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Compensatory Screening Model for B Cell Enlistment

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Twenty percent of the enlistment-age youth population fail to earn a high school diploma. These nongraduates constitute a large pool of potential recruits. A review of the literature documents that high school dropouts have lower academic achievement and vocational aptitude, less employment experience, higher propensity for drug use and criminal behavior and more psychological disturbances. As a result, the armed services minimize the enlistments of nongraduates because of this group's high attrition and reputation for lower personal reliability. Thus, the Navy Recruiting Command accepts only limited numbers of nongraduates even when it is faced with significant shortfalls of qualified high school graduate applicants. To aid recruiters in accessing the nongraduate labor market, the objective of this study was to design a compensatory screening model (CSM) to assess applicants on the basis of available measures of individual attributes. The resulting model computes the probabilities of completing the first 2 years of enlistment from four application variables: number of years of education attended, education credential attained, age at application, and Armed Forces Qualification Test (AFQT) score. The CSM was operationalized as an actuarial table for use by Navy recruiters. Evaluation analyses demonstrated expected reductions in attrition and improvements in the aptitude and educational characteristics of nongraduate accessions.

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Foreword

This research was conducted under the Adaptability Screening Program in support of Work Request Number N0002295WRASP01. It was sponsored by the Assistant Chief of Naval Personnel for Military Personnel Policy and Career Development.

This report describes the technical development of an enlistment screening model for selecting non-prior service Navy applicants who have not achieved a high school diploma. The resulting compensatory screening model (CSM) was implemented by the Commander, Navy Recruiting Command on 19 September 1994.

The CSM project was originally directed by the Head, Recruiting Plans and Programs Division (Pers-23), CAPT J. C. Kinney and his successor, CAPT G. S. McInchok. Their policy support and the program management of Dr. Clessen Martin (Pers-2FF/234) were largely responsible for this successful research and development effort. Several individuals contributed to an initial model that was used during the operational testing period: Mr. John Folchi, Mr. Drew Sands, Dr. Jerry Laabs, and Dr. Jules Borack at NPRDC, and at the Human Resources Research Organization, Mr. Jeffrey Barnes, Mr. Jack Dempsey, Dr. James McBride, Dr. Janice Laurence, and Dr. Brian Waters. Outstanding operational support was provided by Dr. Edward Schmitz and Mr. Carl Kannapel of the Navy Recruiting Command.

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Summary

Background

The Navy minimizes the enlistments of non-high school graduates in order to control attrition and enhance the quality characteristics of recruit cohorts. The basis for this exclusionary policy is found in both the military and civilian literature: nongraduates exhibit an array of relative shortcomings that bear upon personal reliability and job performance. These factors include low academic achievement, criminal involvement, drug and alcohol abuse, unemployment, and psychological dysfunction.

Problem and Objective

Despite a nongraduate first-term attrition rate in excess of 50%, the Navy Recruiting Command has accepted limited numbers of nongraduates to compensate for the shortfall of qualified high school diploma graduates. For this reason, the primary research objective was to design a model of individual differences among high school dropouts that could be used as a secondary screen for Cell B applicants (i.e., nongraduates who score above the population mean on the Armed Forces Qualification Test (AFQT)). This enlistment screen was constrained by the requirement to minimize recruiter administrative procedures.

Methodology

The model development sample consisted of 25,199 Navy enlisted personnel who had not earned a high school diploma. A comparison sample consisted of 281,425 high school graduate enlisted personnel.

The criterion measure was completion of the first 2 years of enlistment versus premature separation. For exploratory purposes, the explanatory variables included the AFQT score, years of education, attainment of an alternative secondary education credential, gender, ethnicity, age, home geographic region, arrest record, and term of enlistment. Scales corresponding to enlistment completion rates were developed for four of these variables and were utilized in the Compensatory Screening Model (CSM). CSM parameter estimates were derived from a logistic regression procedure.

Results

Attrition during the first 2 years of enlistment amounted to 39% for the high school dropout cohort, compared to 20% for high school graduates. Furthermore, high school dropouts incurred higher rates of fraudulent enlistments, disciplinary offenses, drug and alcohol abuse, psychological disorders, desertion, and substandard job performance. Within this nongraduate sample, attrition varied substantially for groups representing different education credentials, years of education, AFQT categories, and age categories.

The CSM parameter estimates were used to compute probabilities of 2-year service completion. These probabilities ranged from 49% to 80%, according to variable categories, and were arrayed in an actuarial table for use by Navy recruiters.

At the level of a proposed CSM eligibility cut-score, 37% of FY88-91 nongraduate accessions would have been eligible for enlistment. Compared to the total accession group, no adverse impact would have resulted for Hispanic and African-American Cell Bs. For education groups, eligibility ranged from 31% for applicants with no secondary credential to 100% for applicants with an occupational program diploma.

Among the hypothetical group of eligibles, 66% completed the first 2 years of enlistment (true positives). This completion rate was six percentage points higher than the rate for the total sample of Cell B personnel and 10 percentage points higher than the rate for the group scoring below the eligibility cut-score (i.e., 56% were false negatives).

Conclusions and Discussion

Analyses of the incidences and reasons for premature enlistment separations generally supported the empirical basis for policies that minimize enlistment opportunities for high school dropouts. However, attrition variances across Cell B subgroups make additional enlistment screening of Cell B applicants feasible. This objective was accomplished by operationalizing the four CSM factors into a recruiter friendly actuarial table.

The use of CSM to determine enlistment eligibility of Cell B applicants is expected to result in a small reduction in attrition during the Delayed Entry Program (DEP), boot camp, A School, and assignment to the fleet. The Navy Recruiting Command will contract approximately 2,700 CSM-screened recruits in FY95, resulting in personnel replacement cost savings of $2.6M. In addition to reducing attrition-related turbulence in the fleet, CSM screening will significantly improve the educational achievement, vocational aptitude, and job performance of Cell B recruits.

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Introduction

Background

Roughly 20% of the 18 to 24-year-old youth population fail to complete secondary school and do not earn a high school diploma (U.S. Bureau of the Census, 1992).[1] As a group, high school dropouts are generally considered to be poor candidates for military enlistment. Indeed, the armed services minimize the enlistments of nongraduates during periods when recruiting goals can be accomplished with high school diploma graduates who satisfy minimum standards on the Armed Services Vocational Aptitude Battery (ASVAB). From an institutional perspective, the basis for this exclusionary policy is found in both the military and civilian literature: nongraduates exhibit an array of relative shortcomings that bear upon personal reliability and job performance. These factors include low academic achievement, criminal involvement, drug and alcohol abuse, unemployment, and psychological dysfunction.

While one-fifth of dropouts report leaving school to support family economic responsibilities (Rumberger, 1987), and one-third of female dropouts leave because of pregnancy (National Center for Education Statistics, 1992), the majority of male nongraduates have substantial school-related problems. Dropouts have lower school grades, reading grade level, achievement and intelligence test scores, and educational and occupational aspirations, while exhibiting higher incidences of truancy, misbehaviors in school, suspensions from school, grade retention, and trouble with the police (Alpert & Dunham, 1986; Barrington & Hendricks, 1989; Ekstrom, Goertz, Pollack, & Rock, 1986; Hahn, 1987; Hammack, 1989; Rumberger, 1987; Wehlage & Rutter, 1986). Cairns, Cairns, and Neckerman (1989) found that as early as grade seven, school dropouts demonstrated low academic achievement and high levels of aggression.

The association between adolescent delinquency and school-leaving has been well documented, first in the urban sociology classics (cf., Cohen, 1955), and more contemporarily with Elliott and Voss's (1974) study of school-leaving and criminality. Eventual dropouts were found to have considerably more police contacts and delinquent behaviors. This delinquency was reduced upon leaving school, as school-related failures and frustrations were alleviated. Nonetheless, subsequent criminal arrests and convictions were significantly higher for dropouts than for graduates (Hathaway, Reynolds, & Monachesi, 1969; Thornberry, Moore, & Christenson, 1985). In fact, nongraduates represented 66% of state prison inmates in 1991 (Bureau of Justice Statistics, 1993). Recidivism rates are also higher for dropouts. One study found that 71% of young nongraduate parolees were rearrested within 6 years of release (Bureau of Justice Statistics, 1987).

In support of a general deviance hypothesis concerning school-leaving, Bachman, Johnston, & O'Malley (1981) and Newcomb and Bentler (1986) found that cigarette and illicit drug use predicted failure to graduate from high school. A number of studies, controlling for other attrition risk factors, have also associated use of cigarettes, alcohol, and illicit drugs with dropping out of school (cf., Mensch & Kandel, 1988; Dunham & Alpert, 1987). Initiating drug use in adolescence

[1]The incidence of dropping out of school varies according to non-standardized methods of computation (see Rumberger, 1987). This report defines dropouts and nongraduates as those military recruits who had not earned a regular high school diploma from a day school program. This includes non-high school diploma graduates who attended 12 years of school, as well as school leavers who subsequently earned an alternative education credential.

reduced school involvement and performance, increased absenteeism and delinquent behaviors, and detoured commitment from conventional institutions to deviant subcultures (Mensch & Kandel, 1988). For most legal and illegal substances, this prevalence continued into adulthood (Mensch & Kandel, 1988). Relatedly, Kandel (1980) reported that the highest rates of drug use were found among the unemployed.

The bulk of employment-related research on nongraduates has been conducted with military personnel. Numerous studies have consistently found that nongraduates prematurely separate from their service contracts at considerably higher rates than graduates (cf., Buddin, 1984; Cooke & Quester, 1989; Hosek, Antel, & Peterson, 1989; Lockman & Gordon, 1977; Mobley, Hand, Baker, & Meglino, 1979; Sands, 1978; Steinhaus & Waters, 1991). First-term enlistment attrition rates vary, but generally exceed 20% for high school graduates and 50% for nongraduates (Flyer & Elster, 1983; Laurence, 1993; Trent, 1993). In addition to the turbulence caused by attrition in general, nongraduates have a higher incidence of adverse behaviors that are disruptive to military organization. Among Navy nongraduate recruits, Trent and Devlin (1993) reported significantly higher rates of separation for alcohol and drug abuse, psychological disorders, and fraudulent entry. In a study of Navy enlisted drug abusers, Nail, Gunderson, Kolb, and Butler (1975) found that 50% had not completed high school, 30% had been expelled or suspended from school, and 38% had been arrested before enlistment. Edwards and Newell (1994) studied misconduct discharges and found a disproportionate number of nongraduates. Quester (1988) reported that the highest rates of demotion and desertion from the Navy were found among male nongraduate recruits.

Higher rates of disciplinary actions and unsuitability discharges have also been found among Air Force (Kantor & Guinn, 1975) and Army (Eaton, Weltin, & Wing, 1982) recruits. Across the military services, Flyer (1987) found that unsuitability discharges from security-sensitive positions were disproportionately non-high school graduates.

While enrolled in high school, eventual graduates tend to have more work involvement, suggesting that dropouts experience employment difficulties early on (Weidman & Friedmann, 1984). After leaving school, nongraduates experience considerably higher rates of unemployment (Bureau of Labor Statistics, 1992; Rumberger, 1987) and lower wages (U.S. Bureau of the Census, 1992). Unemployment and underemployment may have other insidious effects. Stafford, Jackson, and Banks (1980, p. 301) reported that dropouts "who do not enter stable employment are considerably more vulnerable to psychiatric disorder." Feather and O'Brien (1986) concluded that unemployment played a causative role in reducing psychological well-being and self-esteem among school-leavers. Egan (1989) studied unemployed school leavers and found them to have elevated scores on two dimensions of the Eysenck Personality Questionnaire (psychoticism and neuroticism), while indicating a high degree of hostility on the Hostility and Direction of Hostility Questionnaire (Caine, Foulds, & Hope, 1967). Conversely, Gurney (1980) found that school-leavers who subsequently gained employment exhibited significantly greater psychosocial development as compared to dropouts who remained unemployed.

Yet, few studies have examined personality profile and psychopathology differences between dropouts and graduates. Hathaway, Reynolds, and Monachesi (1969) found elevated validity scales (Lie (L), Infrequency (F), and Cannot Say (?)) on the Minnesota Multiphasic Personality Inventory (MMPI) for dropouts, indicating naive distortion (L) and psychopathology (F) or inadequate

reading ability or noncooperativeness. Among the MMPI's clinical scales, dropouts had elevated profiles on all scales, except Masculinity-femininity (Mf). The Psychopathic Deviate (Pd) and Schizophrenia (Sc) scales were most elevated. As compared to high school graduates, this suggests that dropouts are rebellious, apathetic, nonconformist, and socially withdrawn. Vestre and Lorei (1967) found the life-history factors of patients with functional psychiatric disorders to be associated with two MMPI scales. Lower scholastic achievers scored significantly higher on the Social Introversion (Si) scale and lower on the Mf scale. Higher Sc scores were also reported for patients with 11 or fewer years of education (Davis & Jones, 1974).

Problem and Objective

If high school dropouts have lower academic achievement and vocational aptitude, less employment experience, higher propensity for drug use and criminal behavior, and are possibly more prone to psychological disturbances, why is military enlistment eligibility an issue? First, the Navy Recruiting Command has accepted limited numbers of nongraduates to compensate for the shortfall of qualified high school diploma graduates. For this reason, the primary research objective was to design a model of individual differences among high school dropouts that could be used as a secondary screen for Cell B applicants (i.e., nongraduates who score above the population mean on the Armed Forces Qualification Test (AFQT)). The purpose of the resulting Compensatory Screening Model (CSM) was to reduce first-term enlistment attrition, while minimizing recruiter administrative procedures.

Secondly, the U.S. Congress has urged the Department of Defense (DoD) to utilize a personnel screening system that does not exclude applicants solely on the basis of educational attainment. Group statistics notwithstanding, many non-high school diploma graduates complete successful military enlistments and careers. In this context, the research was designed to develop a compensatory type of screening model that assesses applicants with high attrition-risk education backgrounds on the basis of readily available measures of individual attributes.

Methodology

Samples

The model development sample consisted of 25,199 non-prior service Navy enlisted personnel who accessed during fiscal years 1988-1991, were high school dropouts, and scored at or above the 50th percentile on the AFQT. These high school dropouts included those who completed alternative secondary education credentials and those classified as high school graduates for enlistment eligibility purposes (adult education diploma holders and nongraduates with one semester of college credit).

The sample's minority group representation was 15% Hispanic and 10% African-American. Although female dropouts had generally been excluded from enlistment, the model-development sample included 914 women, most of whom had attained an adult education diploma or completed one semester of college. Among the total sample, 66% were 17-19 years of age, 12% were married or had a dependent, and 54% had attended 10 or fewer years of school.

For comparison purposes, an independent sample from fiscal years 1988-1991 included all non-prior service Navy accessions who had attained a high school diploma or completed higher post-secondary education ($N = 281,425$). An additional sample of 75,528 Army, Navy, and Marine Corps nongraduate personnel was utilized to scale an education credential measure.

Measures

The criterion measure was a dichotomy that indicated completion of the first 2 years of military enlistment (coded "1"; $N = 15,365$) versus premature separation from the enlistment contract (coded "0"; $N = 9,834$).

Model-1 Independent Variables

The independent variables consisted of measures available as data elements on the Military Entrance Processing Reporting System (MEPRS) that were conceptually or statistically associated with the criterion. The AFQT percentile score results from a composite of raw scores (Arithmetic Reasoning + Math Knowledge + (2 x (Paragraph Comprehension + Word Knowledge))) from the ASVAB. Educational achievement was captured by two measures: years of education attended and a dichotomous variable that indicated completion (coded "1") of one of the following alternative secondary education programs: General Education Development Test (GED), high school certificate of attendance, occupational program, home school, correspondence school, adult education, or one semester of college. Non-completion was coded "0."

Several demographic variables were also dichotomized as "0" versus "1" with the following categories in parentheses coded as "1": gender (female), race (non-white), ethnicity (Hispanic), dependents (married or dependent child), home geographic region (West/Midwest/South), arrest record (one or more misdemeanor or felony arrests), and military youth program participation (e.g., Sea Cadets). Years of age at application and term of military enlistment in years were also included as independent measures.

Model-2 Independent Variables

Five of the exploratory measures from Model-1 were excluded from Model-2. Term of enlistment was excluded because it is highly associated with occupational assignment and cannot be used for primary selection. The arrest record variable was eliminated because of its marginal predictive validity, lack of a small effect-sized incremental validity, and the fact that the Navy Recruiting Command has established screening procedures for applicants with arrest records. In addition, gender, ethnicity, and home region were deemed inappropriate for personnel selection and excluded from Model-2.

The remaining four predictor measures were utilized in a model developed for personnel selection. The scales of these variables were modified according to the constraints of operational use by Navy recruiters. To this end, the number of variables and variable categories was minimized to afford construction of an actuarial table to be utilized by military recruiters to determine enlistment eligibility. The AFQT percentile distribution was collapsed into "mental categories" in accordance with established military selection procedures. Category I, II, and IIIA represent the following percentile intervals, respectively: 93-99, 65-92, and 50-64. For public policy reasons,

each of the education credentials was treated as a separate category. Years of education attended was categorized as 9 or fewer, 10, 11, and 12 or more. Age at application was collapsed into two categories, which corresponded to general differences in service completion rates: 17 to 18 years and 19 years or older. All of the resulting variable categories were then scaled according to the actual 2 year service completion rates of personnel representing those categories. Due to the small sample sizes of several education credential categories, this variable was scaled according to the combined sample of Army, Navy, and Marine Corps personnel.

Procedure

Two multivariate models were developed to estimate 2-year completion probabilities for Navy recruits from an array of personal attributes. Model-1 was a general exploratory model that utilized the full array of available independent measures. Model-2 excluded variables that were deemed inappropriate by statute or policy to be employed as personnel selection criteria. Model-2 also restricted the predictor set to variable categories that could be economically administered by Navy recruiters.

Model-1 was developed from the total sample of non-high school graduates ($N = 25{,}199$). The preliminary set of predictor variables was derived by testing the linear association between the attrition criterion and each independent measure. To reduce chance associations resulting from this post hoc approach, a Bonferroni procedure (Pedhazur, 1982) was used to adjust the alpha level of significance to .004 and define variables for initial inclusion. The parameter estimates for the exploratory Model-1 were derived from a linear probability model.

As described in the Measures section, the response categories for four variables (education credential, years of education, AFQT, and age) were modified. Using a double cross-validation design, two preliminary sets of parameter estimates for Model-2 were derived, one from each of two random one-half subsamples of the total sample. These Model-2 alternatives were subsequently cross-validated on their respective holdout samples by correlating predicted outcomes with actual criterion outcomes. A final set of parameters for use in personnel selection was obtained from the full sample.

With a dichotomous dependent variable, a nonlinear model is expected to provide greater efficiency in estimation. To obtain parameters for personnel selection (Model-2), the logit model was emulated by a linear approximation approach to logistic regression (Aldrich & Nelson, 1984). This was accomplished by the nonlinear regression procedure in the Statistical Package for the Social Sciences (SPSS Inc., 1988). The logistic regression model was:

$$P = \frac{1}{1 + \exp(-Z)}$$

where P = probability of 2 years of service completion, and

$$Z = \log\left(\frac{\hat{Y}}{1 - \hat{Y}}\right) = \beta_o + \Sigma\, \beta_j \chi_{ij}$$

where χ_{ij} = values of the explanatory measure j for applicant i

β_j = estimated weights for χ_j

β_o = estimated constant

$\hat{Y}$ = initial linear probability model estimate

The resulting parameter estimates were derived from previously screened personnel and are constrained by variable restriction in range and preselection bias. Unrestricted data on applicants to the military are not maintained at the initial screening level (recruiting stations). While data are available for applicants who proceed to the next level of screening at Military Entrance Processing Centers, the final educational status is unknown for some applicants in school who do not continue in the enlistment process. An additional consideration was that Navy recruiting policy restricts entry of high school dropouts to those scoring above the 49th percentile on the ASVAB. Thus, the selection model proposed in this report amounts to a secondary enlistment screen. In fact, a comparison of predictor variable variances between the applicant sample and the accession subsample revealed no practical differences. For these reasons, parameter estimates were not adjusted for restrictions in range that result from sample preselection.

Results

Comparing high school dropouts with their diploma graduate counterparts, Table 1 describes the types and frequencies of premature separations that occurred during the first 2 years of enlistment. Among the dropout group, attrition amounted to 39% of total —nearly double the rate that was found for high school graduates (20%). In particular, the dropout cohort incurred higher rates of fraudulent enlistments, disciplinary offenses, drug and alcohol problems, psychological disorders, desertion, and substandard performance.

Table 2 presents the results of an exploratory linear regression (Model-1) of the explanatory variables on the service completion of the Navy nongraduate sample. Several measures from the full array of explanatory variables did not satisfy the initial significance criterion ($p < .004$) and were omitted (race, dependents, home region (south), and military youth program). In order of the standardized beta weights, those personnel more likely to complete the first 2 years of enlistment had contracted for longer enlistment periods, had completed more years of education, scored higher on the aptitude test (ASVAB), were not from the north central region, had not recently been arrested by the police, were older than 18 years of age, were Hispanic, had completed an alternative secondary education credential, were female, and had lived in the West. However, most of these relationships were of minimal practical significance and the multiple regression coefficient was only .17.

Several of these variables (gender, ethnicity, home region, arrest record, and term of enlistment) were eliminated from Model-2 for the reasons described in the Methodology section of this report. Table 3 presents the four remaining predictor scales that were employed in the operational model.

Table 1

Separation Categories by Education Group

	Education Group					
	Dropouts			High School Diploma Graduates		
Category	Number of Attrites	% of Total Attrition	% of Accessions	Number of Attrites	% of Total Attrition	% of Accessions
Erroneous/Fraudulent Enlistment	2,154	21.9	8.6	14,945	26.3	5.3
Disciplinary Offense	2,246	22.8	8.9	7,799	13.7	2.8
Drug/Alcohol Abuse	1,348	13.7	5.4	5,955	10.5	2.1
Psychological Disorders	1,289	13.1	5.1	8,449	14.8	3.0
Deserter	176	1.8	0.7	566	1.0	0.2
Substandard Performance/ Conduct	841	8.6	3.3	5,749	10.1	2.0
Medical Problems	680	6.9	2.7	6,591	11.6	2.3
Substandard Physical Condition	145	1.5	0.6	1,733	3.0	0.6
Homosexuality	82	0.8	0.3	791	1.4	0.3
Pregnancy	40	0.4	0.2	1,906	3.3	0.7
Other/Unknown	833	8.5	3.3	2,445	4.3	0.9
Total	**9,834**	**100.0**	**39.0**	**56,929**	**100.0**	**20.2**

Table 2

Exploratory Linear Probability Model of 2-Year Service Completion

		Parameter Estimates		
Variable	Validity Coefficient	b	SE_b	β
Armed Forces Qualification Test	.06	.002	.000	.050
Years of Education	.10	.038	.003	.085
Education Credential	.05	.017	.007	.017
Gender	.03	.042	.017	.016
Ethnicity-Hispanic	.02	.023	.009	.017
Age	.05	.003	.001	.019
Home Region--West	.04	.014	.007	.013
Home Region--Midwest	-.04	-.036	.008	-.030
Arrest Record	.03	.028	.007	.027
Term of Enlistment	.10	.030	.002	.105
(Constant)		-.167	.039	

Note. Validity coefficients were significant at the $p < .004$ level. The multiple regression coefficient equaled .17 ($N = 25,124$).

Table 3

Predictor Variable Scales in Logistic Regression Model

Variable Category	*N*	Scale Value	Standard Error
Educational Credential			
No Credential	18,963	.572	.004
Correspondence School Diploma	138	.579	.042
Test Equivalency Diploma (GED)	28,662	.594	.003
One Semester of College	10,871	.634	.005
Adult Education Diploma	10,433	.636	.005
Home School Diploma	64	.656	.060
High School Certificate of Attendance or Completion	3,245	.667	.008
Occupational Program Diploma	152	.744	.036
Years of Education			
≤9	5,425	.536	.007
10	8,188	.598	.005
11	8,687	.640	.005
≥12	2,899	.693	.009
Armed Forces Qualification Test (AFQT) Category			
IIIA (50th-64th percentile)	13,714	.587	.004
II (65th-92nd percentile)	10,917	.633	.005
I (93rd-99th percentile)	568	.717	.019
Age			
17 to 18	11,058	.569	.005
19 or older	14,141	.642	.004

Note. The scale values for the education credential variable were based on 2-year service completion rates for FY88-91 Navy, Army, and Marine Corps accessions (N = 72,528). The scale values for years of education, AFQT, and age were based on 2-year service completion rates for FY88-91 Navy accessions (N = 25,199).

Scale values for the four predictor measures correspond to the observed 2-year completion rates of groups representing each variable category and ranged from a low of .536 for applicants with 9 or fewer years of education to a high of .744 for applicants having completed an occupational training program. GEDs, the largest educational group, showed only a two percentage point improvement in service completion over high school dropouts who did not subsequently earn an education credential. Adult education diploma graduates and those having completed one semester of college, however, demonstrated a six percentage point advantage. Home schoolers and those with a high school certificate of attendance also had considerably higher rates of completion than those with no secondary credential. Given the small sample sizes, the standard errors of service completion rates were large for correspondence school, home school, and occupational program diplomas; yet, these groups were not combined with other educational categories because of a public policy consideration to preserve the independence of each alternative education group.

The completion rates increased markedly with additional years of education. AFQT category I and II personnel had 13.0 and 4.6 higher percentage points of completion, respectively, than

category IIIA personnel. Recruits who were 17 or 18 years of age at the time of application to the Navy exhibited markedly lower enlistment completion than older applicants.

Within each of the two model development subsamples, logistic regression of the four scales on the service completion criterion resulted in equations with validity coefficients of .12 and .13 (i.e., point-biserial correlations between predicted criterion values and the bivariate criterion). Applying each equation to the other group's criterion outcomes, the cross-validity coefficients were .13 and .12, respectively ($p < .001$). In the total sample, the correlation between the two predicted outcomes that resulted from the independent equations was .98. Employing the total Model-2 sample, the final parameter estimates for the logistic regression model are shown in Table 4.

Table 4

Logistic Regression Model of 2-Year Service Completion

	Parameter Estimates		
Variable	b	SE_b	β
Years of Education	3.266	.002	.599
Age	2.843	.002	.392
Armed Forces Qualification Test	3.132	.003	.331
Education Credential	2.764	.003	.249
(Constant)	-6.822	.002	

Note. $N = 25,199$.

Table 5 presents the logistic regression model (i.e., CSM) as an array of probability estimates of completing the first 2 years of enlistment for each combination of predictor attributes. The lowest predicted outcome (49%) is for applicants who have no secondary education credential, completed 9 or fewer years of education, scored in the lowest B Cell AFQT mental group category, and are 17 or 18 years of age. The group most likely to complete 2 years of service are those who possess an occupational training certificate, have completed 12 or more years of school, scored in the highest AFQT category, and are 19 years of age or older.

The institutional expectancies of utilizing the CSM for personnel selection are shown in Table 6 for those dropouts ($N = 20,980$) who will be targeted for operational screening (i.e., all dropouts except adult education and one-semester of college educational groups). Improvements in true positives (percent completing service among personnel scoring at or above the cut score) that are expected to result from CSM screening are constrained by the modest predictive validity of the instrument ($r_{pbis} = .13$). At a selection ratio of 1 eligible for every 3 applicants, the expected true positive rate for enlistment completion is 66.2%, an increase of 6.4 percentage points over baseline (59.8% of the total sample completed the first 2 years of service). False negative rates (percent of personnel scoring below the cut score who were successful) were generally about 10 percentage points below the true positive rates for the total sample.

Table 5

Compensatory Screening Model for Non-High School Diploma Graduates: Estimated Percentages of 2-Year Service Completion

Education Credential	Age	Education Years Attended: 9 years or fewer, AFQT Category: IIIA	II	I	10 years, AFQT Category: IIIA	II	I	11 years, AFQT Category: IIIA	II	I	12 years or more, AFQT Category: IIIA	II	I
Occupational Certificate	17-18	61	64	70	66	69	74	69	72	77	72	75	80
	≥19	66	69	74	70	73	78	73	76	80	76	79	83
High School Certificate of Attendance or Completion	17-18	56	59	65	61	64	70	64	67	73	68	71	76
	≥19	61	64	70	65	69	74	68	72	77	72	75	80
Home School Diploma	17-18	55	58	65	60	63	69	63	66	72	67	70	75
	≥19	60	63	69	65	68	73	68	71	76	71	74	79
Adult Education Diploma	17-18	54	57	63	59	62	68	62	65	71	66	69	74
	≥19	59	62	68	63	67	72	67	70	75	70	73	78
One Semester of College	17-18	53	57	63	58	62	68	62	65	71	66	69	74
	≥19	59	62	68	63	67	72	66	70	75	70	73	78
Test Equivalency Diploma	17-18	51	54	61	56	59	65	59	62	68	63	66	72
	≥19	56	59	66	61	64	70	64	67	73	68	71	76
Correspondence School Diploma	17-18	50	53	60	55	58	64	58	62	68	62	66	71
	≥19	55	58	65	60	63	69	63	66	72	67	70	75
No Credential	17-18	49	53	59	54	58	64	58	61	67	62	65	71
	≥19	54	58	64	59	63	69	63	66	72	67	70	75

Table 6

Expectancies of Compensatory Screening Model (CSM)

CSM Cut Score	Group								
	Total (N = 20,980)			Hispanic (N = 3,202)			African-American (N = 2,068)		
	Selection Ratio	False Negatives	True Positives	Selection Ratio	False Negatives	True Positives	Selection Ratio	False Negatives	True Positives
49	100.0	--	59.8	100.0	--	62.4	100.0	--	59.1
50	94.5	50.0	60.4	94.4	55.6	62.8	95.9	52.9	59.4
51	94.5	50.0	60.4	94.4	55.6	62.8	95.9	52.9	59.4
53	91.3	50.3	60.7	91.0	55.4	63.1	92.5	50.6	59.8
54	88.9	50.3	61.0	88.7	55.4	63.3	91.2	51.9	59.8
55	70.1	51.5	62.2	77.9	56.2	64.2	82.4	50.4	61.0
56	70.1	51.5	62.1	77.9	56.2	64.2	82.4	50.4	61.0
57	69.7	52.7	62.9	67.3	57.5	64.8	72.0	52.3	61.8
58	69.7	52.7	62.9	67.3	57.5	64.8	72.0	52.3	61.8
59	58.0	54.1	63.9	57.3	58.4	65.4	61.3	54.3	62.2
60	48.4	55.1	64.9	47.2	58.8	66.4	51.2	55.4	62.8
61	48.4	55.1	64.9	47.2	58.8	66.4	51.2	55.4	62.8
62	36.7	56.3	65.9	35.8	59.4	67.7	38.8	57.0	62.6
63	34.2	56.5	66.2	33.4	59.5	68.1	37.0	57.6	61.8
64	28.2	57.0	66.9	28.2	59.8	69.0	30.1	57.8	62.2
65	16.4	58.2	68.0	14.8	60.9	70.9	15.7	59.0	60.0
66	16.1	58.3	67.9	14.6	60.9	71.1	15.5	59.0	60.1
67	11.9	58.7	68.1	10.8	61.2	72.1	11.6	58.8	62.1
68	5.2	59.2	70.3	4.1	62.0	72.3	5.9	58.5	69.1
69	3.3	59.4	71.7	2.4	62.1	75.3	2.7	58.7	74.6

Note. Excludes CSM scores $\geq$ 70. The false negatives and true positives are 2-year service completion rates below and at/above each CSM cut score, respectively.

Selection impacts and cut-score hit rates were also evaluated for the Hispanic and African-American subsamples as shown in Table 6. Based on the scoring distribution of the African-American sample (N = 2,068), no adverse impact is expected. At a CSM cut-score of 63, for example, 34.2% of the total sample would have been eligible, while 37.0% of African-Americans would have been eligible. Compared to the total group, a slightly smaller proportion (33.4%) of Hispanics would have been eligible. This difference was not statistically significant at the .05 level.

At the same cut-score level, the true positive (correctly accepted) rate was higher for Hispanics (68.1%) than for the total group (66.2%), but significantly lower for African-Americans (61.8; $p < .001$). False negative (incorrectly rejected) rates were slightly higher for these minority groups. More generally, a moderated regression analysis (Pedhazur, 1982; Humphreys, 1986) found no significant differences in regression slopes between (1) African-Americans and non-African-Americans, and (2) Hispanics and non-Hispanics. Significant intercept differences, however, were found between the Hispanic and non-Hispanic groups. Point-biserial correlation coefficients between CSM scores and the service completion criterion were .08 ($p < .001$) and .10 ($p < .001$) for African-Americans and Hispanics, respectively.

At a total group selection ratio of 1 in 3, a comparison of predicted and observed completion rates showed that CSM underpredicted Hispanic service completion by 2.5 percentage points and overpredicted African-American service completion by 2.7 percentage points. During the period that the data were collected, female high school dropouts were largely excluded from enlistment; thus, the CSM was not evaluated for test fairness on the small female sample (N = 153).

Table 7 presents eligibility rates for non-high school diploma education groups if CSM had been used to screen FY88-91 applicants for enlistment. Among alternative credential holders, only 53% of GED applicants scored above the standard, while all of the occupational program diploma holders were eligible. Applicants with home school diplomas and high school certificates of attendance also demonstrated high rates of eligibility (91%).

Table 7

CSM Eligibility by Education:
FY88-91 Navy Non-High School Diploma Applicants

Credential	Education Group	Number of Applicants	Percent Eligible
	Tier II/III		
No Credential		15,657	31.1
Test Equivalency Diploma (GED)		18,121	52.8
Correspondence School Diploma		13	53.8
Home School Diploma		22	90.9
High School Certificate of Attendance		316	91.1
Occupational Program Diploma		106	100.0
	Tier I		
One Semester of College		3,476	89.3
Adult Education Diploma		2,281	93.6

Conclusions and Discussion

The enlistment survival comparisons of high school dropouts with diploma graduates generally support previous studies establishing the empirical basis for policies that minimize enlistment opportunities for nongraduates. However, attrition rates vary considerably among groups representing alternative secondary education programs and these rates are not entirely consistent with the DoD's empirically based three-tier classification of educational eligibility (see Appendix). Most notably, those Tier-2 nongraduate Navy accessions who earned a High School Certificate of Attendance are more likely to complete their enlistments than those Tier-1 applicants who possess an Adult Education Diploma. The same may be true for Occupational Program Diploma holders, but the small number in this education group precludes a reliable conclusion.

To diminish the reliance on possession of a high school diploma as the primary enlistment standard, the DoD has invested considerable resources into the development of alternative personnel assessment instruments. The results of this research have demonstrated potential improvements in the predictive validity of preemployment screening, while improving the enlistment opportunities for alternative secondary education group members (Trent & Laurence, 1993). In addition to educational achievement, biographical and temperament inventories, such as the Assessment of Background and Life Experiences (ABLE; White, Nord, Mael, & Young, 1993) and the Armed Services Applicant Profile (ASAP; Trent, 1993), measure a wide array of factors (e.g., delinquency, work experience, career orientation, emotional stability, social adaptation, and physical involvement). Yet, these applicant-reported data inventories have not been employed for military personnel screening at large because of the potential for applicant dissimulation, recruiter coaching, and test misnorming. However, the feasibility of a restricted utilization of these instruments for non-high school graduate applicants has not been specifically addressed at the technical or policy levels.

Concerns about the reliability of biographical self-reports directly resulted in the constrained predictor domain of the CSM for selecting nongraduate applicants to the Navy. As a result, the four objective and verifiable CSM factors should prove highly reliable, but at the expense of potential predictive validity. Indeed, only modest reductions in attrition are expected to result from CSM screening—approximately six percentage points during the first 2 years of enlistment. In addition, the Navy Recruiting Command has reported that CSM screening reduced attrition during the Delayed Entry Program (DEP) and reduced personnel replacement costs by $948 per Cell B billet. Replacement costs included recruiting, boot camp, and A School costs (Schmitz & Kannapel, 1994). Given the FY95 Cell B recruiting goal of 2,700, CSM screening will save approximately $2.56M per year. In addition to reducing attrition, CSM screening will significantly improve the educational achievement and vocational aptitude (AFQT scores) of Cell B recruits. Furthermore, these improvements in the quality characteristics of nongraduates will result in enhanced military job performance (Green, Wing, & Wigdor, 1988).

The FY94 Navy accession goal was accomplished in part by depleting the DEP reserve. Relatedly, the number of recruit contracts fell short of several consecutive monthly goals. In FY95 and beyond, improving private sector employment and a shrinking enlistment-age youth population will continue to challenge the recruiting mission. The recruitment of high aptitude nongraduates, approximately 5% of the FY95 accession goal of 53,000 enlisted personnel, will

continue to provide relief to Navy recruiters. In addition to selecting recruits with higher aptitude and educational achievement, use of the CSM as a secondary enlistment screen will result in a decrease in attrition-related turbulence in the fleet. At preenlistment screening, further improvements in attrition management could be realized by administering a biographical inventory such as ASAP or ABLE. Enlistment completion of Cell B personnel would also be improved by decreasing the proportion of General Detail (GENDET) shipboard assignments in favor of technical ratings.

Finally, the CSM achieves the objective of minimizing recruiter administrative procedures. The model that was utilized for initial operational testing (Folchi, Devlin, & Trent, 1993) required recruiters to complete application blanks and compute weighted eligibility scores. The use of an actuarial table based on the revised CSM greatly reduces the workload required of recruiters to process Cell B applicants for enlistment.

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Appendix A

Twenty-Four Month Attrition for FY 1988-1992 NPS Accessions by Education Credential and Service

Table A-1

Twenty-Four Month Attrition for FY 1988-1992 NPS Accessions by Education Credential and Service

	Service									
	Army		Navy		Marine Corps		Air Force		Total DoD	
Tier/Education Credential[a]	*N*	% Attrition	*N*	% Attrition	*N*	% Attrition	*N*	% Attrition	*N*	% Attrition
Tier 1										
High School Graduate[b]	383,208	23.0	320,306	22.6	147,244	23.3	174,983	17.7	1,025,741	22.0
College										
One Semester	7,804	37.3	5,686	36.6	1,491	35.4	1,094	14.7	16,075	35.3
2 Years or More	13,528	18.6	6,147	19.1	1,394	22.4	3,972	13.2	25,041	18.1
Adult Education	4,139	34.2	7,251	38.2	1,756	34.2	115	34.8	13,261	36.4
Tier 2										
High School Equivalency	15,360	39.6	12,124	41.5	1,841	44.5	1,191	30.2	30,516	40.3
Occupational Program Certificate	29	31.0	111	21.6	23	43.5	80	26.3	243	26.3
High School Certificate of Attendance or Completion	103	35.9	616	33.3	2,853	33.6	78	12.8	3,650	33.2
Correspondence School Diploma	19	36.9	10	20.0	119	42.9	4	0	152	39.5
Home School Diploma	19	36.9	21	42.9	40	35.0	173[c]	12.7	253	20.6
Tier 3										
Less Than High School Diploma	7,100	41.0	11,257	44.3	750	38.1	246	30.1	19,353	42.6
Total	**431,950**	**24.1**	**369,462**	**24.4**	**158,096**	**24.0**	**182,057**	**17.7**	**1,141,565**	**23.2**

[a]Codes A, M, S, 2, 3, 4, 5, 6, 9 and missing excluded ($N = 7,280$).

[b]Excludes old Code 2 for diploma graduate ($N = 3,799$).

[c]These Air Force recruits were erroneously classified as Home School graduates. Corrected data were not available at press time.

Source: Defense Manpower Data Center.

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