quality measure} = .187(\text{education}) - .0029(\text{GCT}) - .0017(\text{CI}) + .109(\text{age}) + .8694 \quad . \qquad (1)$$

The interpretation of the quality measure is a predicted rate of failure or attrition for men with given levels of age, education and test scores. This measure can be converted to a positive measure of success:

$$\text{success rate} = 1 - \text{quality measure} \qquad (2)$$

$$= 1 - [.187(\text{education}) - .0029(\text{GCT}) - .0017(\text{CI}) + .109(\text{age}) + .8694] \qquad (3)$$

$$\text{success rate} = .0029(\text{GCT}) + .0017(\text{CI}) + .187(\text{education}) - .109(\text{age}) - .1306 \quad . \qquad (4)$$

Using this equation, the chances for successful service can be predicted for enlistees with any combination of test scores and age and education levels. By comparing the chances for success of applicants for enlistment, those applicants with the lowest chances of serving satisfactorily can be identified prior to enlistment. Tables 12 through 15 show the predicted chances of success for applicants with a combination of test scores and age and education levels. These tables provide a method of comparing men with different levels of dissimilar characteristics before they are accepted for enlistment. The man with a low GCT score but a high school diploma can be compared with a non-graduate who scored high on the GCT. Although any screening system will have some errors resulting from it, this model provides the best linear estimate of success chances in terms of test scores and personal characteristics available for this analysis.

Since the data were collected for this analysis, a new enlistment and classification test has been adopted for all-service use. This test, the Armed Services Vocational Aptitude Battery (ASVAB), has been administered to Marine Corps applicants since July 1974. This test now provides the only aptitude information available prior to enlistment. The implementation of a screening method such as the one developed here would require that these results be expressed in terms of the data currently available to recruiters prior to enlistment: ASVAB scores, age, and education. Such a transformation has been published (see reference 4). For an analysis of the correlation between the ACB-61 test scores and the new ASVAB test scores, see reference 6.

CONCLUSIONS

This analysis provides insight into some differences in the attrition rates at the two recruit training depots and in the recruits assigned to each one. In addition, a method of early identification of men unlikely to perform well in Marine Corps units is presented.

TABLE 12

PREDICTED SUCCESS RATES
HIGH SCHOOL GRADUATES, AGE 17-20

Classification Inventory (CI) score	General Classification Test (GCT) score						
	160	140	120	100	80	60	40
160	.99[a]	.99[a]	.94	.88	.82	.76	.71
140	.99[a]	.96	.90	.85	.79	.73	.67
120	.99	.93	.87	.81	.75	.70	.64
100	.95	.89	.84	.78	.72	.66	.60
80	.92	.86	.80	.74	.69	.63	.57
60	.88	.83	.77	.71	.65	.59	.54
40	.85	.79	.73	.68	.62	.56	.50

Predicted success = +.0029 GCT + .0017CI + .317

[a]Predicted success rate constraint ≤ .99.

TABLE 13

PREDICTED SUCCESS RATES
HIGH SCHOOL GRADUATES, AGE 21 OR MORE

Classification Inventory (CI) score	General Classification Test (GCT) score						
	160	140	120	100	80	60	40
160	.94	.89	.83	.77	.71	.65	.60
140	.91	.85	.79	.74	.68	.62	.56
120	.88	.82	.76	.70	.64	.59	.53
100	.84	.78	.73	.67	.61	.55	.49
80	.81	.75	.69	.63	.58	.52	.46
60	.77	.72	.66	.60	.54	.48	.43
40	.74	.68	.62	.57	.51	.45	.39

Predicted success = + .0029 GCT + .0017 CI + .2086

TABLE 14

PREDICTED SUCCESS RATES
NON-GRADUATES, AGE 17-20

Classification Inventory (CI) score	General Classification Test (GCT) score						
	160	140	120	100	80	60	40
160	.87	.81	.75	.69	.63	.58	.52
140	.83	.77	.72	.66	.60	.54	.48
120	.80	.74	.68	.62	.57	.51	.45
100	.76	.71	.65	.59	.53	.47	.42
80	.73	.67	.61	.56	.50	.44	.38
60	.70	.64	.58	.52	.46	.41	.35
40	.66	.60	.55	.49	.43	.37	.31

Predicted success = + .0029 GCT + .0017 CI + .1306

TABLE 15

PREDICTED SUCCESS RATES
NON-GRADUATES, AGE 21 OR MORE

Classification Inventory (CI) score	General Classification Test (GCT) score						
	160	140	120	100	80	60	40
160	.76	.70	.64	.58	.53	.47	.41
140	.72	.67	.61	.55	.49	.43	.38
120	.69	.63	.57	.52	.46	.40	.34
100	.66	.60	.54	.48	.42	.37	.31
80	.62	.56	.51	.45	.39	.33	.27
60	.59	.53	.47	.41	.36	.30	.24
40	.55	.50	.44	.38	.32	.26	.21

Predicted success = + .0029 GCT + .0017 CI + .0216

Analysis of the attrition experience of fiscal year group 1974 recruits trained at each Marine Corps Recruit Depot (MCRD) revealed that approximately 11 percent of the variance in attrition can be explained by a linear, individual data model. (A linear, grouped data model explains 77 percent of the variance in group attrition, see appendix A.) The difference in recruit attrition at each depot was found to be 5.2 percentage points, of which slightly more than half (2.8 percentage points) was due to the test scores and personal characteristics of the recruits and slightly less than half (2.4 percentage points) was due to a "depot effect." The depot effect includes unmeasured differences in recruits as well as any policy or procedure differences which may exist at the two depots. It does not appear that these differences are large enough to warrant changes in either recruit assignment procedures or in recruit depot policies.

Quality of service of enlisted Marines was defined as service for twenty-four months without attrition or desertion. The variables shown to be most highly correlated with this (and other) quality measures were education, age, general classification test (GCT) score, and classification inventory (CI) test score. A method of early identification of applicants for enlistment most likely to perform poorly was presented. An extension of this methodology suitable for implementation at the recruiting station level has been published (see reference 4).

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APPENDIX A

VALIDATION OF THE MODEL AND A COMPARISON WITH ALTERNATIVE MODELS

APPENDIX A

VALIDATION OF THE MODEL AND A COMPARISON WITH ALTERNATIVE MODELS

Comparison of the Model with the Data

The model used in this analysis is a linear regression model with the record of each man in the sample treated as a separate data point (nongrouped data). It is desirable to know just how well this model fits the data or predicts attrition. The most straightforward method to validate the model is to compare the actual data with model predictions of the same data. The data selected for this validation are actual twenty-four month attrition, not corrected for range restriction.

Table A-1 shows actual attrition rates by education, age, and the test scores CI and PA. These variables have been shown by the analysis to be among the best available predictors of attrition. The range of each test score is divided to include approximately one-quarter of the scores in each group. Table A-2 shows the attrition rates predicted by the linear, nongrouped data model for men with selected combinations of test scores and age and education levels. Since this model predicts attrition rates associated with specific test scores rather than with broad ranges of scores, it was necessary to select scores for the computation of table A-2. The scores selected are the scores falling at the midpoint of each score range shown in table A-1. An X^2 test was used to compare the actual (table A-1) and predicted (table A-2) attrition experience assuming a uniform distribution of 100 men in each cell. The result is that we can find no statistical difference between the two distributions ($X^2 = 44.8$, $X^2_{.05,63} = 45.7$). When only the age 17-20 portions of the distributions are compared, the same result is found ($X^2 = 18.0$, $X^2_{.05,31} = 19.3$). The conclusion is that the linear regression model (with nongrouped data) does fit the data and is a satisfactory model for this analysis.

An Alternative Model

An alternative to the model selected is a linear regression model with grouped data. In such a model, the men in the sample are grouped by education, age, CI and PA (for instance). The attrition rates of each subgroup thus defined are calculated. The data for such a model then are the average attrition rate, average test scores, average education level, etc., of the men in each subgroup. Such a model reduces the variance in attrition by smoothing the variance within each subgroup. The R^2 statistic in such a model is higher than in a nongrouped regression model with the same underlying data. In order to demonstrate this finding, a grouped data regression model was computed. Table A-3 shows the grouping of the four variables (HS, age, CI and PA). Table A-4 shows the regression results. The cumulative R^2 statistic indicates that 76.9 percent of the variation of (subgroup) attrition can be explained by these four variables. The regression equation of table A-4 has been computed for each of the sixty-four subgroups

TABLE A-1

ATTRITION RATES BY SUBGROUPS

	High School Graduate				Non-High School Graduate			
	Classification Inventory Score (CI)				Classification Inventory Score (CI)			
	113+	94-112	79-95	1-78	113+	94-112	79-95	1-78
Age less than 21								
Pattern Analysis Score (PA):								
119+	8.5%	10.0%	14.2%	17.5%	24.0%	23.5%	31.8%	32.1%
106-118	11.7	11.4	15.7	18.5	24.5	27.2	30.7	34.5
92-105	11.1	14.2	17.5	21.8	27.7	30.3	31.0	39.2
1-91	14.7	19.0	22.1	32.2	31.9	34.5	38.5	48.9
Age 21 or more								
Pattern Analysis Score (PA):								
119+	19.9%	22.0%	18.8%	46.5%	37.3%	44.4%	36.4%	45.2%
106-118	24.0	30.4	30.3	44.3	42.1	40.9	50.0	53.9
92-105	35.3	28.3	31.5	38.7	50.0	50.0	40.2	50.1
1-91	39.2	30.0	43.7	41.6	51.5	45.3	53.0	61.3

TABLE A-2

PREDICTED ATTRITION RATES
INDIVIDUAL DATA REGRESSION MODEL

	High School Graduate				Non-High School Graduate			
	Classification Inventory Score (CI)				Classification Inventory Score (CI)			
	136	104	87	59	136	104	87	59
Age less than 21								
Pattern Analysis Score (PA):								
139	1.9%	7.3%	10.2%	15.0%	17.0%	22.5%	25.4%	30.1%
112	7.8	13.3	16.1	20.9	23.0	28.4	31.3	36.1
98	10.9	16.3	19.2	24.0	26.1	31.5	34.4	39.1
65	18.2	23.6	26.5	31.3	33.3	38.7	41.6	46.4
Age 21 or more								
Pattern Analysis Score (PA):								
139	17.4%	22.9%	25.8%	30.5%	32.6%	38.0%	40.9%	45.7%
112	23.4	28.8	31.7	36.5	38.5	44.0	46.9	51.6
98	26.5	31.9	34.8	39.5	41.6	47.1	49.9	54.7
65	33.7	39.2	42.1	46.8	48.9	54.3	57.2	62.0

Predicted attrition rate = -.1515(HS) - .0022(PA) - .0017(CI) + .1556(Age) + .7073

$R^2 = .078$

TABLE A-3

VARIABLES USED IN SUBGROUP REGRESSION

Variable	Values	
HS	1 if high school graduate	0 otherwise
Age	1 if age 21 or more	0 otherwise
CI-1	1 if CI $\geq$ 113	0 otherwise
CI-2	1 if 96 $\leq$ CI $\leq$ 112	0 otherwise
CI-3	1 if 79 $\leq$ CI $\leq$ 95	0 otherwise
PA-1	1 if PA $\geq$ 119	0 otherwise
PA-2	1 if 106 $\leq$ PA $\leq$ 118	0 otherwise
PA-3	1 if 92 $\leq$ PA $\leq$ 105	0 otherwise

TABLE A-4

RESULTS OF REGRESSION OF ATTRITION BY SUBGROUP

Variable	Regression Coefficient	Cumulative R^2
HS	-.1650	.494
Age	.1523	.594
CI-1	-.1096	.641
CI-2	-.0980	.692
CI-3	-.0704	.719
PA-1	-.0969	.735
PA-2	-.0794	.750
PA-3	-.0621	.769
(Constant)	+.4477	

defined by these ranges of the four variables and the results are shown in table A-5. These are the attrition rates predicted by the grouped-data regression model for the subgroups. An X^2 test has been used to compare the grouped-data predicted attrition rates (table A-5) with the actual attrition rates (table A-1). The result is that the grouped-data model also fits the data ($X^2 = 29.4$, $X^2_{.005, 63} = 37.8$). Comparison of the age 17-20 portions of the distributions yields the same result ($X^2 = 5.2$, $X^2_{.005, 31} = 14.5$). Therefore, both the nongrouped data and the grouped-data models fit the data. The nongrouped data model offers the advantage of results cast in terms of actual test scores rather than broad and arbitrary ranges. The lower R^2 statistic of the nongrouped model is shown not to reduce the predictive power of the model compared with the grouped-data model.

A Cross Validation of the Model

The sample of 45,948 men was divided at random into two samples, A and B. Table A-6 shows the mean values of selected variables in each sample. Using the quality measure of either early attrition or desertion, a regression equation was predicted for each sample. The regressions were first computed with all variables available. The results of this step-wise regression are shown in table A-7. Note that the significant variables are the same in each subsample, the order of the variables is the same with one exception, and the coefficients are comparable. A second regression was computed for each sample which included GCT, the composite test composed of PA, AR, and AE which is similar in structure to the ASVAB mental group composite score. The results of the second set of regressions are shown in table A-8. Again, the coefficients are similar and each equation is statistically significant.

To cross-validate the model, the regression equation of sample A was computed for each man in sample B. Then the predicted and actual quality measures for the men in sample B were computed. The comparisons were based on three passing (cutting) scores of the quality measure: .25, .33, and .50. Note that .33 is near the sample mean. The performance of the prediction model can be considered by determining the number of correct and incorrect predictions. Each category can be grouped into those that passed or failed. Table A-9 shows this grouping. Each man in sample B is predicted to "pass" unless his predicted quality measure equals or exceeds .25, .33, or .50, respectively. With a maximum "pass" score of .33, 63 percent of the men in sample B are correctly predicted. Thirty-nine percent were predicted to pass ($\hat{Q} \leq .33$) and did pass ($Q = 0$), while 24 percent were predicted to fail ($\hat{Q} \geq .33$) and did so ($Q = 1$). Analysis of the erroneous predictions reveals that 9 percent of the men were predicted to pass but failed while 28 percent of them were predicted to fail but passed. These results are consistent with the results reported by Lockman and Warner, (reference 4). Their linear model used nongrouped data for 60,000 Navy enlisted men who were tracked for one year and who had a loss rate of .17. Their cross-validation at a maximum passing score of 20 (minimum failing score of 80) resulted in 65 percent accurate predictions,

TABLE A-5

PREDICTED ATTRITION RATES GROUPED DATA REGRESSION MODEL

	High School Graduate Classification Inventory Score (CI)				Non-High School Graduate Classification Inventory Score (CI)			
	113+	96-112	79-95	1-78	113+	96-112	79-95	1-78
Age less than 21								
Pattern Analysis Score (PA):								
119+	7.6%	8.8%	11.5%	18.6%	24.1%	25.3%	28.0%	35.1%
106-118	9.4	10.5	13.3	20.3	25.9	27.0	29.8	36.8
92-105	11.1	12.3	15.0	22.1	27.6	28.8	31.5	38.6
1-91	17.3	18.5	21.2	28.3	33.8	35.0	37.7	44.8
Age 21 or more								
Pattern Analysis Score (PA):								
119+	22.8%	24.0%	26.8%	33.8%	39.4%	40.5%	43.3%	50.3%
106-118	24.6	25.7	28.5	35.5	41.1	42.2	45.0	52.0
92-105	26.3	27.5	30.2	37.3	42.8	44.0	46.7	53.8
1-91	32.5	33.7	36.4	43.5	49.0	50.2	52.9	60.0

Predicted attrition rate = -.165[illegible](HS) + .1523(Age) - .1096(CI1) - .0983(CI2) - .0704(CI3)
-.0970(PA1) - .0794(PA2) - .0621(PA3) + .4477

R^2 = .769

TABLE A-6

MEAN VALUES OF SELECTED VARIABLES
IN TWO MUTUALLY EXCLUSIVE RANDOM SAMPLES

Selected variables	Mean	
	Sample A	Sample B
Quality measure	.3255	.3309
Early attrition	.2870	.2913
Desertion	.1111	.1150
Early promotion	.1617	.1618
Rank achieved	2.5774	2.5703
Race	1.2275	1.2218
Marital status	1.0688	1.0724
Age	.1010	.1007
Education	.4861	.4869
AFQT	59.0143	58.8392
VE	100.3362	100.1012
AR	95.8911	95.7734
PA	105.5450	105.5085
CI	96.0029	96.1363
GT (VE+AR)/2	98.3622	98.1819
GCT (VE+AR+[illegible])/3	100.5908	100.4610
(N)	(23,025)	(22,923)

TABLE A-7

REGRESSION RESULTS: QUALITY MEASURE
WITH ALL VARIABLES IN EACH SAMPLE

Sample A		Sample B	
Variable	Coefficient	Variable	Coefficient
High school	-.185	High school	-.182
PA	-.002	CI	-.002
CI	-.002	PA	-.002
Age	+.103	Age	+.110
Enlistment guarantee	-.039	Enlistment guarantee	-.054
GIT	-.001	GIT	-.002
Race	-.028	Race	-.028
ARC	-.001	AFQT	+.001
(Constant)	+.943	(Constant)	+.939
R^2 = .114		R^2 = .116	
F = 372		F = 374	

Variables considered but not selected	Variables considered but not selected
Marital status	Marital status
AFQT	VE
VE	AR
AR	MA
MA	ACS
ACS	ARC
SM	SM
AI	AI
ELI	ELI

7 percent predicted "passes" of men who attrited and 28 percent predicted attritions for men who did not. In addition, their analysis showed, with the same data, that a non-linear nongrouped data regression model (logarithmic) and a non-linear grouped-data regression model could not provide better predictions of attrition.

TABLE A-8

REGRESSION RESULTS: QUALITY MEASURE
WITH SELECTED VARIABLES IN EACH SAMPLE

Sample A		Sample B	
Variable	Coefficient	Variable	Coefficient
High school	-.188	High school	-.186
GCT	-.003	GCT	-.003
CI	-.002	CI	-.002
Age	+.105	Age	+.102
(Constant)	+.864	(Constant)	+.874
r^2 = .109		r^2 = .110	
F = 707		F = 706	

APPENDIX B

CORRECTION FOR RANGE RESTRICTION

APPENDIX B

CORRECTION FOR RANGE RESTRICTION

All Marine Corps enlistees in fiscal year 1974 were required to pass the AFQT mental group test with a percentile score of 21 or more. Those scoring lower than 21 were excluded from enlistment and are, therefore, not in the 45,000-man sample. Since mental group or GCT is an important variable in explaining attrition and performance, it is prudent to correct the data for this restriction in the range of mental group.

In recent years the Marine Corps has enjoyed the benefits of double testing enlistees. Applicants were given the AFQT test prior to enlistment, and successful applicants were then given the ACB-61 test upon arrival at recruit training. The AFQT score, composed of verbal, arithmetic, and pattern analysis components, defines mental group. The ACB-61 test includes three analogous subtests: word knowledge, arithmetic, and spatial perception, which together form the GCT score.

During fiscal year 1974, an apparent discrepancy between AFQT mental group scores and the subsequent ACB-61 scores of enlistees developed. It appears that a sizable number of fiscal year 1974 enlistees obtained higher AFQT mental group scores than would be expected based on their ACB-61 scores. The ACB-61 test, administered at the Recruit Depots under controlled conditions, is thought to be a better measure of the verbal, arithmetic and spatial perceptions of the men in the sample. Therefore, the correction for range restriction is applied based on GCT score.

Reference 2 provides an estimate of the GCT distribution of the mobilization population. This GCT distribution was compared with the actual GCT distribution of the 45,000-man sample, and weights were computed for each of seven segments of the GCT range. The weights were then applied to each man in the 45,000-man sample to produce the table of correlation coefficients shown at appendix C. These coefficients were used to conduct the regression analysis of this report. Table B-1 shows the relevant GCT distribution and the derived weights.

TABLE B-1

GCT DISTRIBUTIONS AND WEIGHTS

GCT range	Mobilization population distribution	Fiscal year 1974 Marine Corps distribution	Weight (2) ÷ (3)
(1)	(2)	(3)	(4)
130-160	6.924%	2.320%	2.984
110-129	29.954	24.832	1.206
100-109	18.394	23.343	.788
90-99	16.734	21.664	.772
80-89	12.801	15.126	.846
65-79	12.921	10.613	1.217
1-64	2.273	2.104	1.080
Total	100.0	100.0	-

APPENDIX C

TABLE OF CORRELATION COEFFICIENTS
(WEIGHTED TO THE MOBILIZATION POPULATION)

TABLE C-1

TABLE OF CORRELATION COEFFICIENTS

CORRELATION COEFFICIENTS

A VALUE OF 99.00000 IS PRINTED
IF A COEFFICIENT CANNOT BE COMPUTED.

	OVATTR	VATTR	RACE	NDEP	MARIT	ASVAB	VE	AR	PA	CI	MA	ACS
OVATTR	1.00000	0.91245	0.09103	0.04949	0.03637	-0.11569	-0.20500	-0.21896	-0.21353	-0.22193	-0.18638	-0.17598
VATTR	0.91245	1.00000	0.08156	0.05218	0.03665	-0.12419	-0.21899	-0.23273	-0.22269	-0.21970	-0.19463	-0.18582
RACE	0.09103	0.08156	1.00000	0.02536	-0.00981	-0.27241	-0.35977	-0.35108	-0.34869	-0.25855	-0.38024	-0.29348
NDEP	0.04949	0.05218	0.02536	1.00000	0.78178	-0.02372	-0.04529	-0.02913	-0.03543	-0.00734	-0.02480	-0.02376
MARIT	0.03637	0.03665	-0.00981	0.78178	1.00000	-0.01507	-0.02581	-0.01798	-0.01208	0.00156	-0.00762	-0.01228
ASVAB	-0.11569	-0.12419	-0.27241	-0.02372	-0.01507	1.00000	0.47920	0.51992	0.50418	0.50706	0.46847	0.34490
VE	-0.20500	-0.21899	-0.35977	-0.04529	-0.02581	0.47920	1.00000	0.73948	0.61847	0.56428	0.65798	0.54444
AR	-0.21896	-0.23273	-0.35108	-0.02913	-0.01798	0.51992	0.73948	1.00000	0.67619	0.51677	0.63273	0.61615
PA	-0.21353	-0.22269	-0.34869	-0.03543	-0.01298	0.50418	0.61847	0.67619	1.00000	0.46676	0.61809	0.57729
CI	-0.22193	-0.21970	-0.25855	-0.00734	0.00156	0.50706	0.56428	0.51677	0.46676	1.00000	0.54692	0.45555
MA	-0.18638	-0.19463	-0.38024	-0.02480	-0.00762	0.46847	0.65798	0.63273	0.61809	0.54692	1.00000	0.55414
ACS	-0.17598	-0.18582	-0.29348	-0.02376	-0.01228	0.34490	0.54444	0.61615	0.57729	0.46555	0.55414	1.00000
ARC	-0.19611	-0.17668	-0.25954	-0.02045	-0.01133	0.32472	0.51195	0.53697	0.48795	0.39544	0.46940	0.53351
GIT	-0.21638	-0.22479	-0.42251	-0.01754	-0.00151	0.44120	0.75373	0.66443	0.59533	0.56972	0.67061	0.52334
SH	-0.17447	-0.20087	-0.39156	-0.01724	-0.00744	0.44175	0.65953	0.61179	0.60677	0.52117	0.70733	0.52718
AI	-0.13652	-0.16165	-0.33778	0.03529	0.04431	0.38637	0.53327	0.50703	0.52539	0.44118	0.62934	0.41546
ELI	-0.14680	-0.15774	-0.33215	-0.00435	0.00571	0.43629	0.57279	0.53431	0.55617	0.48494	0.57729	0.38511
MCRD	-0.17647	-0.14707	-0.15997	-0.01078	-0.00178	0.04273	0.13549	0.11627	0.10682	0.22493	0.10188	0.01164
ACRGT	-0.22725	-0.24215	-0.34119	-0.04096	-0.02484	0.53510	0.93419	0.93087	0.69369	0.54072	0.69256	0.62183
NOTPLAT	0.00502	0.00743	0.07039	-0.00335	-0.00612	-0.05240	-0.07350	-0.08010	-0.08265	-0.08988	-0.07854	-0.07472
CORCUS	0.05680	0.06867	0.12708	0.01240	0.00516	-0.03903	-0.04573	-0.05587	-0.05295	-0.04754	-0.04874	-0.05156
SEP	0.55539	0.54758	0.02464	0.05470	0.03330	-0.07701	-0.15303	-0.16548	-0.13556	-0.13560	-0.14154	-0.10576
DES	0.29795	0.31076	0.02521	0.02620	0.02342	-0.00230	-0.12439	-0.12573	-0.10103	-0.08546	-0.08622	-0.08153
RCYC	0.11699	0.10949	0.03134	0.00096	0.00237	-0.06507	-0.09941	-0.10236	-0.10118	-0.13010	-0.08036	-0.10436
RAWK	-0.02703	-0.06434	-0.12213	-0.03008	-0.01879	0.29300	0.29792	0.32051	0.29011	0.27206	0.26038	0.27864
PROM	-0.13588	-0.14329	-0.13576	-0.00799	0.00306	0.14400	0.18529	0.19088	0.18238	0.20420	0.17989	0.18653
GUAR	-0.24854	-0.25598	-0.22341	-0.04212	-0.02502	0.33461	0.34331	0.33983	0.31790	0.24913	0.29866	0.23795
OCT	-0.25563	-0.25301	-0.39863	-0.04134	-0.02177	0.56522	0.88395	0.90793	0.86109	0.59030	0.71817	0.65336
AGE21	0.05947	0.05144	0.09107	0.28395	0.22451	-0.00146	0.01242	0.00548	-0.04608	0.01926	-0.01979	-0.03454
MS	-0.22696	-0.23971	-0.34669	-0.02902	-0.02190	0.24981	0.34309	0.33074	0.23616	0.22458	0.24768	0.25913
NJ	-0.21642	-0.23002	-0.35511	-0.02709	-0.01653	0.47082	0.70284	0.67726	0.67117	0.54302	0.66131	0.51868
AR	-0.21239	-0.22729	-0.36126	-0.04338	-0.02383	0.46866	0.99498	0.75207	0.63503	0.00105	0.66128	0.55891
SP	-0.21639	-0.22640	-0.36955	-0.03013	-0.01113	0.52431	0.65517	0.69841	0.98615	0.48931	0.65613	0.58416
CC	-0.24697	-0.24445	-0.33744	-0.01127	0.00074	0.56177	0.69816	0.61678	0.55556	0.98498	0.64237	0.53163
AT	-0.23415	-0.23701	-0.34845	-0.02218	-0.00572	0.46117	0.69879	0.68558	0.62241	0.00699	0.67456	0.60896

TABLE C-2

TABLE OF CORRELATION COEFFICIENTS

	ARC	BIT	SH	AI	ELI	MCRD	ACBGT	MOTPLAT	CORCUS	SEP	BES	RCYC
OVATTN	-0.19611	+0.21638	-0.19447	-0.15852	-0.14580	-0.17847	-0.22725	0.08902	0.08660	0.95639	0.28765	0.18499
VATTN	-0.17098	-0.22679	-0.20087	-0.16165	-0.15794	-0.14767	-0.24215	0.08743	0.08687	0.90768	0.91074	0.10649
PACE	-0.29554	-0.42281	-0.39156	-0.38779	-0.30216	-0.25997	-0.38189	0.07839	0.07908	0.02484	0.02321	0.03144
PREP	-0.02005	-0.01736	-0.02724	0.03526	-0.00435	-0.01098	-0.04056	-0.00305	0.00240	0.05370	0.02620	0.00698
MARIT	-0.01033	-0.00151	-0.00044	0.04431	0.00571	-0.00178	-0.02484	-0.00612	0.00516	0.03830	0.02342	0.00287
ASVAB	0.32472	0.44123	0.44175	0.38837	0.43629	0.04273	0.53510	-0.05240	-0.04908	-0.07791	-0.06230	-0.06507
VE	0.31495	0.75373	0.65953	0.53527	0.57578	0.13646	0.93415	-0.07350	-0.06573	-0.15108	-0.12438	-0.09941
AR	0.32037	0.66443	0.61179	0.51733	0.53431	0.11627	0.93087	-0.08010	-0.05587	-0.16548	-0.12373	-0.10238
PA	0.43755	0.59533	0.56677	0.52559	0.55617	0.10982	0.69369	-0.08285	-0.05298	-0.18356	-0.10163	-0.10116
CI	0.37548	0.56972	0.52117	0.44116	0.48194	0.12425	0.59072	-0.06968	-0.04759	-0.19560	-0.08546	-0.13010
MA	0.42540	0.67061	0.59753	0.62454	0.57725	0.10186	0.69209	-0.07854	-0.04874	-0.14154	-0.08629	-0.08636
AFS	0.33251	0.52334	0.52718	0.41336	0.39511	0.01164	0.62188	-0.07472	-0.05156	-0.16576	-0.08053	-0.10458
AFC	1.00000	0.46378	0.42343	0.32158	0.33877	0.08262	0.55943	-0.04783	-0.04703	-0.14028	-0.07854	-0.11665
OIT	0.46374	1.00000	0.71578	0.66225	0.61452	0.20996	0.76076	-0.08462	-0.05279	-0.15338	-0.11252	-0.09511
SH	0.42640	0.71578	1.00000	0.72408	0.62492	0.11729	0.68184	-0.07593	-0.04446	-0.13131	-0.08632	-0.08425
AI	0.32158	0.66225	0.72408	1.00000	0.61625	0.17049	0.55793	-0.06579	-0.03325	-0.11795	-0.06354	-0.06745
ELI	0.33877	0.61452	0.62492	0.61625	1.00000	0.07257	0.59532	-0.06318	-0.03951	-0.13723	-0.07958	-0.08684
MCRD	0.08262	0.20996	0.11926	0.17048	0.07259	1.00000	0.13559	-0.04342	0.02915	-0.07332	-0.05008	-0.06401
ACBGT	0.55943	0.76076	0.68184	0.55793	0.59532	0.13559	1.00000	-0.08226	-0.05434	-0.17083	-0.13299	-0.10815
MOTPLAT	-0.04783	-0.08462	-0.07593	-0.06579	-0.06318	-0.04342	-0.08225	1.00000	0.08699	0.07610	0.02222	0.29601
CORCUS	-0.04703	-0.05279	-0.04446	-0.03325	-0.03951	0.02915	-0.05434	0.08699	1.00000	0.08547	0.04080	0.26018
SEP	-0.14028	-0.15338	-0.13131	-0.11795	-0.13723	-0.07332	-0.17083	0.07610	0.08547	1.00000	-0.12226	0.09198
BES	-0.07854	-0.11252	-0.08632	-0.06354	-0.07958	-0.05008	-0.13299	0.02222	0.04080	-0.12226	1.00000	0.05268
RCYC	-0.11663	-0.09511	-0.08425	-0.06745	-0.08684	-0.06401	-0.10815	0.29601	0.26018	0.09198	0.05268	1.00000
RANK	0.25800	0.29469	0.26367	0.21253	0.21732	0.00033	0.33140	-0.10965	-0.11148	-0.40004	-0.35313	-0.13211
PROX	0.19573	0.17646	0.16239	0.12762	0.12537	0.01695	0.20636	-0.06936	-0.05176	-0.15504	-0.04754	-0.08552
GLAR	0.24216	0.32117	0.29671	0.26139	0.27276	0.00463	0.36632	-0.04639	-0.03264	-0.08454	-0.06753	-0.06369
OPT	0.57529	0.75514	0.71673	0.58702	0.62693	0.13541	0.96319	-0.08688	-0.05909	-0.18872	-0.13170	-0.11393
ACE21	-0.03685	0.03222	-0.01636	0.02929	0.01780	-0.00229	0.01115	0.00219	0.00155	0.00687	-0.00620	0.02473
MS	0.23527	0.29791	0.24788	0.17412	0.19476	0.00173	0.35953	-0.05874	-0.03760	-0.11954	-0.20610	-0.08296
NJ	0.59156	0.65232	0.62825	0.50638	0.50689	0.00543	0.84606	-0.08573	-0.05948	-0.18405	-0.11110	-0.11508
WK	0.52436	0.81572	0.65952	0.57024	0.60139	0.15210	0.93811	-0.07758	-0.04829	-0.15810	-0.12062	-0.10198
SP	0.44429	0.64365	0.65494	0.58279	0.68632	0.18707	0.72594	-0.08312	-0.05425	-0.18264	-0.10510	-0.10189
CC	0.45772	0.76537	0.63602	0.55689	0.51327	0.24317	0.76544	-0.09746	-0.05408	-0.18214	-0.10284	-0.13225
AT	0.57695	0.67734	0.65268	0.55613	0.59089	0.20847	0.74221	-0.10100	-0.05825	-0.22167	-0.10815	-0.13652

TABLE C-3

TABLE OF CORRELATION COEFFICIENTS

	RANK	FROM	GUAR	GCT	AGE21	MS	MJ	MK	SP	CC	AT
QUARTR	-0.61783	-0.13988	-0.14864	-0.23963	0.85987	-0.22396	-0.21682	-0.21339	-0.21639	-0.24287	-0.25415
YARTR	-0.66434	-0.14329	-0.15598	-0.25351	0.95344	-0.25971	-0.23002	-0.22729	-0.22640	-0.24445	-0.25761
RACE	-0.12213	-0.03576	-0.22341	-0.39863	0.49107	-0.04689	-0.35501	-0.38106	-0.36555	-0.33744	-0.34845
NDEP	-0.03508	-0.02199	-0.02120	-0.04104	0.28495	-0.02902	-0.02909	-0.04338	-0.03013	-0.01127	-0.02216
MARIT	-0.01879	0.00306	-0.00592	-0.02177	0.22451	-0.02190	-0.01650	-0.02383	-0.01013	0.00074	-0.00572
ASVAB	0.17390	0.14400	0.35461	0.56922	-0.00146	0.14961	0.47062	0.48898	0.52631	0.58177	0.60117
VE	0.29752	0.13028	0.34331	0.86698	0.01542	0.14009	0.70284	0.99498	0.65617	0.69816	0.69879
AR	0.34651	0.15668	0.33983	0.94795	0.02548	0.13074	0.87726	0.75207	0.64641	0.61678	0.68550
PA	0.29011	0.13038	0.30780	0.86169	-0.04608	0.23026	0.69117	0.63563	0.98615	0.55556	0.62241
CI	0.27496	0.12420	0.24913	0.59630	0.01926	0.22054	0.54302	0.50105	0.48931	0.96498	0.88699
MA	0.25430	0.12909	0.29686	0.71617	-0.01979	0.24768	0.66131	0.66128	0.65613	0.64237	0.67456
ACS	0.27659	0.13653	0.29795	0.65336	-0.03458	0.25913	0.91960	0.55891	0.58416	0.53163	0.60195
ARC	0.23590	0.11973	0.22710	0.57229	-0.01685	0.23527	0.59155	0.52038	0.49429	0.45772	0.50895
GIT	0.27469	0.13646	0.32117	0.75614	0.03922	0.29701	0.85232	0.81572	0.64305	0.76537	0.87714
SH	0.25387	0.12639	0.29891	0.77673	-0.00656	0.24780	0.82525	0.82952	0.65494	0.63662	0.69208
AI	0.21463	0.12762	0.25139	0.58902	0.02529	0.17412	0.59838	0.57024	0.58279	0.55589	0.55813
ELI	0.21792	0.12537	0.27278	0.62693	0.01780	0.19876	0.59888	0.60039	0.68532	0.51327	0.55089
PCRD	0.09633	0.11695	0.28063	0.13541	-0.06225	0.05279	0.66543	0.15210	0.10797	0.24317	0.20047
ACQGT	0.33140	0.27536	0.38662	0.98319	0.01115	0.35953	0.84606	0.93811	0.72590	0.70544	0.74221
MOTPLAT	-0.15965	-0.08038	-0.04459	-0.08858	0.08219	-0.05474	-0.08573	-0.07758	-0.08512	-0.09743	-0.10108
CAUCUS	-0.11148	-0.05176	-0.13264	-0.05609	0.06155	-0.07230	-0.05946	-0.04829	-0.05425	-0.05408	-0.05825
SIB	-0.15934	-0.05504	-0.08454	-0.18772	0.08887	-0.11954	-0.18405	-0.15810	-0.18204	-0.20214	-0.22167
DES	-0.09213	-0.04754	-0.06753	-0.13170	-0.10920	-0.20610	-0.11116	-0.12662	-0.10500	-0.10284	-0.10813
RCYC	-0.13211	-0.06552	-0.06369	-0.11343	0.02773	-0.08269	-0.11905	-0.10198	-0.10109	-0.13225	-0.13652
RANK	1.00000	0.25956	0.18620	0.34168	-0.03587	0.35911	0.33063	0.30710	0.29738	0.30712	0.32649
FROM	0.25956	1.00000	0.17627	0.21346	-0.09654	0.14908	0.21245	0.19259	0.18483	0.21624	0.22658
GUAR	0.18620	0.17627	1.00000	0.37277	-0.04143	0.16920	0.31553	0.35109	0.32303	0.29762	0.32087
GCT	0.34168	0.21346	0.37277	1.00000	-0.09924	0.34150	0.85374	0.89793	0.89723	0.70428	0.82966
AGE21	-0.03587	-0.09654	-0.04143	-0.09924	1.00000	0.07773	-0.01932	0.01848	-0.03678	0.02537	-0.01167
MS	0.35911	0.14908	0.16920	0.34150	0.07773	1.00000	0.32387	0.34470	0.24634	0.27253	0.26956
MJ	0.33063	0.21245	0.31553	0.85374	-0.01632	0.32387	1.00000	0.71797	0.70644	0.63347	0.71022
MK	0.30710	0.19259	0.35109	0.89793	0.01848	0.34470	0.71797	1.00000	0.67557	0.73187	0.71822
SP	0.29738	0.18483	0.32303	0.89723	-0.03678	0.24634	0.70644	0.67557	1.00000	0.58864	0.82968
CC	0.30712	0.21624	0.29762	0.70428	0.02537	0.27253	0.63347	0.73187	0.58864	1.00000	0.91853
AT	0.32649	0.22658	0.32087	0.82966	-0.01167	0.26956	0.71022	0.71822	0.82968	0.91853	1.00000

APPENDIX D

MEANS AND STANDARD DEVIATIONS

MEANS AND STANDARD DEVIATIONS OF VARIABLES[a]

Variable	Mean	Standard[b] deviation
Quality measure	.3282	n/a
Early attrition	.2891	n/a
Desertion	.1130	n/a
Recruit training attrition	.1118	n/a
Rank achieved	2.5738	n/a
Promoted after training	.1617	n/a
High school graduate (diploma)	.4865	n/a
Enlistment guarantee	.5322	n/a
Age upon entrance	.1009	n/a
Marital status upon entrance	1.0706	n/a
Recruit training depot	6.5432	n/a
Recycled at depot	.1868	n/a
Correctional custody at depot	.0211	n/a
Motivation platoon at depot	.0277	n/a
Race	1.2247	n/a
Number of dependents	.1135	n/a
ACB-61 test scores:		
VE	100.2190	22.9649
AR	95.8324	22.3711
PA	105.5268	22.3827
CI	96.0695	27.5743
MA	99.3176	19.7982
ACS	97.5904	20.3177
ARC	83.8106	25.8739
GIT	93.2583	20.0883
SM	96.2610	19.0195
AI	99.0146	19.2821
ELI	92.6454	23.6465
GCT (VE+AR+PA)/3	100.5260	20.0046
GT (VE+AR)/2	98.2718	21.1535
AFQT Mental Group (percentile score)	58.9270	n/a

[a]Variables weighted to the GCT distribution of the mobilization population (see appendix B).

[b]n/a, not applicable

APPENDIX E

REGRESSION RESULTS: FOUR MEASURES OF PERFORMANCE

TABLE E-1

REGRESSION RESULTS: RANK ACHIEVED WITHIN TWENTY-FOUR MONTHS

Variable	Coefficient	Cumulative R^2
Education	+.6488	.128
AR	+.0054	.174
CI	+.0046	.185
PA	+.0052	.191
Age	-.2144	.194
(Constant)	+.7733	

F = 2,215
N = 45,948

Variables considered but not selected:

Race
Marital status
AFQT
VE
MA
ACS
ARC
GIT
SM
AI
ELI

TABLE E-2

REGRESSION RESULTS: SUPERIOR RECRUIT TRAINING PERFORMANCE[a]

Variable	Coefficient	Cumulative R^2
CI	+.0016	.042
ARC	+.0016	.058
Education	+.0596	.066
PA	+.0012	.068
Race	+.0469	.070
(Constant)	-.3372	

F = 696
N = 45,948

Variables considered but not selected:

Marital status
VE
AR
MA
ACS
GIT
SM
AI
ELI
Age

[a]As indicated by promotion at end of recruit training.

TABLE F-3

REGRESSION RESULTS: DESERTION

Variable	Coefficient	Cumulative R^2
Education	-.1152	.042
AR	-.0004	.046
VE	-.0004	.046
Marital status	+.0215	.047
PA	-.0003	.047
(Constant)	+.2557	

F = 454
N = 45,948

Variables considered but not selected:

Race
CI
MA
ACS
ARC
GIT
SM
AI
ELI
Age

TABLE E-4

REGRESSION RESULTS: ATTRITION
DURING FIRST TWENTY-FOUR MONTHS OF SERVICE

Variable	Coefficient	Cumulative R^2
Education	-.1493	.050
CI	-.0019	.081
PA	-.0015	.091
Age	+.1098	.096
GIT	-.0010	.097
AR	-.0006	.097
(Constant)	+.8315	

F = 827
N = 45,948

Variables considered but not selected:

Race
Marital status
VE
MA
ACS
ARC
SM
AI
ECI