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Identifying Successful Marine Corps Recruits

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ABSTRACT

After briefly reviewing trends in Marine Corps first-term attrition, the paper analyzes recruit background characteristics and Marine Corps environment variables associated with successful adaptation to Marine Corps life. Three measures of success are examined: completion of the first term of service, completion of the first term of service at the rank of corporal, and retention beyond the initial service obligation.

EXECUTIVE SUMMARY

This research memorandum builds on the insights offered by previous work in the 1970s on the characteristics of enlistees who are likely to become good Marines. By far the strongest indicator of success found in the earlier research was high school diploma graduation. Over the last decade, the Marine Corps, recognizing the historically successful performance of high school diploma graduates (HSDGs), sharply increased the proportion of accessions that are HSDGs. Another characteristic the earlier work associated with recruit success was higher test scores on the military entrance processing examinations. In recent years, the Marine Corps has also substantially increased the proportion of Marine Corps recruits who test in the top half of the armed forces qualification test (AFQT).

Figure I shows how the proportion of "quality" recruits in the Marine Corps has changed over the last decade. The proportion of quality recruits, HSDGs who scored in the top half of AFQT distribution, more than doubled (from 28 to 62 percent). These increases in accession quality have produced many benefits for the Marine Corps. One benefit has been reduced first-term attrition.

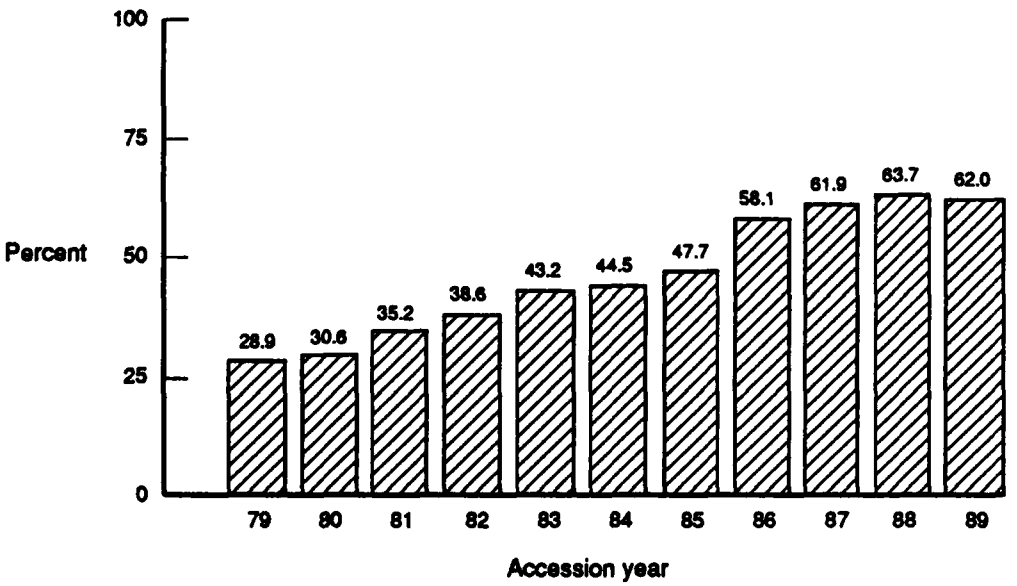

Figure I. Quality accessions (AFQT I-IIIAs, HSDGs) as a percentage of total recruits

This research memorandum examines background characteristics and Marine Corps environmental variables associated with successful adaptation to the Marine Corps in the 1980s. Three measures are examined. The first is simply completion of the first-term of service; the second is the completion of the first term of service and promotion (by 45 months of service) to corporal; and the final measure is retention beyond the first term of service. All three measures of success are calculated from initial entry. The analysis focuses on the largest group of FY 1984 non-prior-service recruits, those with a four-year service obligation. Thus, for first-term completion, as well as completion and promotion, data through FY 1988 are used. For retention beyond the first term of service, FY 1989 data are used. All explanatory variables are available through Marine Corps administrative record data.

To analyze the quantitative impact of changes in background variables on success, predicted probabilities of success are estimated for recruits with different background characteristics. Table I illustrates these probabilities for male recruits scoring in the top half of AFQT score distribution (AFQT categories I-IIIA). The overall finding is that characteristics associated with success for one of these measures are generally associated with success for all three measures. HSDG accessions, certificate (CERT) accessions over the age of 20 years, AFQT categories I-IIIA accessions, accessions from the Delayed-Entry Program (DEP), and accessions who meet the in-service weight standard for their height are most likely to adapt successfully to Marine Corps life.

Table I. Predicted probabilities for NPS male AFQT categories I-IIIA accessions[a]

Attributes	First-term completion	First-term completion and promotion to corporal	Initial entry to retention beyond the first-term
HSDG, average DEP	0.75	0.49	0.22
Overweight	0.63	0.35	0.16
Not overweight	0.76	0.51	0.23
HSDG, no DEP	0.67	0.42	0.20
Overweight	0.54	0.29	0.14
Not overweight	0.69	0.43	0.20
CERT (20+), average DEP	0.73	0.54	0.24
Overweight	0.61	0.40	0.17
Not overweight	0.75	0.56	0.25
CERT (20+), no DEP	0.66	0.47	0.21
Overweight	0.52	0.33	0.15
Not overweight	0.67	0.48	0.22
CERT (17-19), average DEP	0.62	0.29	0.17
Overweight	0.48	0.19	0.12
Not overweight	0.63	0.31	0.18
CERT (17-19), no DEP	0.53	0.23	0.15
Overweight	0.39	0.15	0.11
Not overweight	0.54	0.25	0.16
Non-HSG, average DEP	0.51	0.19	0.14
Overweight	0.38	0.11	0.10
Not overweight	0.53	0.20	0.15
Non-HSG, no DEP	0.42	0.14	0.12
Overweight	0.30	0.09	0.09
Not overweight	0.44	0.15	0.13

a. Attributes are all calculated at the means unless they are identified among the variables in the left column.

CONTENTS

ILLUSTRATIONS

TABLES

INTRODUCTION

This research memorandum expands upon previous findings of attrition probabilities by recruit characteristics. More characteristics (background and Marine Corps environment) are explored, and the analysis is updated to include recruits who successfully adapt to Marine Corps life in the late 1980s.

Each year the Marine Corps accesses over 30,000 recruits. Each of these accessions is costly--in recruiting dollars, in training dollars, and in their impacts on readiness. Historically, about one-third of all recruits accessed have been separated prior to the completion of their contract. These high levels of first-term attrition create a continual tradeoff between spending more time and resources on recruiting (either by attempting to procure higher quality recruits or by screening all recruits more carefully prior to entry) or by screening recruits after entry (by attriting those that do not successfully adapt).

While this research memorandum cannot directly address the optimal mix of screening before rather than during the enlistment, it can add to the insights offered by previous work on this important question (see [1, 2, 3] for the Marine Corps and [4, 5] for the Navy). The earlier Marine Corps work, utilizing recruit cohorts in the early to mid-1970s, focuses on characteristics of enlistees who are likely to become good Marines [3, p. 1], examining educational background, mental aptitude as measured by test scores, age at entry, and participation in the Delayed Entry Program (DEP).

Previous studies have found that by far the strongest indicator of success was high school diploma graduation. Over the last decade, the Marine Corps, recognizing the historically successful performance of high school diploma graduates (HSDGs) relative to recruits with other educational credentials, has sharply increased the proportion of accessions that are HSDGs.[1] Another characteristic the earlier work associated with recruit success was higher test scores on the military entrance processing examinations. In recent years, the Marine Corps has also substantially increased the proportion of Marine Corps recruits who test in the top half of the armed forces qualification test (AFQT).

Increasing Quality of Recruits

Figure 1 shows the proportion of Marine Corps accessions for FY 1979 to FY 1989 who were high school diploma graduates. The proportion of HSDG accessions has increased steadily from 64 percent in FY 1979 to

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1. The Marine Corps' attrition cost for HSDG accessions has been found to be lower than that for non-HSDGs [6]. Cost of attrition was estimated as the cost of replacing an individual who leaves at some time before completion of the first-term multiplied by the probability that the individual leaves.

95 percent FY 1989. Figure 2 shows the proportion of accessions who scored in the top half of the AFQT scores (AFQT categories I-IIIA) from FY 1979 to FY 1989. Again, the proportion scoring in the top half increased substantially--from 44 percent to 68 percent. Finally, figure 3 shows a measure of the proportion of "quality" recruits, who are HSDGs and also scored in AFQT categories I-IIIA. This is where the most dramatic increases have taken place, with the proportion more than doubling, increasing from 28 percent to 62 percent. With the exception of one year, there have been improvements in each successive year for all three measures.

These increases in accession quality have produced many benefits for the Marine Corps, one of which has been reduced overall Marine Corps first-term attrition.

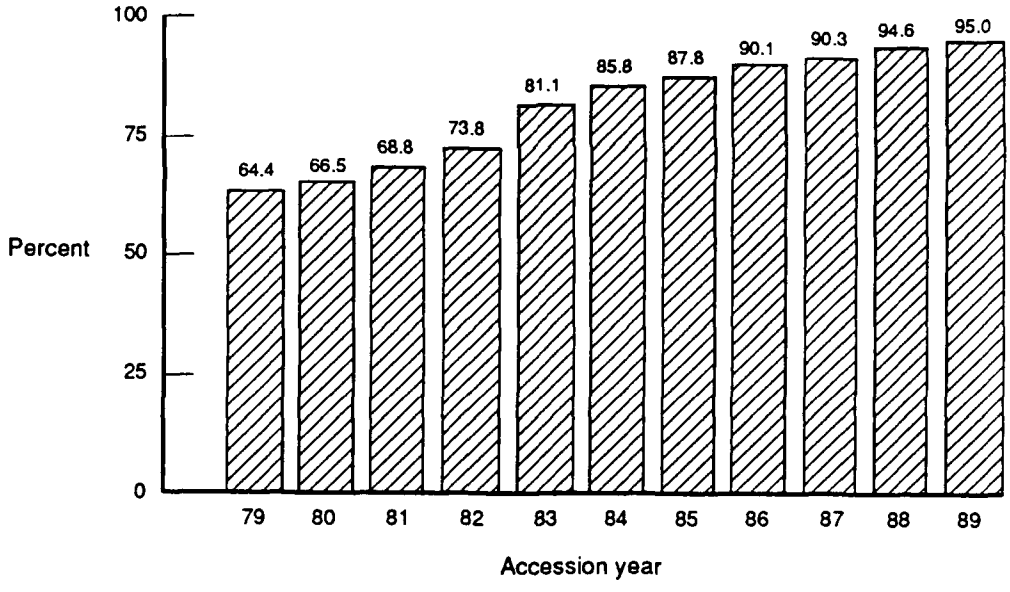

Figure 1. HSDGs (Tier I accessions) as percentage of total recruits

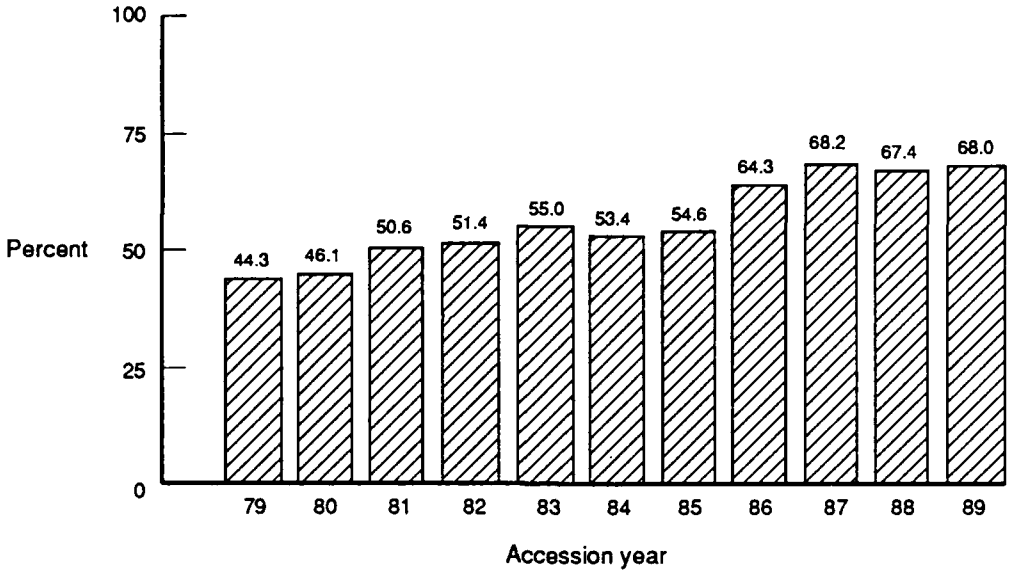

Figure 2. AFQT categories I-IIIA accessions as a percentage of total recruits

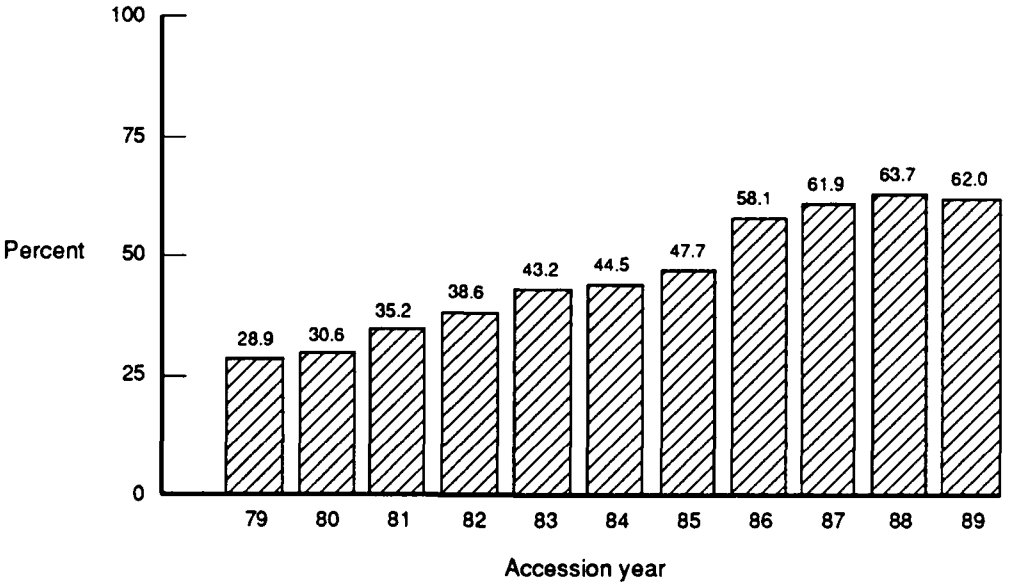

Figure 3. Quality accessions (AFQT I-IIIAs, HSDGs) as a percentage of total recruits

Total First-Term Attrition Rates

In line with the improvement in the quality of the recruits has been a reduction in overall 45-month attrition rates. Figure 4 illustrates 45-month attrition rates for NPS Marine Corps recruits with initial obligations of four or more years.[1] As the figure shows, first-term attrition in the Marine Corps fell for the accessions in the FY 1980 through FY 1984 period. As the HSDG recruits' attrition rate remained fairly constant during this period, much of the improvement must be attributed to increases in the proportion of HSDGs. For accessions in FY 1985, however, the 45-month attrition rate, while still lower than the rate in the early 1980s, is substantially higher than the rate for FY 1984 accessions. Much of this FY 1985 increase has been caused by a rather large unexplained jump in HSDG recruits' attrition rate.[2]

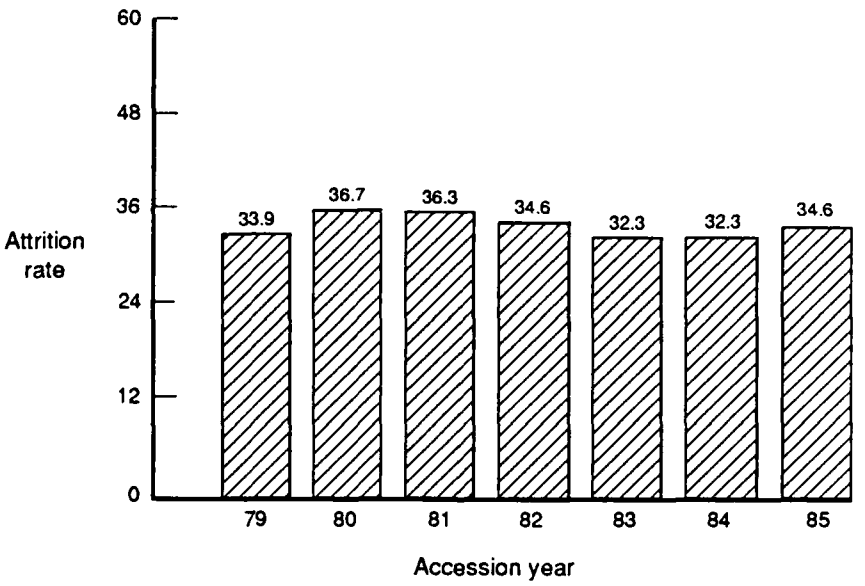

Figure 4. First-term Marine Corps attrition rates

1. Forty-five-month attrition rates are generally used to measure attrition for NPS accessions with initial contract lengths of four years because recruits may satisfactorily complete their contract up to three months before the completion of their 48-month term.
2. See appendix A for a more complete explanation of trends as well as comparisons of Marine Corps attrition rates with rates for other services. While full first-term attrition rates are only available for accession cohorts through 1985, attrition rates through 12 and 24 months of service show some tendency toward increases for accession cohorts since FY 1985.

MEASURES OF RECRUIT SUCCESS

Each year the Marine Corps accesses substantial numbers of new recruits. Selecting successful entry-level personnel is important for the readiness of the first-term force. Moreover, because the Marine Corps accesses enlisted personnel only at this entry-level point, these recruits will compose the universe of potential careerists. Understanding the characteristics of recruits associated with success in the Marine Corps is critical.

Three measures of success are examined. The traditional measure of success has been simply completion of the first-term of service [1, 2, 3]. This is the first measure of success used and is identified as completion of 45 months of service. However, there are other ways of measuring the success of NPS accessions. One may want to see not only completion of the first term of service but also whether the recruit was promoted to corporal (by 45 months of service).[1] This is the second measure of success. Additionally, as retention of recruits is an important goal of the Marine Corps, it may be important to identify the characteristics that are observable at the time of accession and that contribute to retention beyond the first term. Hence the final measure is retention beyond the first term of service.[2] All three measures of success are calculated from initial entry.

In brief, this analysis asks simply what background characteristics are currently associated with recruits who achieve the relevant measure of successful adaptation to Marine Corps life. Since there is virtually no lateral entry in the Marine Corps, selecting successful recruits is critical to building a strong force. The analysis focuses on the largest group of non-prior-service (NPS) recruits who entered the Marine Corps in FY 1984, those with a four-year service obligation.[3] Thus, for first-term completion, as well as completion and promotion, data through FY 1988 are used. For retention beyond the first term of service, FY 1989 data are used.

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1. This measure of success examines recruits who successfully completed 45 months of service and who were, within that time, promoted to corporal. It does *not* analyze the early promotion program.
2. Considerable research has previously looked at monetary variables that affect retention beyond the first term, such as SRBs and military pay relative to civilian pay. The analysis here disregards those factors and looks simply at variables observable when a recruit initially enlists to see how well the variables predict retention beyond the first term.
3. These recruits were almost 90 percent of the non-prior-service enlistees in FY 1984. Currently the Marine Corps offers primarily four-, five-, and six-year contracts. However, the numbers of five- or six-year obligors accessed before FY 1986 are insufficient to permit detailed statistical analysis. Thus, it will be 1990 to 1992 before the entire first-term experience will be completed for these enlistees.

Explanatory Variables

For each measure of recruit success--first-term completion, first-term completion and promotion to corporal, and retention beyond the first-term--similar explanatory variables are used. All explanatory variables are available through Marine Corps administrative record data. While some research has shown other variables (a steady job, plans for college, etc.) to be important delineators of success in the military, these variables are only available by special survey.[1] The explanatory variables were selected for three reasons: they have been shown to be important in past research (for example, educational background); they are common group identifiers (for example, gender or race); or they appeared to be important in preliminary research (for example, enlistment program). These variables are grouped into the two general categories of recruit background characteristics and Marine Corps experience characteristics.

Recruit Background Characteristics

Considerable background information is available for Marine Corps accessions. As suggested earlier, past research has identified certain background characteristics as important predictors of successful adaptation to Marine Corps life. The single most important background characteristic for predicting successful completion of the first enlistment term has been high school diploma graduate (HSDG) status [1, 2, 3, 5]. For the recruits who entered the Marine Corps in FY 1984 with four-year obligations, 70 percent of the HSDGs, 59 percent of those with some type of certificate (CERTs), and 44 percent of the nongraduates (non-HSDGs) successfully completed their first-term enlistment. As indicated by figure 2, there also seems to be a close association between changes in the proportion of HSDG recruits and the overall attrition rate.

Educational background, however, is not the only background characteristic found to be systematically associated with differential probabilities of success. Other background characteristics include:

- Armed Forces Qualification Test (AFQT) score.[2] Higher test scores have generally been associated with better performance and lower attrition risk.[3] For the accession cohort analyzed here, 72 percent of those with test scores that placed them in AFQT Category I, 70 percent of those in AFQT category II, 66 percent of those in AFQT category IIIA, 66 percent of those in AFQT category IIIB, and 62 percent of those in AFQT category IV successfully completed their enlistment.

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1. See [7 and 8] for examples of such research.
2. AFQT scores are normally divided into AFQT categories I-V, with top scorers in AFQT category I and lowest scorers in AFQT category V. No AFQT category V scorers are permitted into the military.
3. The relationship between attrition and AFQT score, however, appears to be stronger in the Marine Corps than the Navy [9]. See [10] for evidence on Marine Corps performance and AFQT test score category.

- Entering at a weight that meets the in-service standards for height. Recent work showed sharp differences in successful completion for recruits who entered the Marine Corps at a weight above the in-service standards for their height [11]. Since the accession standards are closer to the in-service standards for women than they are for men, the effects are stronger for males.

Other potentially important background characteristics include race, gender, region of origin, and marital status and age at entry. Hispanic recruits as well as black recruits are separately identified. Analysis of Navy data suggests that women who enter the Navy have a lower probability of completing the first term than do their male counterparts [12].[1] However, if women successfully complete the first term of service, they are *more* likely than their male counterparts to either extend or reenlist [12]. Figure 5 indicates the same pattern for NPS Marine recruits that entered the Marine Corps in FY 1984 with four-year obligations. This pattern means that about the same proportion of women enter the second term of service as the proportion of women in the accession cohort, or the probability of surviving into the second term of service is as great for women as it is for men.

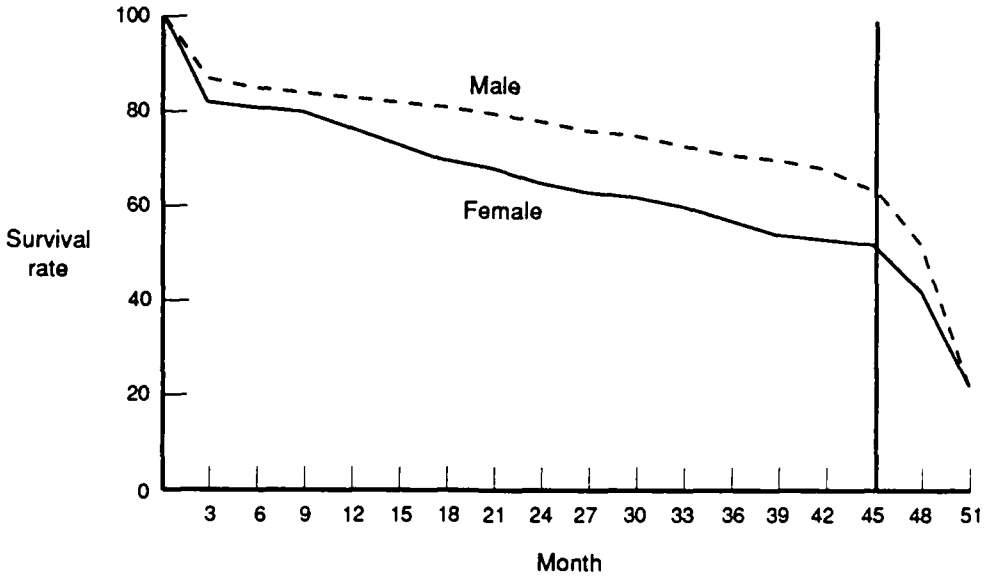

Figure 5. First-term survival rates for males and females

1. These higher "quit" rates are probably not surprising. In civilian-sector occupations considered "nontraditional" for women, women have had higher quit rates than men.

Married recruits are expected to have a higher survival rate because of family responsibilities [13]. The cost of quitting in terms of potentially lost income is greater for married than for single recruits. However, an earlier study of Marine Corps attrition rates [1] found no significant effects of marriage on first-term survival, and a recent study of Marine Corps Recruit Depot (MCRD) attrition rates [14] found married recruits to have higher recruit depot attrition rates.[1]

Also, studies have found an effect for geographic origin on attrition [8]. Economic conditions in a recruit's home region are expected to affect his perception of employment alternatives to military service. Therefore if the recruit is from a region with low unemployment, the expectation is that he is more likely to quit. Additionally, unobservable regional differences in taste could differentially impact the probability of a recruit's survival. Thus variables have been included that indicate whether or not a recruit is from the Midwest, Northeast, or South.[2]

Earlier research suggests that older recruits are less likely to complete the first term [1]. In fact, the Marine Corps, at least since 1984, does not appear to access individuals over 26 years of age, probably as a result of the earlier analysis of age at entry and successful adaptation to Marine Corps life.[3] Preliminary tabulations made possible by the Marine Corps Interactive Database (MCAID) validated this overall relationship with age at entry but suggested more complex relationships, at least for more recent accession cohorts [15].[4]

In short, different completion patterns by age at entry were observed depending upon the recruit's educational background. For HSDGs, successful completion of the first term of enlistment appeared generally more likely if the recruit entered the Marine Corps at a younger age. For nongraduates, age at entry did not seem to make much difference: for all age groups, the probability of successful completion of the first-term was less than 50 percent.

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1. One should note that in the latter study, only boot-camp attrition was analyzed, and the relative importance of being a married recruit may change when the entire first term is taken into account.
2. Since a Western place of origin is excluded, all coefficients measure the different attrition rates relative to a Western origin. For example, the Midwest place of origin coefficients measure the impact of being from the Midwest relative to being from the West.
3. Earlier work [1] showed that regardless of AFQT category, HSDG Marine Corps recruits who were at least 23 years old, had between 7 and 10 percent lower probability of success than 18-year-old recruits.
4. MCAID calculates attrition rates at given points in time and produces a table of these rates, organized by accession age, AFQT category, and educational background. Examples of selection criteria include fiscal year of accession, gender, MCRD, and accession program.

For holders of certificates (CERTs), age at entry had generally an opposite effect to that for HSDGs. Young CERT recruits had lower probabilities of successfully completing the first enlistment than did CERTs enlisting at older ages.[1] In fact, the older CERTs (those 20 years or older when enlisting) had Marine Corps experiences similar to those experienced by HSDGs. Thus, variables in the model that relate to age at entry will be specified differently for recruits with different educational backgrounds. Additionally, the model will be separately estimated for different educational background/accession-age groups to see if the effects of other background characteristics differ systematically among these groups.

Marine Corps Background Variables

Variables grouped in this category include whether or not the recruit entered the Marine Corps from the Delayed Entry Program (DEP), the month of the year that the recruit entered the Marine Corps, and the general program under which the recruit entered.

Within this category of variables, probably the most important predictor of recruit success is whether or not the recruit entered the Marine Corps through the DEP, or was, instead, accessed as a direct "ship" within the month that the initial contract was signed [2, 5, 9]. Participation in the DEP means that the recruit signed a contract for future entry into the Marine Corps (from the next month to 12 months into the future).

Accessions from the DEP are believed to be better survival risks for at least two reasons. First, all recruits who enter the Marine Corps from the DEP have had more time, after they signed their enlistment contract, to reflect upon whether or not they really want to be a Marine. There is attrition from the DEP before the recruit ever enters the Marine Corps; presumably, some, or most, of this DEP attrition would have been Marine Corps attrition had the recruit been immediately accessed into the Marine Corps. Second, recruits who enter the Marine Corps from the DEP are believed to be more likely to have received their choice of enlistment month and enlistment program because it is easier to accommodate preferences over a longer period than it is within any particular month. DEP participation is included as a predictor variable in all the success-measure equations. Months in the DEP are also analyzed in the first-term completion equation.

For four-year obligors there are three main enlistment programs: aviation, ground, or open. Open enlistments are those for which the occupational specialty will be decided after, or during, training at the Recruit Depot. Open contracts preserve considerable flexibility for Marine Corps planners, but they may not be as attractive to entering recruits. Since the study team is not aware of any previous work on the relationship between these three entry programs and the probability of successful completion of the first term, the importance of the enlistment program is an empirical question.

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1. Since most NPS Marine Corps accessions are HSDGs, earlier results, which did not stratify by educational background, were dominated by the behavior of HSDGs.

Figure 6 shows, by entry month, the first-term completion rates for non-prior-service (NPS) recruits accessed in FY 1984. Recruits who entered the Marine Corps in the July-to-November period have higher survival rates (68.3 to 70.9 percent for the group analyzed here) than recruits who entered in the February-to-May period (63.1 to 65.1 percent). (Recruits who enter in December, January, or in June seem to have rates between the rates of these two groups (65.1 to 67.5 percent).) Accession month, however, is not independent of the other variables that are associated with successful completion. In particular, higher proportions of non-HSDGs enter the Marine Corps in the spring months than in the summer months. It is thus an empirical question whether or not the month of entry has an effect on the probability of successful completion that is independent of the other predictors of success.[1,2]

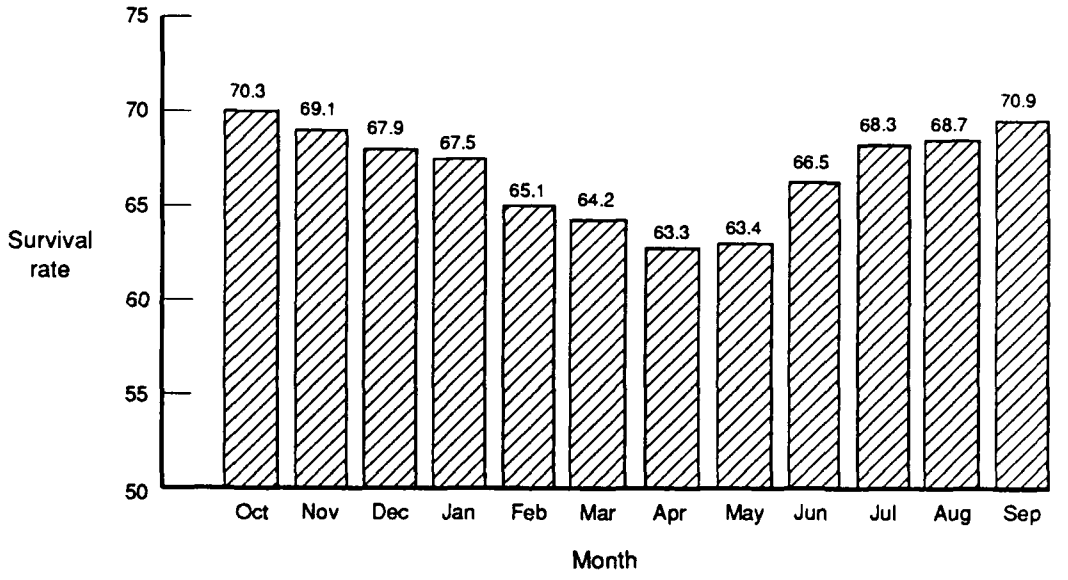

Figure 6. Survival rates, by month of accession

1. The models are estimated by maximum likelihood techniques. Such techniques are very intensive in computer time, and the time expands rapidly as the number of explanatory variables increases. Entry months were grouped together as spring accessions (February through May) and summer accessions (July through November). Accessions in December, January, and June are the omitted category (i.e., the estimates for accessions in the spring and the fall should be interpreted as differences from December, January, and June accessions).
2. One previous study on Marine Corps boot-camp attrition found that holding other factors constant, October to January and February to May accessions had a higher probability of attrition than June to September, which shows that in spite of seasonal changes in other determinants of success, summer accessions still have a higher probability of success.

ESTIMATION

Since each of the measures of recruit success is a binary variable (the recruit succeeds or does not succeed), the models estimate probabilities of success. The probabilities are bounded by zero and one and require that the underlying functional form of the model be nonlinear. A logit specification was chosen. More information about this functional form is contained in appendix B.

Table 1 presents the variable descriptions and the average values of the variables. Table 2 contains the logit coefficient estimates for the probability of first-term completion, the probability of first-term completion and promotion to corporal by 45 months, and the probability of retention beyond the first term. Additionally, the estimates for the probability of retention beyond the first term (*only* for those recruits that successfully finished the first term) are reported.

Qualitative Results

The logit coefficients and their associated t-statistics show direction and statistical significance of the explanatory variables.[1]

First-Term Completion

The impact of recruit background characteristics is discussed initially. All effects of educational background should be considered in relation to the omitted educational category (non-high-school graduate). The coefficient estimates for HSDGs of the two age groups are both significant and positive, indicating that relative to non-HSDGs, the higher quality recruits are more likely to survive the first term, as expected. Also the two age categories for CERTs variables have positive and significant coefficients, indicating that relative to non-HSDGs, CERTs of all ages have a higher probability of success. Supporting previous studies, the data indicate that higher educational attainment increases the probability of completing the first term.

Additional results in line with past studies show that scoring in the top half of the AFQT test is associated with a higher probability of first-term completion. There is, however, no statistically different effect in the probability between the first-term completion rate for scorers in AFQT category IV versus those in AFQT category IIIB (the omitted group).

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1. Logit coefficients scale into an S-shaped curve. See appendix B for more information.

Table 1. Marine Corps variable description and means for four-year non-prior-service obligors in FY 1984

Variable	Mean value	Variable description
Success measures		
Completion	.685	One if 45 or more months of service is completed; otherwise zero
Completion and promotion to corporal	.407	One if 45 or more months of service is completed and promoted to corporal within 45 months of service; otherwise zero
Retention (51 months)	.222	One if still in the Marine Corps at 51 months of service (extend or reenlist); otherwise zero
Retention (provided completed first term)	.324	Defined only for the 23,045 recruits that completed 45 months of service. One if still in Marine Corps at 51 months of service (extend or reenlist); otherwise zero
Explanatory variables		
Male	.946	One if male; otherwise zero
DEP	.897	One if entered through delayed entry program; otherwise zero
DEPMOS	5.590	Months in DEP; zero if variable DEP is zero
HSDG (17-19)	.682	One if entered Marine Corps as 17- through 19-year-old HSDG (Tier I); otherwise zero
HSDG (20+)	.172	One if entered Marine Corps as 20-year-old or older HSDG (Tier I); otherwise zero
CERT (17-19)	.059	One if entered Marine Corps at age 17 through 19 as certificate graduate (Tier II); otherwise zero
CERT (20+)	.047	One if entered Marine Corps as 20-year-old CERT (Tier II); otherwise zero

Table 1. (Continued)

Variable	Mean value	Variable description
Non-HSG	.040	Non-high-school graduates
AFQT categories I-IIIA	.533	One if AFQT test scores in categories I-IIIA; otherwise zero
AFQT category IV	.034	One if AFQT test scores in category IV; otherwise zero
Overweight	.108	One if did not meet in-service weight standards for height; otherwise zero
Hispanic	.044	One if Hispanic recruit; otherwise zero
Black	.174	One if black recruit; otherwise zero
Aviation	.178	One if aviation program; otherwise zero
Ground	.413	One if ground program; otherwise zero
Spring accession	.262	One if entered February-May; otherwise zero
Summer accession	.475	One if entered July-November; otherwise zero
Initial marital status	.041	One if recruit is married at the time of initial enlistment; otherwise zero
South	.210	One if place of origin is in the South; otherwise zero
Northeast	.258	One if place of origin is in the Northeast; otherwise zero
Midwest	.297	One if place of origin is in the Midwest; otherwise zero

Table 2. Logit coefficient estimates

Variable	First term		Retention beyond first term	
	Completion	Completion and promotion to corporal	Unconditional	Conditional on completing first term
HSDG (17-19)	1.014[a] (16.76)	1.333[a] (17.13)	.553[a] (6.52)	-.001 (-.01)
HSDG (20+)	1.035[a] (16.12)	1.560[a] (19.29)	.541[a] (6.10)	.016 (.16)
CERT (17-19)	.416[a] (5.61)	.590[a] (6.37)	.253[b] (2.49)	-.029 (-.26)
CERT (20+)	.962[a] (12.18)	1.650[a] (17.96)	.643[a] (6.31)	.167[c] (1.48)
AFQT categories I-IIIA	.259[a] (9.86)	.404[a] (16.30)	-.011 (-.39)	-.097[a] (-3.08)
AFQT category IV	-.062 (-.94)	-.169[b] (-2.54)	.068 (.95)	.114 (1.43)
Overweight	-.630[a] (-17.05)	-.652[a] (-16.55)	-.465[a] (-9.57)	-2.23[a] (-4.32)
Male	.767[a] (15.13)	.342[a] (6.65)	-.029 (-.50)	-.495[a] (-7.18)
Hispanic	.497[a] (7.56)	.241[a] (4.23)	.333[a] (5.19)	.173[a] (2.55)
Black	.160[a] (4.76)	-.072[b] (-2.24)	.704[a] (20.73)	.766[a] (20.17)
South	-.034 (-0.90)	.044 (1.23)	.144[a] (3.55)	.160[a] (3.64)
Northeast	-.113[a] (-3.22)	-.142[a] (-4.22)	-.177[a] (-4.47)	-.159[a] (-3.72)
Midwest	-.011 (-0.32)	.010 (-0.31)	-.122[a] (-3.18)	-.133[a] (-3.24)
Initially married	-.043 (-0.70)	.206[a] (3.56)	.331[a] (5.17)	.427[a] (6.01)

Table 2. (Continued)

Variable	First term		Retention beyond first term	
	Completion	Completion and promotion to corporal	Unconditional	Conditional on completing first term
DEP	.191[a] (4.45)	.338[a] (8.38)	.170[a] (3.60)	.004 (.08)
DEPMOS	.034[a] (8.85)	Omitted	Omitted	Omitted
Aviation	.558[a] (14.70)	.428[a] (13.13)	.241[a] (6.34)	.026 (.65)
Ground	.201[a] (7.43)	.136[a] (5.27)	.073[b] (2.42)	-.034 (-1.04)
Spring accession	.023 (.70)	Omitted	Omitted	Omitted
Summer accession	.079[a] (2.66)	Omitted	Omitted	Omitted
Constant	-1.512 (-16.71)	-2.575 (-25.47)	-2.066 (-18.42)	-.325 (-2.58)
Chi square	1,813.2	1,769.2	872.9	756.6
Number of observations	33,622	33,622	33,622	23,043
Mean dependent variable	.685	.407	.222	.324
Slope adjustment factor	.216	.241	.173	.219

NOTE: Asymptotic t-statistics in parentheses.

a. Statistically significant at 1-percent level (two-tailed test).
b. Statistically significant at 5-percent level (two-tailed test).
c. Statistically significant at 10-percent level (two-tailed test).

For the other recruit background characteristics, it was found that when all else is equal, Hispanic and black recruits are more likely than are non-black/non-Hispanic recruits to successfully complete the first term of service. Overweight recruits have a lower probability of survival than other recruits. As has been found elsewhere, males are substantially more likely to complete the first term than are females. Relative to recruits from the West, only recruits from the Northeast have a lower probability of successfully completing the first term of service. Finally, initial marital status has no impact on the probability of completion. Another study found married recruits to have higher MCRD attrition rates than single recruits [14]. For the FY 1984 accessions analyzed here, there were no statistically different first-term attrition rates between married and single recruits.[1]

Marine Corps background characteristics generally had the expected effect on recruit success. Participation in the DEP is an important predictor of success, with additional months in the DEP adding to the probability that the recruit will not attrite. Those accessed in aviation programs, as well as those accessed in ground programs, are more likely to complete the first term of service than are those accessed under "open" contracts.[2]

In line with earlier findings for the MCRD, recruits accessed in the summer months are also more likely to complete the first term.[3] Although the effect is small, it is independent of the characteristics of the recruits accessed. Spring accessions appear to have first-term completion probabilities, other background characteristics being equal, comparable to the accessions in December, January, and June (the accession months omitted from the regressions). This finding suggests that the level-loading of accessions may impose additional costs upon the Marine Corps. Not only are some potential recruits not accessed (because they could not be fit into the full quotas for the summer months), but attrition is higher, other things being equal, for recruits accessed in other months. The effect, however, is small--at the mean of the data, the estimated increase in completion probability of a summer accession is less than 2 percentage points.

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1. It should be noted that results related to marital status should be taken with caution because only about 4 percent of the new recruits were married when they entered the Marine Corps.
2. See [15] for an interactive data base for accessions in FY 1979 through FY 1988. It permits additional exploration of the effects of these background variables on first-term attrition. See [16] for a different method of examining losses. While this paper focuses on losses for an accession cohort, [16] focuses on losses by year of separation.
3. One study [14] showed that summer accessions were more likely to survive Marine Corps boot camp than accessions during other seasons of the year. Apparently lower attrition rates found among summer accession recruits in MCRD are also translating into lower attrition rates for the entire first term.

Completion of First Term and Promotion to Corporal (by 45 Months)

The results for the second indicator of successfully completing the first term, promotion to corporal, show that generally the determinants of successfully completing the first term are also the determinants of completing and being promoted to corporal. For estimates of the effects of recruit background variables on the probability of both first-term survival and early promotion, the effects of educational categories are still positive and significant. HSDGs and CERTs have a greater probability of completing the first term at the rank of corporal than non-HSDGs. AFQT categories I-IIIA have a greater probability of success than does AFQT category IIIB. With two exceptions, other recruit background variables associated with survival to the end of the first term also translate into increased probability of promotion by the end of the first term. First, initially married recruits have a higher probability of completing the first term and being promoted than initially unmarried recruits. This indicates that while there is no marital status difference in first-term completion rates, married recruits have a higher probability of promotion. The second change indicates that AFQT category IV recruits have a lower probability of completing the first term and being promoted to corporal, relative to AFQT category IIIB recruits, although the difference between the two groups in first-term survival is not significant.[1]

For Marine Corps background variables in the completion of first term and promotion to corporal equation, the separate effect of months in the DEP as well as the month of accession were omitted from the model. Other Marine Corps factors are specified similarly to the first-term completion equation. The predictor variables that were important for first-term completion--entry through the DEP and the enlistment program--are also important for predicting early promotion and first-term completion.

Initial Entry to Retention beyond the First Term

It is interesting to examine the probability that a recruit, with a four-year contract, will either extend or reenlist beyond the first term of service. It should be noted that these estimates are conditioned only upon characteristics observable at the time of the initial enlistment into the Marine Corps.[2] The third column of table 2 provides the results of our estimation. Of those with four-year contracts, 22.2 percent of those accessed in FY 1984 were still in the Marine Corps at

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1. This is likely to be indicative of the lower AFQT scorers being assigned to MOS classifications with slower promotion cycles.
2. One of the major monetary determinants of retention beyond the first-term is the Selective Reenlistment Bonus (SRB). Since this study is interested in predicting successful Marines from when they are accessed, SRBs are disregarded here. See [17 and 18] for additional analyses of retention.

51 months of service. Certain results follow from the first column of table 2 (estimates of survival to the end of first term). Other things equal, recruits who are Hispanic or black, who entered the Marine Corps through the DEP, ground, or open programs, and who are HSDG or CERT are more likely than other recruits to be retained beyond the first term. It is interesting to note the changes from column one to column three. The AFQT category of a recruit has no effect on the probability of survival beyond the first term. This indicates that while AFQT categories I-IIIA have a higher probability of completing the first term than AFQT category IIIB, they must have a lower probability of reenlisting or extending beyond the first term.[1] Also, while male recruits had a higher probability of first-term completion, their survival beyond the first term is not different from that of females.

Additionally, initially married recruits have a higher probability of survival beyond the first term. This result coincides with the economic literature's prediction that married employees have lower quit rates. Finally, there are significant regional effects in determining retention, which may be related to regional civilian economic opportunities. Certainly during the period analyzed the economy in the Northeast was booming, providing recruits from that region with greater civilian job opportunities than other regions, and this may be indicated by lower retention from that region. The effect for recruits who entered through a ground program is positive and statistically significant, but it is virtually zero in magnitude.

Retention Beyond the First Term (Conditional Upon First-Term Survival)

The final column of table 2 examines retention beyond the first term of service for recruits who successfully completed the first term (45 months of service). Thus the sample is restricted to the 23,043 recruits that completed 45 months of service and, as such, is similar to a reenlistment equation. The key difference from a normal reenlistment equation is that the characteristics included are those observed at the time of accession. While the first three columns of table 2 examine the characteristics of recruits relative to their later success in the Marine Corps, the final column examines only the characteristics of survivors, those who completed 45 months relative to their future decision to remain or leave the Marine Corps. These results are presented primarily to emphasize the differences in the characteristics associated with reenlistment decisions relative to the characteristics associated with both first-term survival and subsequent reenlistment.

Thus the estimation in the final column of table 2 is qualitatively different from the earlier three columns, and indicative of only the characteristics of retention for those Marines successfully completing

1. These same effects can be observed by focusing on the characteristics of Marines at different lengths of service (see appendix C).

the first term of service. Educational background, which had been a good predictor of successfully completing the first term, is not important in determining if a recruit will be retained beyond the first term. Moreover, scorers in AFQT categories I-IIIA have a lower probability of reenlistment. Also DEP participation, the Marine Corps background variable with the most significant positive impact on first-term survival, is not important in predicting who will be retained beyond the first term, given completion of the first term of service.

Women who have made it to the end of their first term are more likely to be retained. Although women have a lower probability of surviving the first term, they reenlist at a higher rate. Other studies have shown that these two tendencies "wash out" with the proportion of recruits retained beyond the first term being about the same as the original accession proportion [12]. Thus the proportion of Marines who are women is the same for retention beyond the first term as it was at the time of accession. Hispanic and black Marines, who had a higher survival rate to the end of the first term, also have a higher probability of being retained beyond the first term. Also, Marines who entered the Marine Corps married have a higher probability of being retained beyond the first term. Finally, regional factors strongly affect retention beyond the first term, given survival to the end of the first term. Relative to Marines from the West, Marines from the South are more likely, while Midwestern and Northeastern Marines are less likely, to be retained.

The results in the final column of table 2 show that certain characteristics are better predictors of retention beyond the first term when the prediction is made from the subset of Marines who successfully complete the first term. Nonetheless, the educational, test score, and DEP variables are statistically significant predictors of who will be retained beyond the first term if one asks which group or groups of accessions are most likely to successfully be retained beyond the first term of service. Since the Marine Corps does not utilize lateral entry, but instead draws its second-termers from Marines who completed the first term of service, the estimates of the effects of characteristics on retention found in the third column of table 2 are the most relevant for manpower planners.

Quantitative Results

To analyze the quantitative impact of changes in background variables on the success probabilities, predicted probabilities of success are estimated for recruits with different background variables. Table 3 shows the predicted probabilities. In each of these cases, it is assumed that the recruit is male and scoring in the upper AFQT category. Beyond this, the education level, DEP participation, and weight categories are varied. It must be remembered that to analyze effects of

Table 3. Predicted probabilities for non-prior-service male AFQT categories I-IIIA accessions[a]

Attributes	First-term completion	First-term completion and promotion to corporal	Initial entry to retention beyond the first-term
HSDG, average DEP	0.75	0.49	0.22
Overweight	0.63	0.35	0.16
Not overweight	0.76	0.51	0.23
HSDG, no DEP	0.67	0.42	0.20
Overweight	0.54	0.29	0.14
Not overweight	0.69	0.43	0.20
CERT (20+), average DEP	0.73	0.54	0.24
Overweight	0.61	0.40	0.17
Not overweight	0.75	0.56	0.25
CERT (20+), no DEP	0.66	0.47	0.21
Overweight	0.52	0.33	0.15
Not overweight	0.67	0.48	0.22
CERT (17-19), average DEP	0.62	0.29	0.17
Overweight	0.48	0.19	0.12
Not overweight	0.63	0.31	0.18
CERT (17-19), no DEP	0.53	0.23	0.15
Overweight	0.39	0.15	0.11
Not overweight	0.54	0.25	0.16
Non-HSG, average DEP	0.51	0.19	0.14
Overweight	0.38	0.11	0.10
Not overweight	0.53	0.20	0.15
Non-HSG, no DEP	0.42	0.14	0.12
Overweight	0.30	0.09	0.09
Not overweight	0.44	0.15	0.13

a. Attributes are all calculated at the means unless they are identified among the variables in the left column.

changes, other variables are assumed to be held constant. To make the predictions, the mean values for the variables not mentioned are used.[1]

Three patterns emerge from these results. First, overweight recruits, or those who do not meet the in-service weight standard for their height, have a probability of success that is far lower than the probability of success for other recruits. This relationship holds strongly for all three measures of success. For completion of the first term, probability of success for overweight recruits is approximately 15 percentage points lower than that for recruits who do not exceed the weight-for-height standards.[2] Overweight recruits are 7 to 16 percentage points less likely than nonoverweight recruits to complete the first term at the rank of corporal. For retention beyond the first term, overweight recruits have a success probability that is between 4 and 7 percentage points lower than others.

Second, participation in the DEP improves the probability of success noticeably across the three measures of success. Probability of successfully completing the first term is increased by at least 7 and 9 percentage points. For completion of the first term and promotion to corporal, participation in the DEP improves success probabilities by between 3 and 7.5 percentage points. Participation in the DEP increases the probability of retention beyond the first term by 1.5 to 3.5 percentage points.

Finally, the success probabilities among recruits of different educational backgrounds show large differences. Non-HSG recruits have the lowest probabilities of successful adaptation to Marine Corps life.[3]

The differences between older and younger CERTs are surprisingly large. Across all three measures of success, older CERTs have a much higher probability of success than younger CERTs. The greatest difference in probability is the approximately 20 percent greater chance of

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1. As an example, the first estimate in column one shows that the predicted probability of success for a male, AFQT categories I-IIIA, and HSDG recruit with all other characteristics at the average for FY 1984 recruits was .746.
2. For example, non-DEP HSDG accessions had predicted first-term completion rates of .538 for overweight recruits and .686 for non-overweight recruits (see table 3).
3. See appendix D for more information. Less than half of non-HSG recruits completed the first term of service. Moreover, as is shown in appendix D, when the first-term equation is estimated only for non-HSGs, few explanatory variables achieve conventional levels of statistical significance. In brief, for non-HSG recruits it is very difficult to delineate any of the other characteristics that significantly affect their success in the Marine Corps.

successfully competing the first term and being promoted to corporal. The differences between HSDGs and older CERTs are not major.[1]

SUMMARY AND CONCLUSIONS

This research memorandum has investigated the characteristics associated with higher probabilities of first-term completion, first-term completion and promotion to corporal by 45 months, and retention beyond the initial enlistment contract for accessions in FY 1984 with four-year obligations. In this way we have shown the impact of background variables observable at the time of accession on a broader set of success measures than previously analyzed. Probably the most important finding is that characteristics associated with success for one of these measures are generally associated with success for all three measures. HSDG accessions, CERT accessions over the age of 20 years, AFQT categories I-IIIA accessions, accessions from the DEP, and accessions who meet the in-service weight standard for their height are most likely to adapt successfully to Marine Corps life.

1. Appendix D provides more detail on differences by educational and age category.

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APPENDIX A

FIRST-TERM ATTRITION: OTHER SERVICE COMPARISONS

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FIRST-TERM ATTRITION: OTHER SERVICE COMPARISONS

To provide some perspective, it is important to compare Marine Corps attrition rates with those of the other services. Several points should be made at the onset. First, the Marine Corps has generally been more successful than the other services in translating better accession quality into lower attrition rates. Second, because of the arduousness of early training in the Marine Corps, it has usually experienced a greater proportion of its first-term attrition in the early years of the first-term enlistment contract, relative to the other services. Third, the different mixes of first-term contract length, both across the different services and over time within the Marine Corps, mean that attrition comparisons, across different accession years or across the different services, are not completely straightforward. Interservice comparisons are thus made for all accessions up to two years of service, and Marine Corps accessions are compared over different accession years only for those Marines with initial enlistment contracts of four or more years.

For the Marine Corps and the Navy, information on attrition behavior is currently available through June 1989. This means that all accessions in FY 1987 can be observed for at least 21 months. The two panels in figure A-1 illustrate 21-month Marine Corps and Navy attrition rates for non-prior-service (NPS) accessions in FY 1979 through FY 1987.

Since the proportion of accessions who are HSDGs has risen in recent years, it is important to gain a perspective on rates of attrition for this higher quality group. Thus the results from the upper panel provide an indication of the Marine Corps and Navy attrition rates for the higher quality HSDG recruits. For Marine Corps NPS accessions in the years FY 1980 through FY 1984 or FY 1985, the HSDG 21-month attrition rate stayed relatively constant. For FY 1986 accessions, however, the 21-month HSDG attrition rate increased for that accession cohort. The attrition rate for HSDGs in FY 1987 fell again. The most important result from this historical comparison of cohort accessions is the constancy of the 21-month HSDG attrition rate. With the exception of two years, the FY 1979 to FY 1987 HSDG accessions had 21-month attrition rates of between 19 and 21 percent.

In contrast to the Marine Corps experience, the Navy's 21-month attrition rates for HSDGs have been rising fairly sharply since the 1983 cohort accessions.[1] For accessions in FY 1987, the HSDG 21-month attrition rate is 22.4 percent compared with only 15.2 percent for the FY 1983 accessions.

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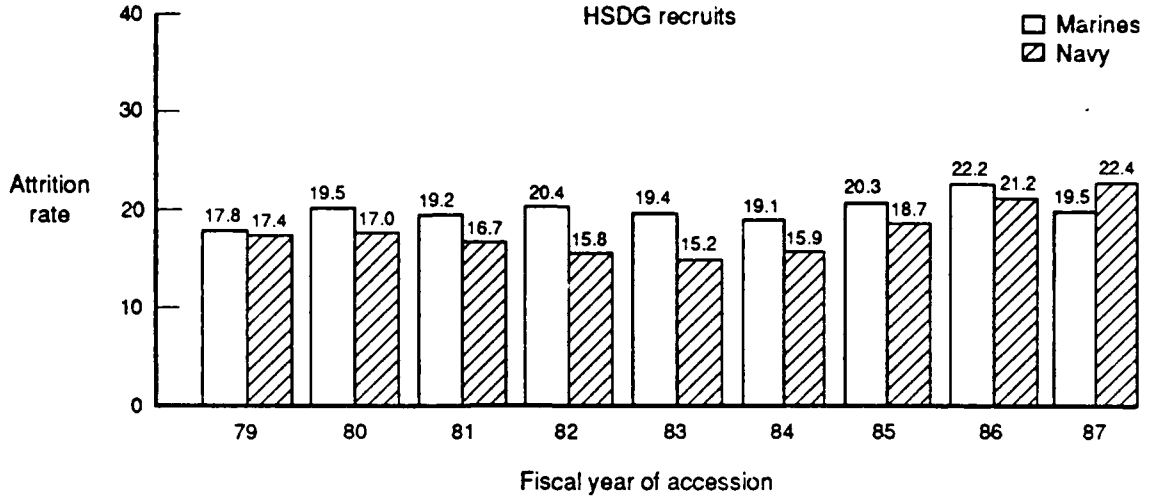
1. The Rand Corporation Report R-3510-FMP, *Military Enlistment and Attrition: An Analysis of Decision Reversal*, by J. Antel, J.R. Hosek, and C.E. Peterson, Jun 1987.



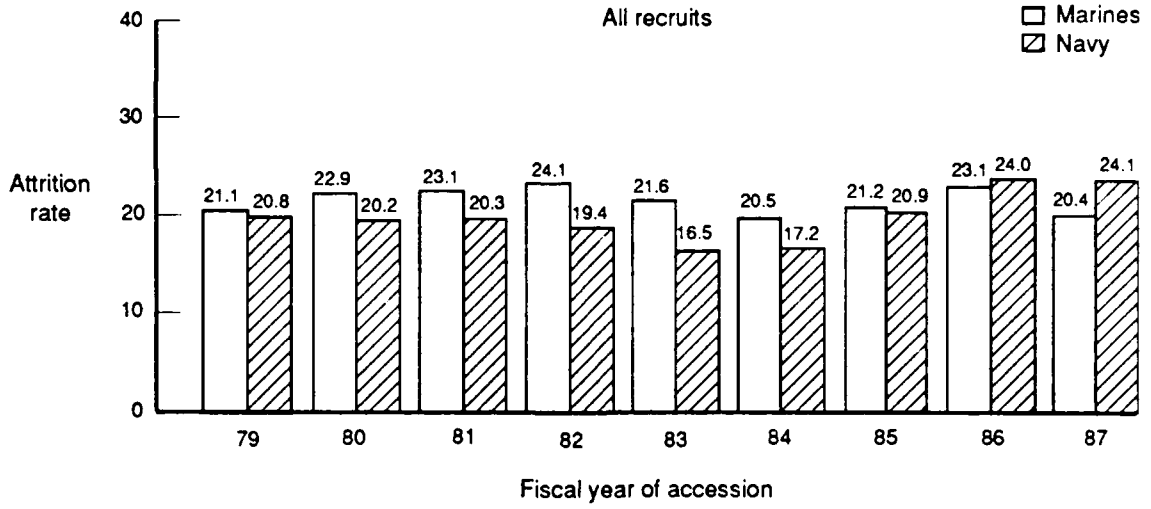


Figure A-1. Comparison of 21-month non-prior-service Marine and Navy attrition rates HSDG recruits

To analyze how the increasing proportions of HSDGs and the relative constancy of HSDG attrition rates translate for overall 21-month attrition rates, the bottom panel shows that these Marine Corps attrition rates declined for accessions in the FY 1982 to FY 1984 period, increased for FY 1985 and FY 1986, and then fell again for FY 1987 accessions. Except for the accessions for FY 1986, the overall 21-month attrition rates remained relatively constant for accessions from FY 1983 to FY 1987. By contrast the Navy's overall attrition rates have climbed sharply both relative to the Marine Corps and in absolute terms. From FY 1983 to FY 1986, the Navy's 21-month attrition rate increased from 16.5 percent to 24 percent, an increase of approximately 45 percent. The Navy's experience shows that improving accession quality cannot *guarantee* a reduction in overall attrition.

To compare overall NPS attrition rates for all the services, Table A-1 shows the 12- and 24-month NPS attrition rates by service from FY 1982 to FY 1987. (The tabulations were provided by the Defense Manpower Data Center (DMDC).) The numbers in the table reinforce the earlier discussion. The overall attrition rate is always higher than the attrition rate for HSDGs because HSDG recruits have lower attrition rates than recruits of other educational backgrounds; this is true in all services. In looking at the different services' attrition rates, it is interesting to note the substantial year-to-year variations in the HSDG attrition rate, particularly in the Navy and the Army. However, with the exception of the FY 1983 Army accessions, the 12-month Marine Corps attrition rate is higher than all the other services, which may be indicative of the rigor of early Marine Corps training.

Table A-1. NPS attrition rates, by fiscal year of accession and service: all recruits and HSDG recruits[a]

Accession year	Marine Corps		Navy		Army		Air Force	
	All recruits	HSDGs	All recruits	HSDGs	All recruits	HSDGs	All recruits	HSDGs
FY 1982								
12-month	18.7	16.5	12.6	10.5	17.4	16.1	12.3	11.7
24-month	26.3	23.0	20.0	16.3	25.9	23.5	18.3	17.4
FY 1983								
12-month	17.3	16.3	11.2	10.5	17.9	16.5	10.3	10.1
24-month	23.4	21.7	17.0	15.7	25.4	23.0	15.3	15.1
FY 1984								
12-month	16.4	15.7	12.0	11.2	16.1	14.9	11.6	11.5
24-month	22.0	21.1	17.9	16.6	23.6	21.7	16.3	16.2
FY 1985								
12-month	16.4	15.9	14.6	13.2	13.1	12.1	11.9	11.8
24-month	22.3	21.8	21.4	19.3	21.4	19.6	17.2	17.2
FY 1986								
12-month	18.6	18.3	16.8	15.2	13.5	12.5	12.5	12.5
24-month	24.3	24.0	24.0	21.5	21.7	20.0	17.7	17.5
FY 1987								
12-month	15.6	15.5	16.4	15.6	12.6	11.7	11.9	11.8

a. These tabulations were provided by the Defense Manpower Data Center (DMDC).

APPENDIX B

LOGIT CURVE ESTIMATION

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Logit regression analysis estimates the following relationship for each of the measures of Marine Corps success:

$$P(success) = (1 + e^{-B'x})^{-1} \quad ,$$

where P is the probability, B' is a row vector of coefficients, and X is a column vector of variables. Figure B-1 shows an example of a logit curve.

The partial derivative of the logit function at the mean of the function is as follows:

$$\frac{\partial P}{\partial x_i}(\bar{P})(1 - \bar{P})B_i \quad ,$$

where i is the ith variable and $\bar{P}$ is the sample mean or proportion. The following equations illustrate this result:

$$P = (1 + e^{-B'x})^{-1}$$

$$1 - P = (e^{-B'x})(1 + e^{-B'x})^{-1}$$

$$\frac{\partial P}{\partial x_i} = -(1 + e^{-B'x})^{-2}(-B_i e^{-B'x})$$

$$= (1 + e^{-B'x})^{-1} \frac{(B_i)(e^{-B'x})}{(1 + e^{-B'x})}$$

$$= P(B_i)(1 - P)$$

$$= B_i(P)(1 - P) \quad .$$

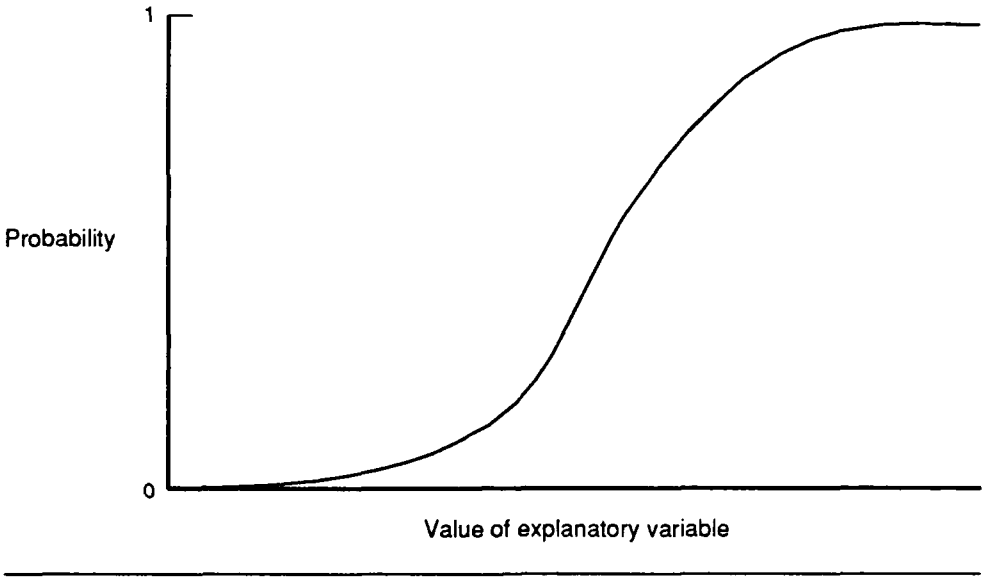

Figure B-1. Example of a logit curve

Table 3 in the main text and tables D-2 through D-4 in appendix D provide a slope-adjustment factor for each logit equation estimate. This is simply $(\bar{P})(1 - \bar{P})$. If the slope adjustment is multiplied by the logit coefficient, one obtains the partial derivative for the variable at the mean of the data. This is often identified as the slope of the conditional mean function.

APPENDIX C

AVERAGES OF PREDICTOR VARIABLES FOR MARINES AT VARIOUS LENGTHS OF SERVICE: ACCESSION, FIRST-TERM COMPLETION, AND RETENTION BEYOND THE FIRST TERM

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AVERAGES OF PREDICTOR VARIABLES FOR MARINES AT VARIOUS LENGTHS OF SERVICE: ACCESSION, FIRST-TERM COMPLETION, AND RETENTION BEYOND THE FIRST TERM

It is instructive to examine the characteristics of Marines who are in the four basic samples: the accessions, the accessions that completed 45 months of service, the accessions that completed 45 months of service and had early promotion to corporal, and the accessions that were retained beyond the first term of service.

While 94.6 percent of accessions were male, males were 95.8 percent of those who completed the first term and 94.2 percent of those retained in the Marine Corps after end of the first term of service. Thus, female recruits are more likely to attrite during the first term, but if they do not attrite, they are considerably more likely than males who do not attrite to extend or reenlist for another term.

Slightly under 90 percent of these accessions entered the Marine Corps through the DEP. For all success measures in table C-1, however, more than 90 percent of the successful Marines entered through the DEP. Participation in the DEP, as was evidenced in the discussion of the estimates presented in table 3 of the main text, enhances the chances that a recruit will successfully adapt to Marine Corps life.

The proportion of the HSDGs is divided into the two age categories; both age categories of HSDGs are overrepresented in the "success samples," reinforcing the finding that HSDG recruits make good Marines. Tier II accessions (CERTs) are underrepresented in the first-term completion sample, but the underrepresentation is very small for CERTs who enter the Marine Corps at age 20 or older. Moreover, the certificate graduates who are a little older when they enter the Marine Corps are more likely to be promoted to corporal and more likely to be retained beyond the first term of service.[1] It should be noted that very few accessions in this schooling category enter the Marine Corps before 18 years of age or over the age of 23 years; thus, the dominant finding is that CERTs who enter the Marine Corps at age 18 to 19 are less successful than CERTs who enter the Marine Corps between the ages of 20 and 23 years. Tier III recruits (non-HSGs) are substantially less successful than recruits with other educational backgrounds. They were 4 percent of accessions, but their high first-term attrition rate made them

1. The finding that older certificate graduates have generally been considerably more successful (in terms of first-term completion and retention beyond the first term) was verified by examination of recruit cohorts in other years.

Table C-1. Table of sample means

		Success measures		
	Accessions	First-term completers	First-term completers and promotion to corporal	Retention beyond the first term
Male	.946	.958	.950	.942
DEP	.897	.915	.921	.913
HSDG (17-19)	.682	.711	.699	.704
HSDG (20+)	.172	.170	.193	.173
CERT (17-19)	.059	.049	.036	.048
CERT (20+)	.047	.045	.054	.051
Non-HSG[a]	.040	.025	.018	.024
AFQT I-IIIA	.533	.544	.591	.507
AFQT IIIB[a]	.433	.453	.382	.454
AFQT IV	.034	.033	.027	.039
Overweight	.108	.089	.077	.075
Hispanic	.044	.050	.048	.051
Black	.174	.175	.158	.262
Aviation	.178	.204	.221	.197
Ground	.413	.421	.408	.422
Number of observations	33,622	23,043	13,698	7,462

a. In the statistical analyses, each characteristic category has an omitted group. For example, there is no variable "female," and the interpretation of the coefficient on the variable "male" is the estimated effect for males, relative to the omitted group (females). Both non-HSG and AFQT category IIIB are omitted groups. Their means are provided in this table, however, for ease of the reader.

only 2.5 percent of those who completed the first term of service. If they complete the first term of service, however, they are about as likely to be retained beyond the first term as are other Marines.[1]

First-term completers and those who complete the first term and receive an early promotion are more likely to test in AFQT categories I-IIIA. While the results in table 3 of the main text suggested that these Marines, if they complete the first term of service, are less likely to reenlist than Marines with lower test scores, table C-1 shows that the proportion of Marines from AFQT categories I-IIIA who are retained beyond the initial contract is not very different from the accession proportion (50.7 vs. 53.3 percent).[2]

Marines who enter at a weight that exceeds in-service standards for their height have poorer prospects for successful adaptation to Marine Corps life than do other Marines. These accessions are substantially less likely to complete the first term, or to be candidates for early promotion. The Marine Corps might consider a more careful screening of overweight recruits, perhaps placing them in the DEP on a weight-reduction program.

Finally, the strong continuation rates of black and Hispanic accessions are reflected in their increasing proportions in the sample of Marines retained beyond the initial contract.

Female accessions comprised only 4.2 percent of first-term completers; this percentage reflects their very high attrition rate within the first term of service. Females, however, represent 5.8 percent of those retained *beyond* the first term: female Marines who successfully complete the first term of service have very high retention rates.

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1. Non-HSGs are 2.5 percent of first-term completers and 2.4 percent of those retained beyond the first term of service.
2. This finding is important because it suggests that restricting the observations to those who complete the first term of service (as one generally does in retention analysis) may be misleading. While retention analysis will show a negative retention effect for AFQT I-IIIA Marines, an analysis that looked from the accession point to those who reenlisted or extended beyond the first term would show no such effect. (This finding is illustrated by the different coefficient estimates for AFQT categories I-IIIA in the last two columns of table 3. In column 3, for example, no statistically significant effect is estimated, suggesting the same finding as shown in table 4.)

APPENDIX D

LOGIT ESTIMATES FOR AGE AT ACCESSION/EDUCATION SUBSAMPLES

APPENDIX D

LOGIT ESTIMATES FOR AGE AT ACCESSION/EDUCATION SUBSAMPLES

Table D-1 illustrates the means of both the explanatory variables and of the success indicator variables for accessions in the different age/education categories. As is clear from the table, there are some systematic differences, in terms both of performance and of background characteristics.

Table D-1. Table of means

	HSDG (17-19 years)	HSDG (20 years and over)	CERT (17-19 years)	CERT (20 years and over)	Non-HSG
First-term completion	.714	.675	.570	.660	.437
First-term completion and promotion to corporal	.417	.458	.248	.490	.159
Retention beyond first term	.229	.224	.181	.243	.131
Male	.949	.927	.966	.887	.999
DEP	.929	.833	.894	.832	.697
AFQT categories I-IIIA	.506	.573	.452	.712	.735
AFQT category IV	.036	.037	.039	.020	.005
Overweight	.095	.152	.095	.154	.092
Hispanic	.044	.050	.052	.036	.035
Black	.175	.184	.189	.179	.089
Aviation	.192	.154	.147	.177	.098
Ground	.442	.359	.417	.321	.255
Spring accession	.200	.433	.219	.410	.488
Summer accession	.537	.309	.495	.316	.287
Accession age	18.22	21.45	18.30	21.70	18.40

HSDG accessions who enter the Marine Corps at ages 17 to 19 are the most likely group to enter from the DEP; CERT accessions in the same age categories are almost as likely to enter from the DEP. Older HSDG or CERT recruits are somewhat less likely to be accessed from the DEP (83.3 and 83.2 percent, respectively), and less than 70 percent of non-HSG recruits enter the Marine Corps from the DEP.

There are also substantial differences, by education/age categories, in the proportion of accessions who test in AFQT categories I-IIIA. While most of these differences reflect higher proportions in educational categories that are generally less successful, it is somewhat surprising to see that less than half of the CERTs who enter the Marine Corps at ages 17 to 19 test in AFQT categories I-IIIA. (CERTs entering in these age categories were 9 percentage points less likely to complete the first term of service than were CERTs entering at older ages.)

Over 15 percent of HSDGs and CERTs entering the Marine Corps at age 20 and older exceeded the in-service weight standard for their height; the percentage was under 10 percent for all other groups. The other sharp differences relate to accession month: while the younger group of accession is more likely to enter in the summer months, the older group is more likely to be accessed in the spring. This finding should come as no surprise to any reader of this paper.

To see if the estimated effects of any of the background characteristics differed systematically by recruit educational background, the logit equations were estimated separately for each of the accession age/education groups (these estimates are found in tables D-2 through D-4). Overall, the results for these estimations suggest that little additional information is gained by stratifying the sample by accession age/education categories.

There are, however, at least three interesting findings from this effort. First, for the sample of non-HSG accessions practically none of the predictor variables achieve conventional levels of statistical significance. The only exceptions are the overweight and aviation program variables. In brief, only 43.7 percent of non-HSG recruits completed the first term, and high AFQT scores or DEP participation have no statistically significant impact on completion probabilities for this group. Overweight non-HSG accessions, however, are particularly poor risks. Second, although all groups except non-HSGs show statistically significant and positive effects for high AFQT scorers, the effects are largest in magnitude for certificate holders accessed at ages 20 and older.

Table D-2. First-term completion

	HSDG (17-19 years)	HSDG (20 years and over)	CERT (17-19 years)	CERT (20 years and over)	Non-HSG
Male	.916[a]	.644[a]	.398	.558[a]	N/A
	(14.52)	(6.06)	(1.54)	(3.28)	
DEP	.383[a]	.363[a]	.464[a]	.384[a]	.155
	(6.93)	(4.88)	(3.04)	(2.68)	(1.23)
AFQT categories I-IIIA	.231[a]	.313[a]	.364[a]	.668[a]	.146
	(7.17)	(4.97)	(3.65)	(5.19)	(1.12)
AFQT category IV	-.096	.050	-.216	.307	-.162
	(-1.23)	(.33)	(-.91)	(.78)	(-.18)
Overweight	-.649[a]	-.614[a]	-.732[a]	-.504[a]	-.638[a]
	(-13.77)	(-8.06)	(-4.60)	(-3.43)	(-3.07)
Hispanic	.522[a]	.382[a]	.899[a]	.554[c]	.309
	(6.44)	(2.72)	(3.83)	(1.74)	(1.03)
Black	.151[a]	.098	.057	.419[a]	.129
	(3.72)	(1.28)	(.47)	(2.75)	(.66)
Aviation	.649[a]	.546[a]	.467[a]	.713[a]	.439[b]
	(14.32)	(6.01)	(3.14)	(4.22)	(2.27)
Ground	.275[a]	.230[a]	.063	-.016	.128
	(8.37)	(3.65)	(.62)	(-.13)	(.97)
Spring	-.043	-.131[c]	-.132	.321[b]	.003
	(-.97)	(-1.83)	(-.98)	(2.36)	(.02)
Summer	.104[a]	-.040	.075	.307[b]	-.003
	(2.93)	-.52)	(.69)	(2.13)	(-.02)
Accession age	.030	-.055[a]	.189[b]	-.052[c]	.048
	(1.15)	(-3.59)	(2.49)	(-1.78)	(1.37)
Constant	-1.219	.810	-4.221	.166	-1.395
	(-2.49)	(2.26)	(-2.89)	(.24)	(-2.07)
Chi square	824.3	219.5	84.8	95.3	24.4
Number of observations	22,939	5,790	1,987	1,575	1,331

Table D-2. (Continued)

	HSDG (17-19 years)	HSDG (20 years and over)	CERT (17-19 years)	CERT (20 years and over)	Non-HSG
Average completion rate	.714	.675	.570	.660	.437
Slope adjustment factor (at mean)	.204	.219	.245	.224	.246

NOTE: asymptotic t-statistics in parentheses.

a. Statistically significant at 1-percent level (two-tailed test).
b. Statistically significant at 5-percent level (two-tailed test).
c. Statistically significant at 10-percent level (two-tailed test).

Table D-3. First-term completion and early promotion to corporal (by 45 months of service)

	HSDG (17-19 years)	HSDG (20 years and over)	CERT (17-19 years)	CERT (20 years and over)	Non-HSG
Male	.398[a] (6.13)	.427[a] (3.99)	-.418 (-1.58)	.170 (1.03)	N/A
DEP	.267[a] (4.82)	.459[a] (6.15)	.426[b] (2.45)	.352[b] (2.47)	.397[b] (2.18)
AFQT categories I-IIIA	.346[a] (11.82)	.486[a] (8.17)	.631[a] (5.54)	-.799[a] (6.33)	.157 (.86)
AFQT category IV	-.152[b] (-1.97)	-.138 (-.90)	-.358 (-1.07)	-.344 (-.84)	.488 (.43)
Overweight	-.664[a] (-13.31)	-.617[a] (-7.91)	-.533[a] (-2.62)	-.667[a] (-4.48)	-1.901[a] (-3.67)
Hispanic	.302[a] (4.55)	.017 (.14)	.448[b] (1.97)	.038 (.13)	.652[c] (1.87)
Black	-.047 (-1.26)	-.152[b] (-2.08)	-.178 (-1.21)	.067 (.47)	-.344 (-1.15)
Aviation	.467[a] (12.10)	.298[a] (3 75)	.356[b] (2.28)	.356[b] (2.45)	.631[a] (2.77)
Ground	.161[a] (5.21)	.081 (1.36)	.245[b] (2.05)	-.065 (-.55)	-.005 (-.03)
Accession age	.034 (1.45)	.028[c] (1.90)	.379[a] (4.29)	.027 (.98)	.156[a] (3.60)
Constant	-1.868 (-4.21)	-1.[illegible]3 (-5.16)	-8.459 (-4.98)	-1.603 (-2.44)	-4.944 (-5.91)
Chi square	631.9	235.6	94.2	95.5	58.45
Slope adjustment factor	.243	.248	.186	.250	.134
Number of observations	22,939	5,790	1,987	1,575	1,331
Mean dependent variable	.417	.458	.248	.49[illegible]	.159

NOTE: Asymptotic t-statistics in parentheses.

a. Statistically significant at 1-percent level (two-tailed test).
b. Statistically significant at 5-percent level (two-tailed test).
c. Statistically significant at 10-percent level (two-tailed test).

Table D-4. Retention beyond the first term

	HSDG (17-19 years)	HSDG (20 years and over)	CERT (17-19 years)	CERT (20 years and over)	Non-HSG
Male	-.052 (-.70)	.101 (.80)	.149 (.44)	-.270 (-1.48)	N/A
DEP	.181[a] (2.75)	.189[b] (2.13)	.279 (1.34)	.179 (1.07)	.179 (.97)
AFQT categories I-IIIA	-.039 (-1.12)	.082 (1.16)	.012 (.10)	-.192 (-.43)	.267 (1.36)
AFQT category IV	.083 (.99)	.112 (.67)	-.114 (-.37)	.172 (1.19)	.587 (.53)
Overweight	-.473[a] (-7.67)	-.432[a] (-4.39)	-.671[a] (-2.73)	-.402[b] (-2.22)	-.357 (-1.12)
Hispanic	.310[a] (4.09)	.334[b] (2.34)	.600[b] (2.50)	.755[a] (2.60)	.606[c] (1.64)
Black	.753[a] (18.98)	.698[a] (8.76)	.567[a] (4.01)	.755[a] (5.02)	.264 (.99)
Aviation	.283[a] (6.24)	.269[a] (2.92)	.196 (1.12)	.148[a] (.91)	-.392 (-1.28)
Ground	.103[a] (2.82)	.081 (1.14)	.004 (.03)	-.012 (-.09)	-.203 (-1.03)
Accession age	-.023 (-.83)	.004 (.22)	.135 (1.41)	-.022 (.71)	.066 (1.36)
Constant	-1.127 (-2.17)	-1.808 (-4.43)	-4.523 (2.45)	-1.811 (-2.44)	-3.378 (-3.66)
Chi square	495.7	110.3	33.2	41.6	11.2
Slope adjustment factor	.179	.174	.148	.184	.114
Number of observations	22,939	5,790	1,987	1,575	1,331
Average retention rate	.229	.224	.181	.243	.131

NOTE: Asymptotic t-statistics in parentheses.

a. Statistically significant at 1-percent level (two-tailed test).
b. Statistically significant at 5-percent level (two-tailed test).
c. Statistically significant at 10-percent level (two-tailed test).

Finally, for both CERTS and HSDGs entering the Marine Corps in the older accession age categories, completion probabilities do decline with age at entry. (The effect of accession age for the younger age categories is positive, but the effect is statistically significant only for the young CERTs.) Overall, the findings suggest that CERT completion probabilities are highest for CERTs accessed in their very early twenties.