

Expanding the Recruiting Market: Noncognitive Testing

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U.S. Sailors participate in a revised yeoman and personnel specialists advanced administration course at the Center for Service Support learning site May 11, 2010, in San Diego. (U.S. Navy photo by Mass Communication Specialist 2nd Class Chelsea Kennedy/Released) Photographer's Name: MC2 Chelsea Kennedy. Date Shot: 5/11/2010

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Contents

Executive summary	1
Introduction and background	3
Noncognitive tests	4
Homeschooling	7
The National Guard Youth ChalleNGe program	11
The General Educational Development credential	12
Implications for recruiting.	12
Data and descriptive statistics	15
Description of the data.	15
AIM test-takers	16
AIM and attrition.	23
Regression results: AIM score and attrition.	28
Implications of using AIM to determine accession eligibility.	33
Conclusions	37
Appendix A: School choice in the United States	39
Magnet schools	39
Charter schools.	39
Private schools	40
Number of homeschooled students in the United States	40
Appendix B: Descriptive statistics and regression results	43
References	47
List of figures	51
List of tables	53

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Executive summary

The relationship between education credentials and first-term attrition rates in the military is well established. Enlistees who lack a traditional high school diploma have first-term attrition rates that are 40 to 50 percent higher than those of high school diploma graduates. Because of the strong relationship between education credentials and first-term performance, as well as the costs associated with recruiting and training, DoD limits the Services' admission of non-graduates to 10 percent of all recruits. The Services often set even lower limits.

Most who lack a traditional high school diploma have fairly high levels of cognitive skills; their poor performance is thought to result from a lack of noncognitive skills. (Noncognitive skills include “soft” skills, such as motivation and timeliness.) Based on the importance of noncognitive skills, the Army Research Institute (ARI) developed a noncognitive screen called the Assessment of Individual Motivation, or AIM. Enlistees holding a variety of education credentials take AIM as a part of their enlistment process.

In this research, we explore the relationships between AIM scores, other personal characteristics, and military performance. We emphasize the performance of homeschoolers in particular. We find that AIM scores have little relationship with education credential or AFQT score, suggesting that AIM is not simply an alternate measure of cognitive skills. Women score markedly lower than men on AIM. Differences by ethnicity, in contrast, are very small.

AIM scores seem to predict attrition for *some* recruits. In the case of GED-holders, those who score in the lowest quartile or decile on AIM have higher attrition than others. The evidence is weaker for traditional high school diploma graduates and dropouts in our sample, but AIM does seem to predict at least early-term attrition for traditional high school diploma graduates.

The case of homeschooled enlistees is more complicated. Among homeschoolers, those with lower AIM scores do have higher attrition but the differences are smaller than those found among some other groups. Also, in regression analyses, AIM has a small and statistically insignificant relationship to attrition. This suggests that other factors explain attrition differences among homeschoolers. Past research indicates that homeschoolers' performance is tied more strongly to AFQT scores than is the performance of others. Our results are consistent with these findings, suggesting that some homeschoolers' poor performance may be due to poor *cognitive* skills, which could be a result of homeschoolers' widely divergent educational experiences.

In summary, AIM offers the possibility of selecting those GED-holders who are most likely to succeed, but there is less evidence that the instrument will be helpful for those with other credentials.

Introduction and background

The relationship between education credentials and first-term attrition rates in the military is strong and long-standing. Nearly half of recruits who lack a traditional high school diploma fail to complete their first 36 months of service; the attrition rate of these recruits is 40 to 50 percent higher than the rate of high school diploma graduates. (See, for example, [1] and [2].) This attrition disrupts unit cohesion, complicates planning, and wastes recruiting and training resources. Therefore, DoD usually limits the Services to accessing no more than 10 percent of their enlistees from among those whose credentials are classified as Tier 2 or Tier 3, and the Services often set internal limits well below the 10-percent mark.¹

The exact pathway through which education credentials influence military performance is not well understood. Researchers believe, however, that obtaining an education credential—in particular, a traditional high school diploma—signals an ability to adapt to military life; some researchers refer specifically to the effect of “seat time” in explaining why those holding other credentials do not adapt as well ([3] and [4]). Alternate credentials, such as a GED certificate, usually require far less classroom instruction than a traditional high school diploma. Thus, many nongraduates lack cognitive skills as measured by the Armed Services Vocational Aptitude Battery (ASVAB)/Armed Forces Qualification Test (AFQT). Consistent with this, applicants with Tier 2 and 3 credentials are required to have higher minimum AFQT scores than applicants with Tier 1 credentials. Nonetheless, those with Tier 2 or 3 credentials attrite at much higher rates, and AFQT has relatively little explanatory power for this attrition. Based

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1. The tier system divides education credentials based on expected attrition rates of the credential’s holders. Tier 1 includes high school diplomas and other credentials considered equivalent, Tier 2 includes GEDs as well as occupational/vocational certificates, and Tier 3 includes those with no recognized credential (“dropouts”).

on this observation and the notion that a high school diploma signals “adaptability,” it is likely that the poor performance of non-high school diploma graduates results from a lack of noncognitive skills.²

Civilian researchers have begun to emphasize the role of noncognitive skills as well. Those who fail to complete high school often exhibit poor noncognitive skills, especially a lack of persistence [5]. Some authors (e.g., [5] and [6]) suggest that developing socially desirable noncognitive skills is a primary way that schools raise earnings of degree-holders. In general, GED-holders possess better cognitive skills but poorer noncognitive skills than dropouts; holding cognitive ability constant, civilian GED-holders earn less than dropouts [7].

Despite overall high attrition rates, many enlistees who lack a traditional high school diploma perform very well in the military. Although obtaining a high school diploma seems to serve as an indicator of noncognitive skills, there are likely to be better predictors. Measuring personality aspects that are associated with good military performance—in the same way that we measure cognitive skills with the AFQT—could be very helpful for selecting those who are most likely to perform well.

Noncognitive tests

The Army developed the Assessment of Background and Life Experience (ABLE) to measure the following aspects of personality related to motivation and attitude: Achievement, Adjustment, Agreeableness, Dependability, Leadership, and Physical Conditioning. These characteristics were originally included in ABLE because each predicts job performance [8]. Indeed, testing revealed that ABLE does predict attrition and performance, and that it does so independently of the ASVAB/AFQT. The particular personality aspects that ABLE measures are tied to motivation/effort. However, ABLE also was found to be fakable or coachable. In many cases, applicants could

2. Noncognitive skills include a number of traits, such as timeliness, motivation, and persistence.

determine the socially desirable answers [8]. (This problem is *not* unique to ABLE; it occurs with numerous noncognitive measures.)

Therefore, the Army Research Institute (ARI) set out to develop a measure of the same constructs, with the same predictive power of military performance, but with less susceptibility to faking. The Assessment of Individual Motivation (AIM) was the result. AIM measures the same personality aspects as ABLE, but it does so with an emphasis on behavioral questions. For each item, the test-taker is presented with four statements in a forced-choice format. In each case, the respondent chooses the statement that best describes his or her personality, as well as the statement that is least descriptive. Research indicates that AIM is resistant to faking (although not fake-proof) and that AIM predicts first-term attrition [9]. ARI's research indicates that those with AIM scores in the top 10 percent have attrition rates that are about half the rates of those with AIM scores in the bottom 10 percent. In addition, all who score above the mean on AIM have attrition rates substantively below the rates of those who score below the mean [8]. To date, AIM has not been found to have an adverse effect on women or minorities [8].

Although AIM was originally intended as an additional screen, recruiting conditions worsened dramatically during the period of development (the late 1990s). Therefore, the Army has used AIM primarily as a market expansion tool. Beginning in 2000, the GED Plus program allowed some recruits who lacked a Tier 1 credential to enlist with the same incentives as high school diploma graduates, conditional on achieving a sufficient score on AIM. From our perspective, this means that no applicant was denied entry into the military based solely on his or her AIM score. Rather, some applicants with Tier 2 education credentials were offered opportunities normally available only to those holding Tier 1 credentials.³

3. In the last few years, ARI has continued to expand its research in the area of noncognitive skills by developing the Tier Two Attrition Screen (TTAS). TTAS uses AIM, ASVAB subtest scores, and a measure of body mass index (BMI) to form a "whole person" measure (see [10]). TTAS has been found to predict job performance and attrition, especially for those who lack a high school degree (see [11], [12], and [13]).

AIM's primary operational focus is to allow some GED-holders opportunities that are usually reserved for those with Tier 1 credentials, but AIM also may be a useful screen for those holding credentials other than the GED. So, along with GED-holders, several other groups took AIM for research purposes during FY08 and FY09. In particular, homeschoolers and National Guard Youth ChalleNGe graduates took AIM as part of the enlistment process, as did a subsample of those holding Tier 1 credentials.⁴ Thus, we have AIM scores for a sample that includes those holding Tier 1, 2, and 3 credentials. We note that this research uses the AIM adaptability composite score. There are several AIM scores; this one correlates with adaptability to military life.

In this research, we explore the relationships of AIM scores, education credentials, and military performance. We investigate the possibility that AIM may predict military performance for those holding various education credentials, and we detail groups with exceptionally low or high AIM scores. We focus on homeschoolers because previous research has found that homeschoolers as a group have attrition rates higher than those of traditional high school diploma graduates (e.g., see [14]); however, homeschoolers who have above-average scores on the AFQT have substantially lower attrition rates than other homeschoolers. The lack of standardization inherent in homeschooling provides a potential explanation for this result. AFQT scores, in general, hold little predictive power over first-term attrition for other recruits.

Next, we provide a brief overview of the history of homeschooling and detail the level of regulation across states. We also discuss the ChalleNGe program and the history of the GED credential, as well as implications of changing education credentials for recruiting.

4. Homeschool diplomas are considered Tier 1 if holders also have above-average AFQT scores; ChalleNGe certificates are considered Tier 2. It is not clear whether the sample of AIM test-takers holding other Tier 1 credentials is random. The official instructions state that homeschoolers and those with Tier 2 credentials have priority for seating in each AIM session, while extra seats will be filled by those with Tier 1 credentials.

Homeschooling

Before the 1980s, homeschooling was not recognized as a legal form of education, and homeschooled students were considered to be truants. During the 1980s, homeschooling advocates worked to establish the legality of the practice. All 50 states and the District of Columbia (DC) passed laws legalizing homeschooling [15], but regulations vary substantially from state to state. In this subsection, we present estimates of the total number of homeschoolers, characterize state homeschooling laws, and place homeschooling within the broader context of school choice.

The number of homeschoolers must be estimated because there is no national governing body charged with keeping such records. The task is complicated by the fact that some states do not require homeschooling parents to notify authorities (making state-level records incomplete as well). Since homeschoolers make up a relatively small group, few such families are included in large, national surveys designed to measure educational trends. Finally, there is reason to believe that homeschooling families attempt to limit the amount of information available on homeschooled children as a way of avoiding potential regulation (see [15] and [16]). For all of these reasons, estimates of the number of homeschoolers vary widely. The most credible estimates imply that somewhat more than 2 percent of children, perhaps 1.5 million, are homeschooled at this time.⁵

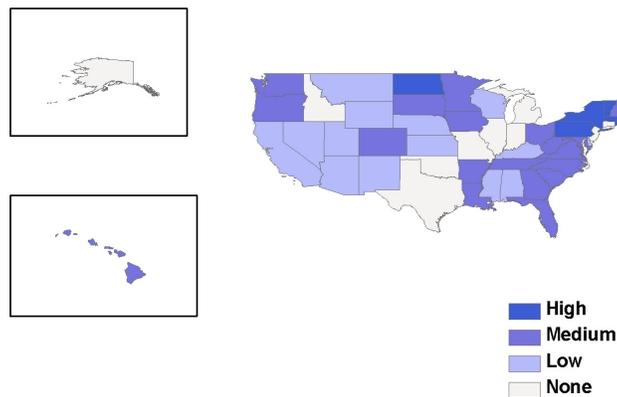
Homeschooled students experience many different methods and curricula; along with states' differing approaches to regulating homeschooling, this ensures that there is no common "homeschooling experience." From DoD's perspective, therefore, knowing that a potential enlistee was homeschooled reveals very little about that person's educational experiences or competencies. In this sense, a homeschooled diploma is the least standard of the common education credentials. This suggests that a noncognitive test has the potential to provide valuable information about homeschoolers in particular.

5. See appendix A for more details on this estimate and a description of school choice in the United States.

In some states, homeschoolers face virtually no regulations. In fact, in 10 states, homeschooling families face no requirements whatsoever on curriculum and are not even obligated to inform local or state educational agencies that they have chosen to homeschool.⁶ Another 15 states require only that parents notify education officials of their intent to homeschool. We consider these 25 states to have low levels of regulation. Nineteen states and DC require that parents notify officials and also present either test scores or some other evaluation of student progress; these states have moderate levels of regulation. Finally, six states require notification, test scores and/or evaluation, and have other requirements, such as curriculum specifics and home visits. We consider these states to have high levels of regulation. Figure 1 characterizes each state’s level of regulation.

Figure 1. Levels of homeschooling regulation vary across states^a

Level of Homeschooling Regulation in each State

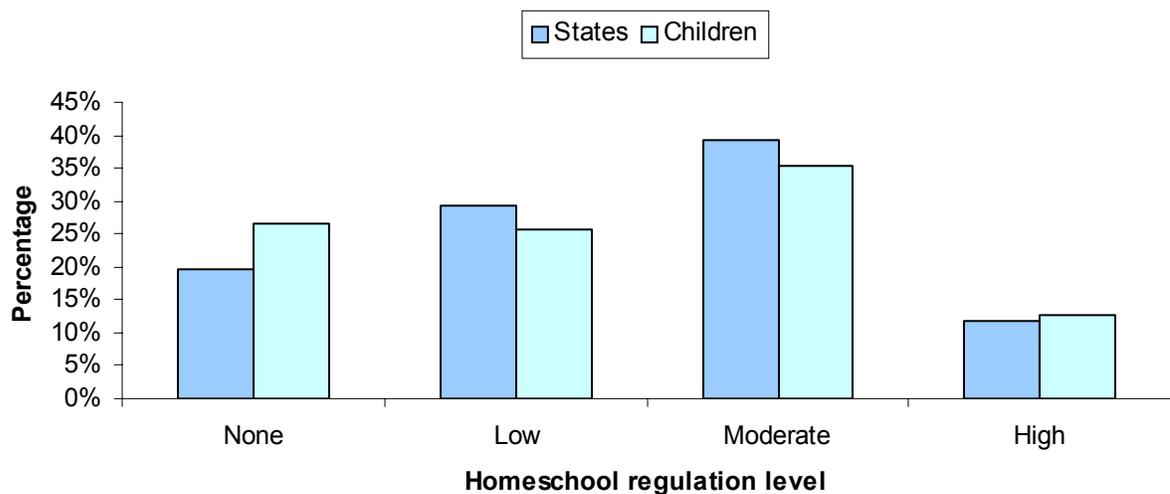


a. Source: Home School Legal Defense Association; www.hsllda.org.

6. We characterize state regulations based on information from the Home Schooling Legal Defense Association (HSLDA). See www.hsllda.org. We also use HSLDA’s distinctions between “low,” “moderate,” and “high” levels of homeschooling regulation.

Figure 2 shows the distributions of states and school-aged children, by level of regulation. States with no homeschooling regulations are larger than the average state; while 20 percent of states have no regulations, about 25 percent of school-aged children live in states that do not regulate homeschooling. The overall distribution is not sharply different from that suggested in figure 1: about half of children live in a state with zero or low levels of homeschooling regulations, whereas half live in states with moderate or high levels of regulation.

Figure 2. Distribution of states and school-aged children, by level of homeschool regulation^a



a. Based on information from the Home School Legal Defense Association (www.hslda.org), as well as *Digest of Education Statistics 2007*.

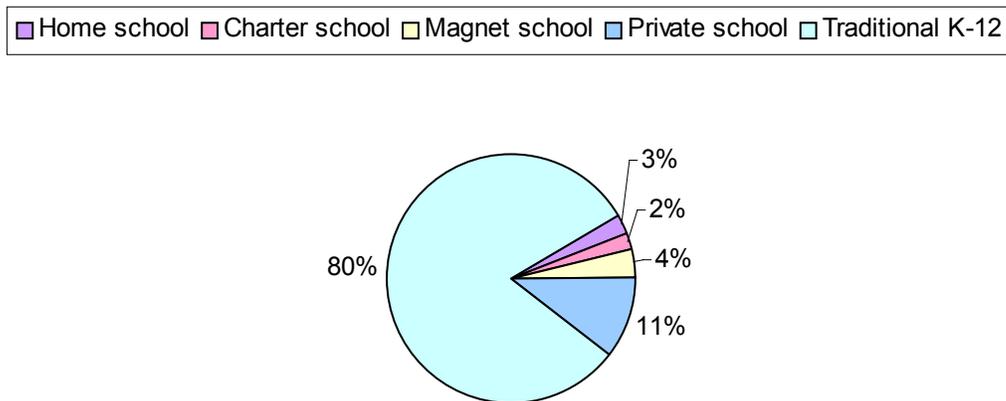
There is no established dataset that details changes in state homeschooling regulations over time, but CNA analysis from several years ago also used the HSLDA data on state laws. Comparing data from our earlier project with the information in figure 2 reveals that state-level homeschooling laws are fairly stable, or that most changes are too small to move a state from one level to another. To the extent that laws have changed in recent years, however, regulation levels have increased without exception. Although homeschooling underwent

rapid deregulation during past decades, the current trends are toward stable or incremental increases in the level of regulation.

Homeschooling is one of several educational movements designed to increase family choice in schools and the types of education available. The period since the legalization of homeschooling also has been characterized by substantial increases in the numbers of students attending magnet and charter schools, as well as several large-scale experiments with private school vouchers. (See appendix A.) Each of these programs has the potential to allow children to attend a school different from their “neighborhood” or assigned school.

Figure 3 summarizes the number of students in each type of school and indicates that the vast majority of students still attend traditional public schools. About 20 percent of students do not attend a traditional public school. Of these, the majority attend private schools, which enroll more students than all other forms of school choice combined and three to four times as many students as homeschools. The estimated homeschool population is slightly larger than the charter school population but smaller than the magnet school population and substantially smaller than the private school population.

Figure 3. Distribution of U.S. K–12 students, by type of school^a



a. Figures are the most recent available: traditional and private data are from *Digest of Education Statistics 2007*; magnet and charter data are from “Numbers and Types of Public Elementary and Secondary Schools From the Common Core of Data: School Year 2005-2006,” National Center for Education Statistics; the homeschooled population is estimated as described in appendix A.

The last 20 to 30 years can be characterized as a period of increasing school choice. Today, students may attend magnet or charter schools without leaving the public school universe, they may be home-schooled, or they may attend private schools. Finally, an increasing number of high school students in public schools, private schools, and homeschooled are enrolled in online courses. From DoD's perspective, these changes represent an increase in the variation in enlistees' schooling experiences. (DoD's education credentials do not distinguish between most types of public and private schooling; homeschooling is the exception.)

While homeschooled recruits are the focus of this research, recruits with other credentials also took AIM during the study period. Next, we provide some background on other common credentials among AIM test-takers.

The National Guard Youth ChalleNGe program

The ChalleNGe program, operated jointly by the states and the state National Guard units with federal funding, targets at-risk youth between the ages of 16 and 18. ChalleNGe is a residential program that lasts 22 weeks. It includes classroom instruction on both academic and life-skill subjects; the academic focus of the program is designed to help cadets attain a GED credential. The program also features leadership opportunities and emphasizes the development of short- and long-term goals. Although the ChalleNGe program has grown rapidly, it is still relatively small; the combined sites produce about 7,000 to 8,000 graduates per year. ChalleNGe graduates, however, have high propensities to enlist.

Past analysis has shown that ChalleNGe graduates who enlist have very low attrition rates over the first year of their terms, but rates go up somewhat in the next 2 years (compared with other enlistees). Also, attrition rates of ChalleNGe graduates have trended downward during recent years. ChalleNGe cadets have low standardized test scores, suggesting weak cognitive skills [17], yet the program has a strong emphasis on the formation of noncognitive skills. Therefore, we expect ChalleNGe graduates to score relatively well on AIM.

The General Educational Development credential

The GED program began during World War II as a route to certification for the many returning veterans who had not completed high school prior to enlistment.⁷ Such certification allowed those veterans who had the necessary skills to take advantage of the GI Bill and enter college without first returning to high school. In the next few years, states began to allow nonveterans to take the test; by 1959, civilian test-takers outnumbered veteran test-takers. During the late 1960s, GED preparation programs began to receive substantial government funds, and the number taking the GED exam grew rapidly. Today, the GED has become an important credential for those who do not complete a traditional high school course of study. (The GED is the most common alternate credential among enlisted Servicemembers, as well as among all Americans.)

Although many people who receive GEDs consider themselves high school graduates,⁸ substantial research indicates that a GED is *not* equivalent to a traditional high school diploma. In particular, young GED-holders have been found to work less, earn less per hour, and have higher job turnover than otherwise similar high school diploma graduates.⁹ Some research suggests that GED-holders specifically lack noncognitive skills ([5] and [7]). For this reason, we expect that GED-holders may score lower than others on AIM, and that AIM may be particularly predictive of this group's military performance.

Implications for recruiting

Education credentials are likely to remain an important predictor of first-term attrition. Recent educational reforms, however, have increased the types of schools available to students. Although the vast

-
7. For more background on the GED, see [18] or [19].
 8. This viewpoint is encouraged by the GED Testing Service, the group that develops, oversees, and collects information on the GED tests.
 9. The seminal research is [20]; more recent research has repeatedly confirmed those findings. DoD classifies the GED as Tier 2, based on the historically high attrition rates of those who enlist with the credential.

majority of students still attend traditional public schools, students today may attend several different types of schools over the course of a K–12 education; a student might spend a few years in a private school, then shift to public school, and perhaps at some point attend a magnet or charter school. Students also may move back and forth between homeschools and other types of schools. This type of movement is likely to continue, particularly for students who live in areas with many schooling options. Finally, the education some students receive at any one time may be a blend. For example, students may be primarily homeschooled but may take a course or two at a nearby public school, or they may be enrolled in a private school but take some courses in a virtual (i.e., online) school.

From the military’s perspective, a student’s education credential is determined by the last school attended. In general, a student attending each type of school in figure 3, with the exception of a homeschool, would be characterized as a regular (traditional) high school diploma graduate. A student who is homeschooled for the first years of school but who attends and graduates from a traditional high school “looks like” a regular high school diploma graduate; a homeschooled student or a GED-holder who attends a community college is coded as having “some college.” Thus, any performance differences that we are able to measure based on DoD-coded education credentials are likely to understate the true differences.

The GED credential remains quite consistent; all GED-holders take exactly the same test. Over the last 10 to 15 years, the number of students who receive a GED rather than a traditional high school diploma has increased. This trend, which often is not evident in national education statistics, is troubling from DoD’s perspective. The most careful estimates indicate that currently, about one-quarter of students (500,000 or so) leave high school without a diploma [21]. Conservatively, at least 150,000 young people receive a GED each year [22]. Of the students who complete high school, nearly two-thirds enroll in college [23, table 191]. Thus, the traditional recruiting market, which includes those who completed high school but do not attend college immediately, is smaller than in the past; today about one-quarter of all students fall in this category. The group without a high school diploma is roughly the same size, but no more than 10

percent of enlistees may be nongraduates. This is likely to prove problematic for recruiting in the future.

We next present our empirical results; we examine the performance of enlistees who took AIM during FY08 and FY09. We continue to focus on homeschoolers but also examine nongraduates based on AIM's potential to measure noncognitive skills and the evidence that those who lack a high school diploma also lack noncognitive skills.

Data and descriptive statistics

Description of the data

To undertake this research, we first requested and received data on all applicants who took AIM in FY08 and FY09. We matched these data to the Defense Manpower Data Center (DMDC) active-duty accession files, producing a dataset that includes a variety of information on all accessions who took AIM. In particular, DMDC added a variable indicating whether the Servicemember completed the first months of service.¹⁰

We have differing amounts of performance data on those who accessed at different times.¹¹ However, we observe at least 6 months of service for *all* accessions; thus, we focus on early-term performance and comment on longer-term performance where appropriate.

Over 67,000 potential recruits took AIM during FY08 and FY09. Not all who took AIM enlisted, and we have no performance measures on those who did not enlist.¹² In addition, some entered the Delayed

10. We thank Mr. Louie Pappamichiel at Military Entrance Processing Command (MEPCOM) for helping us to obtain AIM data and Ms. Marisa Michaels at DMDC for providing accession data and expertise.

11. When we first requested FY08 data, only 3 months of data were available. At our sponsors' request, we asked for and received more FY08 data and returned to request data on FY09 accessions. Thus, we requested data at several different points. At the end of the project, we had obtained data on FY08 accessions through September 2009 and on FY09 accessions through April 2010. Therefore, we have 9 to 21 months of information on FY08 accessions (depending on their date of accession) and 7 to 19 months of information on FY09 accessions. For this reason, we focus on 3- and 6-month attrition rates, which we have for all accessions, and supplement these with 12-month rates, which we have for some accessions.

12. Of those who did not enlist, some failed to meet the standards; others chose not to enlist or not to enlist in available specialties/occupations.

Entry Program (DEP) prior to enlistment; in some cases, we observe entry into DEP but not active-duty performance—either because of DEP attrition or because of remaining in DEP beyond the end of our sample period. These people are not in our sample. The majority of those who took AIM, however, did enlist during our sample period.

Among those who did enlist, nearly half joined the Guard or Reserves. Although those who entered the Guard/Reserves tended to resemble those who enlisted to active duty, they were more likely to be women and were slightly older. They were less likely than active-duty accessions to hold a GED and had somewhat lower AFQT scores. Finally, Guard/Reserve accessions had slightly lower AIM scores. The vast majority (over 80 percent) of homeschoolers who took AIM entered the active-duty forces, not the Guard/Reserves.

Because of the different structure of service in the Guard/Reserves, performance data between those on active duty and those in the Guard/Reserves are not directly comparable. Also, DMDC does not keep integrated performance files on guardsmen/reservists. For these reasons, from this point on, we focus our attention on those who enlist into the active component.¹³

AIM test-takers

Our sample includes 24,989 Servicemembers who took AIM before beginning active-duty service in either FY08 or FY09. The median AIM score is 52, whereas the mean is roughly 50.6; the standard deviation is about 10. (A higher AIM score indicates a higher level of motivation.) The distributions by year, and by Service, are very similar.

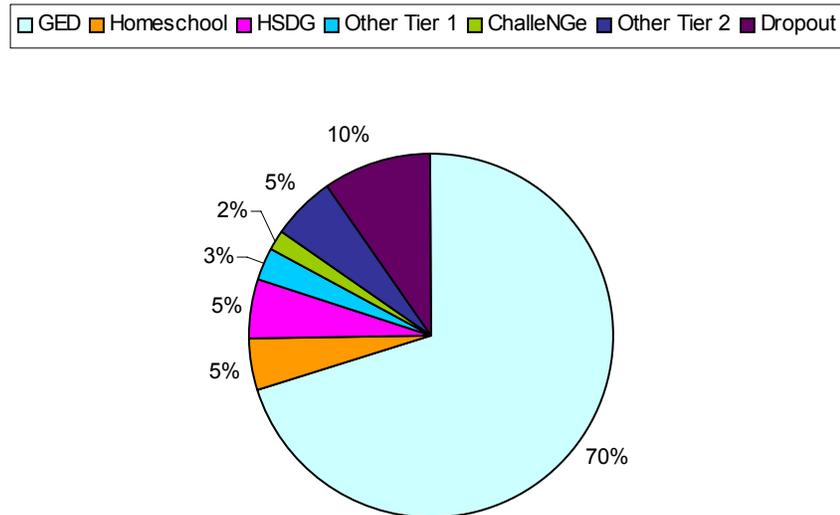
About 96 percent of our sample entered the Army. TTAS drives the large number of AIM test-takers who join the active-duty Army because all who are screened by TTAS take AIM; since TTAS is aimed at GED-holders, nearly three-quarters of the Army sample hold a GED. The rest is made up of homeschoolers (1,192), ChalleNGe participants (495), and Servicemembers with other education creden-

13. Specifically, our sample includes all non-prior-service (NPS) active-duty accessions with nonzero AFQT scores.

tials who took AIM on a time-available basis (5,818). Because all homeschoolers took AIM, only about half of the homeschoolers in our sample entered the Army; the rest entered another Service.

Figure 4 indicates the distribution of education credentials among AIM test-takers who enlisted in FY08 and FY09. As indicated earlier, the majority hold a GED and homeschoolers make up a small proportion of the sample. We carry out our analysis from this point forward with a focus on homeschoolers, but we also examine other AIM test-takers to compare performance across education credentials.¹⁴

Figure 4. Distribution of education credentials^a



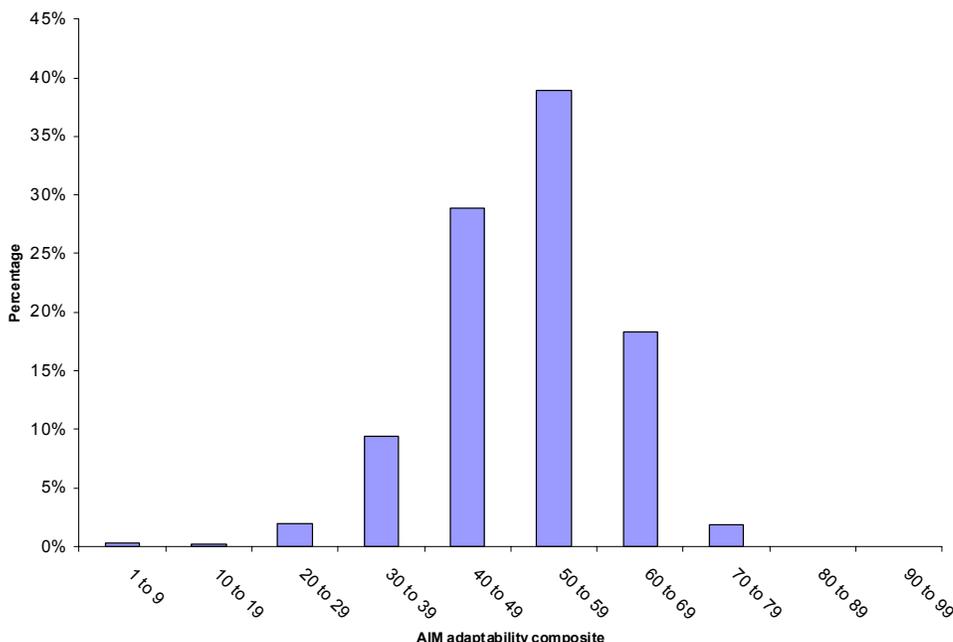
a. Distribution among NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

Next, we examine the distribution of AIM scores in our sample. Specifically, we want to know how AIM scores vary by gender, race/ethnicity, AFQT score, and education credential (see figures 5–9).

14. About 10 percent of the enlistees in our sample have records indicating they dropped out of high school. These enlistees are concentrated in the Army. During these years, the Army’s policy was to recruit very few or no dropouts. Our sponsor is working with DMDC to reconcile this information.

We present the scores by deciles. Note that about two-thirds of test-takers score between 40 and 59 on the test, an additional 10 percent score between 30 and 39, and 18 percent score between 60 and 69. No more than 10 percent of test-takers score below 30 or above 70, and we have no recorded scores above 80 (see figure 5).

Figure 5. Distribution of AIM scores, active-duty accessions, FY08–FY09^a

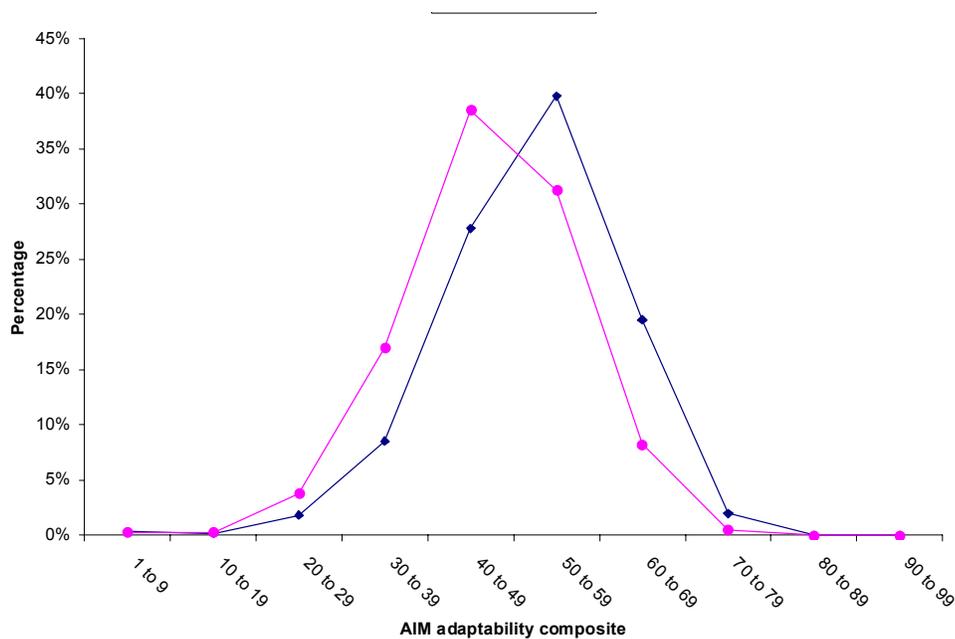


a. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

Figure 6 indicates that the distribution of scores varies between men and women. Women score lower on AIM, and the difference is substantial.¹⁵ This suggests that using AIM to screen *or* to expand opportunities for those with Tier 2 or 3 credentials will have different implications for women than for men.

15. On average, men score about 4.5 percentage points higher than women. A t-test reveals that this difference is statistically significant; such a difference would occur by chance less than 1 time in 10,000. When we use the term “statistically significant,” we generally mean that the result would be unlikely to occur by chance. A commonly accepted level of statistical significance is 5 percent, implying that the result would occur by chance no more than 1 time in 20. In many cases, such as the difference in AIM scores between men and women, our results imply a far lower probability than 1 in 20.

Figure 6. Distribution of AIM scores, men versus women^a



a. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

Figure 7 shows that the distribution of scores varies little by race/ethnicity. That said, the scores of Asian/Pacific Islanders (Asian/Pis) are slightly lower than the scores of other racial/ethnic groups.¹⁶

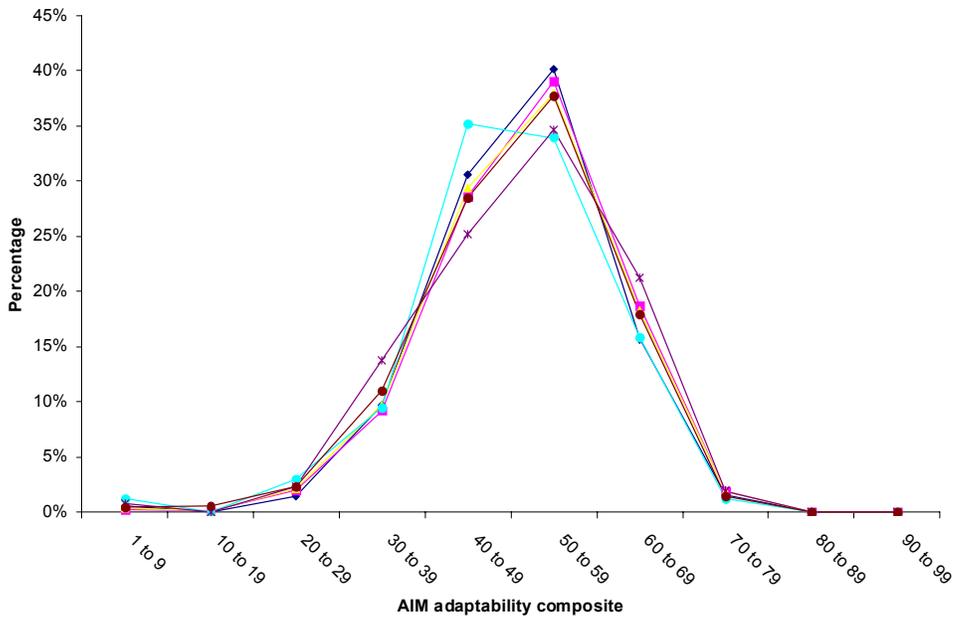
Figure 8 shows that most AIM scores are distributed similarly regardless of AFQT score.¹⁷ Those whose AFQT score is below 31 are the exception; in these cases, AIM scores tend to be lower than for other test-takers.¹⁸ This suggests that, for the vast majority of the sample, AIM may distinguish noncognitive characteristics. (In general, AIM is not strongly associated with AFQT score; thus, if AIM is associated with attrition, it may be measuring some noncognitive aspect.)

16. Mean scores of Asian/Pis are about 2 percentage points lower than scores of others in our dataset. A t-test reveals that this difference would be expected to occur by chance less than 1 time in 1,000.

17. Categories of AFQT scores follow: I, 90 to 99; II, 65 to 92; IIIA, 51 to 64; IIIB, 31 to 49; IV, 10 to 30. Entrance is sharply limited for Category IV prospective recruits; our sample includes only 68 people.

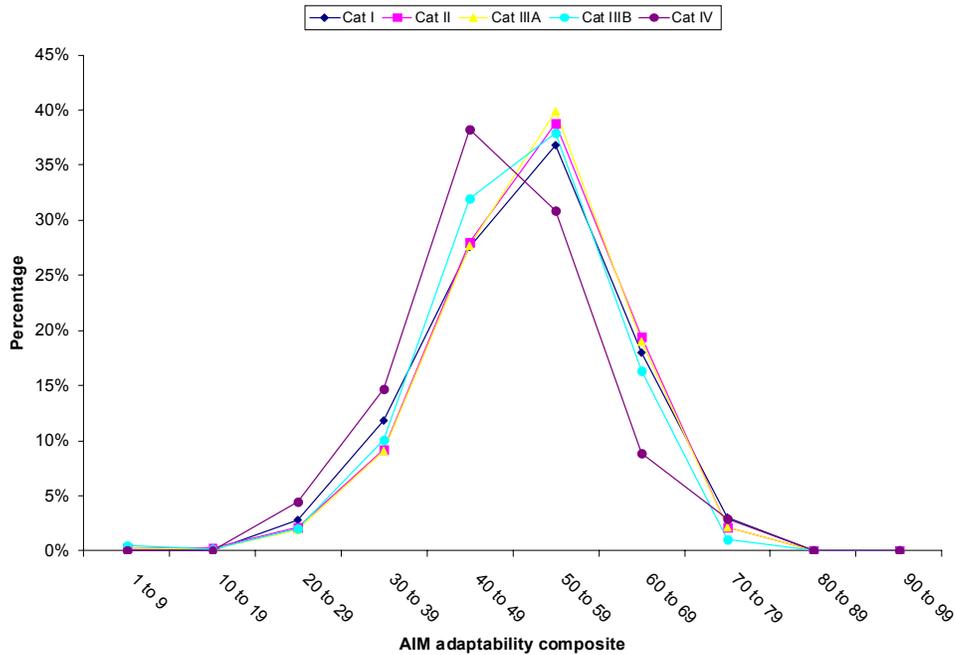
18. Those whose AFQT scores are in Category IV score about 3 percentage points lower than others on AIM. A t-test indicates that such a difference would occur by chance about 1 time in 100.

Figure 7. Distribution of AIM score by race/ethnicity^a



a. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

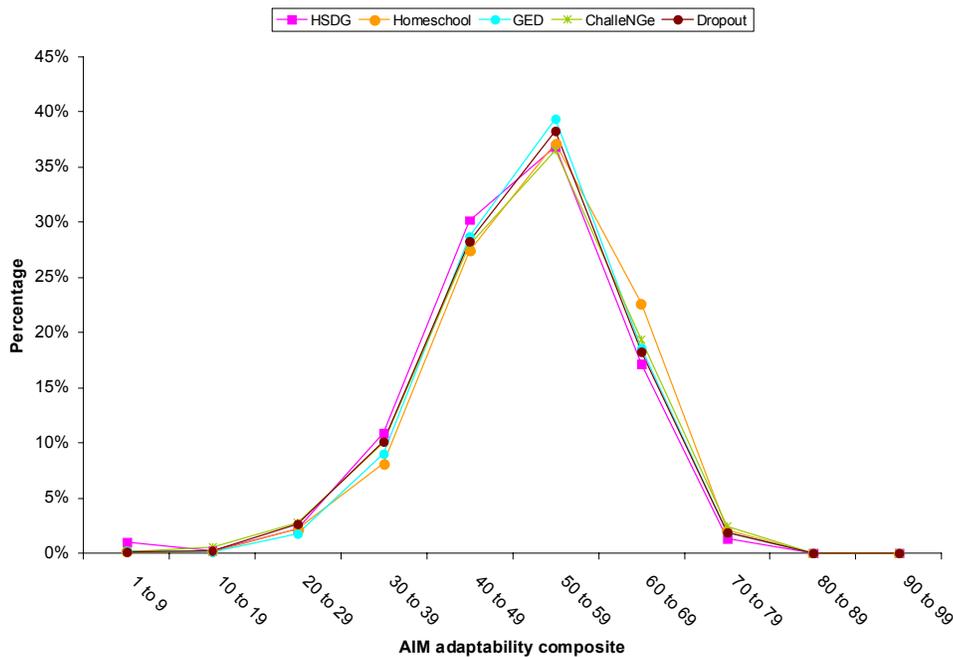
Figure 8. Distribution of AIM scores, by AFQT category^a



a. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

Figure 9 shows AIM score distributions by the most common education credentials in our sample. In general, AIM scores do not vary by education credential. Homeschoolers have slightly higher scores than others, but the differences are small.¹⁹ (We also examined the distribution of AIM scores by year; FY08 and FY09 scores were similar.) These small differences are surprising, given the findings from other research; in particular, GED-holders are often found to have weak noncognitive skills. It is possible that military recruiters select those with the strongest noncognitive skills, or that AIM does not measure the same set of noncognitive skills as other instruments.

Figure 9. Distribution of AIM scores, by education credential^a



a. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

Although AIM currently is used to increase opportunities for some holding Tier 2 or 3 credentials, the most likely future use is to screen

19. Homeschoolers have AIM scores that are, on average, less than 1 percentage point higher than scores of others in our sample. Such a difference would be expected to occur by chance about 4 times out of 100.

out applicants with a high attrition risk. In either case, we are interested in examining the group with the lowest AIM scores. AIM cutoff could be set at any level, but probable “cut scores” are at the 10th and 25th percentiles of the distribution of test-takers (see [8]). Therefore, we next describe the recruits who do *not* achieve these AIM scores, as well as their attrition rates.

Table 1 describes the sample by gender, race/ethnicity, and education credential, as well as those who score in the bottom decile and the bottom quartile among AIM test-takers.²⁰

Table 1. Descriptive statistics by AIM score^a

	Full sample	Lowest quartile	Lowest decile
Male	89%	83%	81%
Female	11%	17%	19%
White (non-Hispanic)	73%	72%	71%
Black	9.4%	9.7%	9.3%
Hispanic	9.6%	9.6%	9.8%
Asian/Pacific Islander	1.3%	1.7%	1.5%
American Indian	1.0%	1.1%	1.4%
Other/unknown	5.6%	6.3%	6.7%
High school graduate	5.4%	6.0%	6.4%
Some college	0.12%	0.20%	0.21%
Homeschool	4.8%	4.5%	4.3%
Other Tier 1	2.7%	3.2%	3.4%
GED	70%	68%	67%
ChalleNGe	2.0%	2.1%	2.2%
Other Tier 2	5.0%	5.7%	5.9%
Dropout	9.9%	10%	9.8%
<i>AFQT score</i>	<i>58.8</i>	<i>58.2</i>	<i>58.2</i>
<i>AIM score</i>	<i>50.6</i>	<i>37.9</i>	<i>32.2</i>
N	24,989	6,592	2,807

a. NPS active duty accessions who took AIM, FY08–FY09 (N = 24,989).

20. Because AIM is scored in discrete values, the lowest decile (quartile) does not include exactly 10 (25) percent of the sample. Table 3 in appendix B has more detailed descriptive statistics of the entire sample.

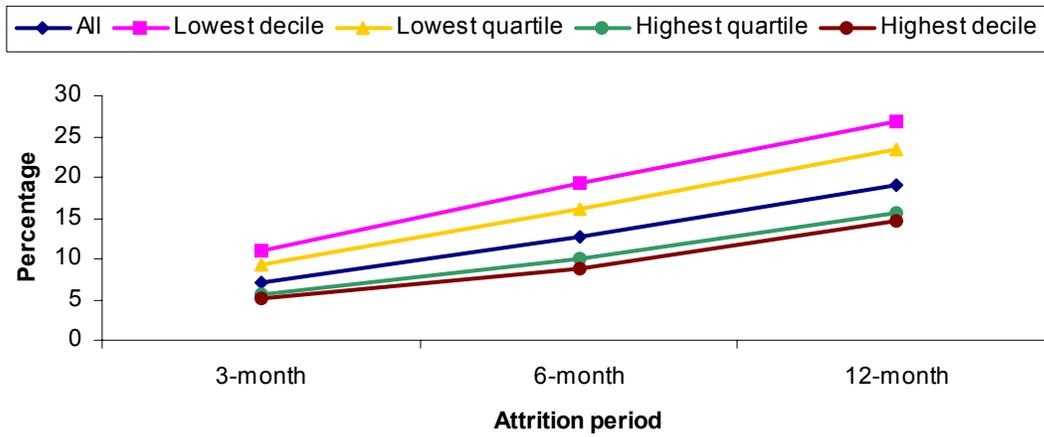
Non-Hispanic whites are slightly less likely than others to have low AIM scores. Consistent with figure 9, there is no clear relationship between education and AIM, although high school graduates are slightly overrepresented among those with low AIM scores and home-schoolers are slightly underrepresented. The clearest pattern is that, as suggested by figure 6, women make up a disproportionate number of those with low AIM scores. However, based on the similarity in education credentials and AFQT scores between those with high versus low AIM scores, table 1 suggests that AIM measures something other than education credential or cognitive ability.

AIM and attrition

Here, we examine the relationship between AIM scores and attrition. Figure 10 shows that those Servicemembers with the lowest AIM scores have, on average, the highest attrition rates. The difference appears within the first 3 months (the period when Servicemembers are attending and then completing bootcamp and moving into the next phase of training). However, the difference between those with high and low AIM scores is not limited to the first 3 months of service; the difference increases between 3 and 6 months and remains fairly stable over the next 6 months. Differences by AIM score are substantial; by 12 months, those who score in the top quartile have attrition rates that are about one-third lower than the rates of those scoring in the bottom quartile. This suggests that AIM has the potential to predict attrition. Of course, figure 10 does not account for other characteristics, such as education and gender.

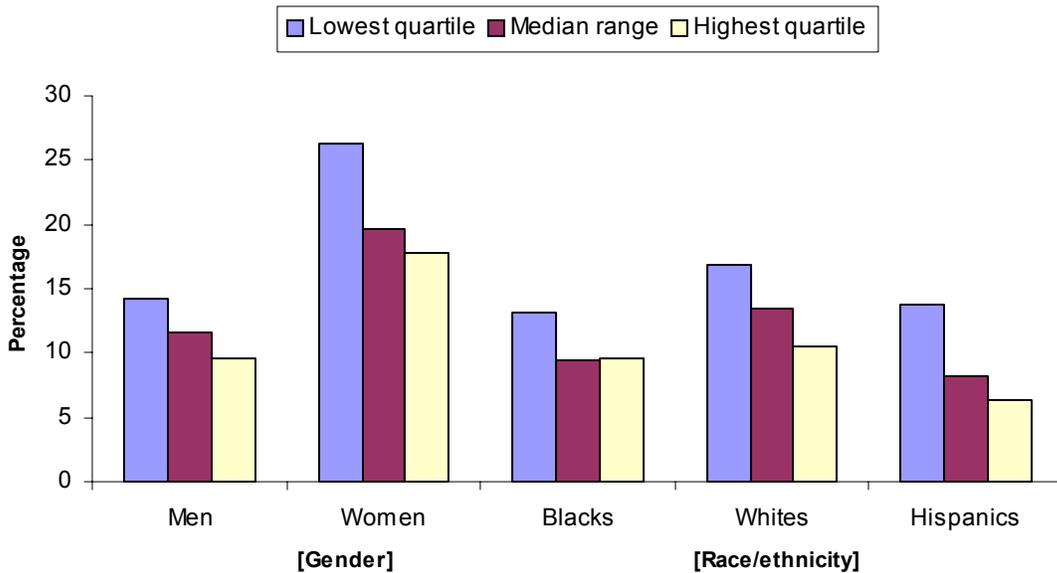
Next, we present more detailed descriptive statistics indicating how attrition varies by a combination of AIM score and gender, race/ethnicity, education credential, or AFQT score. In each case, we present 6-month attrition rates, but the reported patterns hold for 3-month and 12-month rates as well. Figure 11 shows that the relationship between AIM score and attrition generally holds, but is more pronounced in some cases. In each case, however, those with the lowest AIM scores have the highest attrition rates. (Note that figure 11 does not include Asian/PIs, American Indians, or those of other/unknown race/ethnicity because of small sample sizes.)

Figure 10. First-term attrition rates, by AIM score^a



a. Includes FY08 and FY09 data on NPS active-duty accessions who took AIM. Not all FY09 enlistees have completed 12 months of service, but this is not driving our results; the pattern holds when we include only FY08 enlistees.

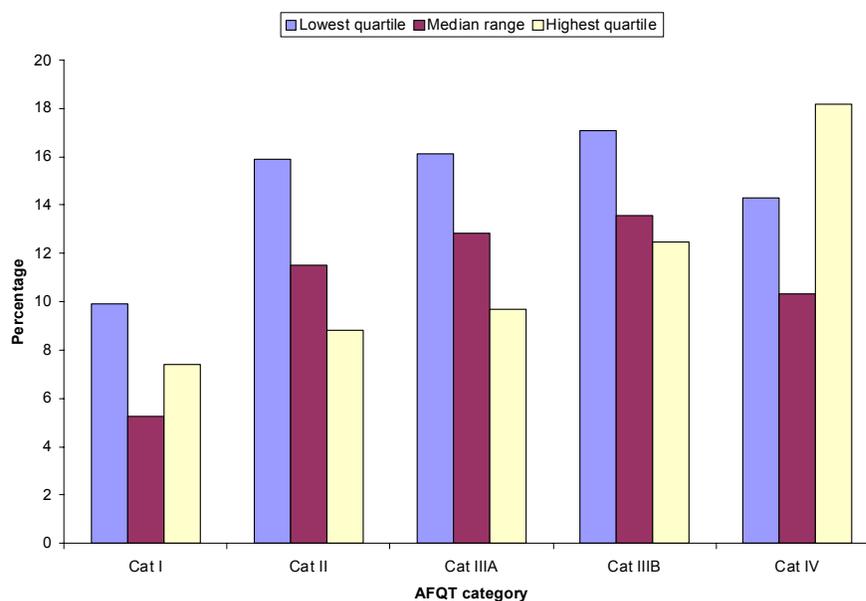
Figure 11. Six-month attrition rates by AIM score and personal characteristics^a



a. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

Figure 12 shows the relationship between AIM score and attrition by AFQT score. Figure 12 suggests that, for the vast majority of accessions (those scoring between 31 and 65, in Categories II, IIIA, and IIIB) the relationship between AIM score and attrition is linear, and those with the lowest scores have the highest attrition rates. The relationship is less clear among those with very low or very high AFQT scores, but these represent fairly small samples.

Figure 12. Six-month attrition rates by AIM score and AFQT score^a

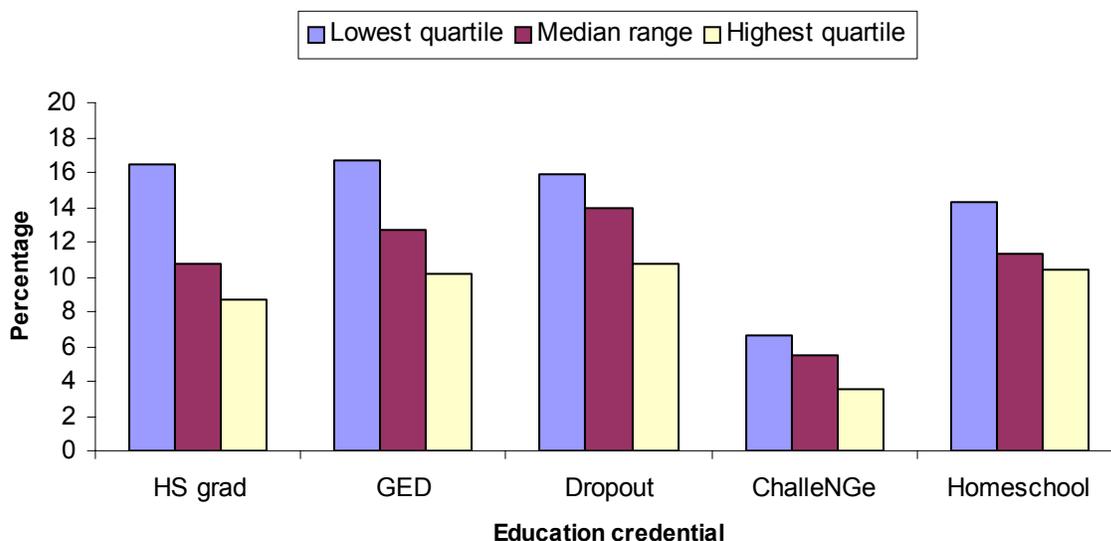


a. Score ranges of AFQT categories: Cat. I, 93 to 99; Cat. II, 65 to 92; Cat. IIIA, 50 to 64; Cat. IIIB, 31 to 49; and Cat. IV, 10 to 30. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

Finally, figure 13 shows the same statistics for the most common education credentials in our sample. For each group, those with the lowest AIM scores have the highest attrition rates. However, the differences across AIM scores are larger for some groups than for others. For example, the difference in attrition rates between those in the lowest quartile versus those in the median range is 5 to 6 percentage points for high school graduates and GED-holders, about

3 percentage points for dropouts and homeschoolers, and about 1 percentage point for ChalleNGe enlistees.^{21 22}

Figure 13. AIM scores and 6-month attrition rates, by education credentials^a



a. .NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

Because the relationship of education credential, AIM score, and attrition is the central focus of our research, we test the differences in figure 13 more stringently. To do this, we calculate the correlation between 6-month attrition rates and AIM score by education credential. We find that AIM score is significantly correlated with 6-month attrition for high school graduates, GED-holders, and dropouts. For

21. ChalleNGe graduates' attrition rates, especially early-term rates, have been trending downward for several years; see [17].
22. Three- and 12-month attrition rates for ChalleNGe graduates have no obvious relationship to AIM scores. Three- and 12-month attrition rates for homeschoolers have a weak relationship to AIM scores, similar to that shown in figure 13.

homeschoolers, the relationship fails to achieve statistical significance; for ChalleNGe enlistees, the relationship is smaller than for other groups and again fails to achieve statistical significance.²³

To summarize, our descriptive statistics indicate that AIM scores do differ by personal characteristics. In particular, scores are distributed differently between men and women, and there are slight differences across racial/ethnic groups. Distributions are similar across most education credentials (homeschoolers have only slightly higher scores than others). For the vast majority of accessions, AIM scores differ little by AFQT scores. This last fact suggests that AIM scores may measure noncognitive skills.

Across the sample, AIM scores are related to early-term attrition. In particular, those who score in the lowest AIM quartile have attrition rates that are substantially higher than others. However, the relationship between AIM score and attrition is stronger for some groups than for others. In the case of homeschoolers, those with the lowest AIM scores have higher attrition than others at the 6- and 12-month points, but the relationship between AIM score and attrition is not as well defined as for some other groups. Among ChalleNGe graduates, AIM scores seem only weakly related to attrition. Thus, our descriptive statistics suggest that AIM scores *may* be more predictive of attrition for some groups than for others. Next, we use regression analysis to separate the effects of gender, race/ethnicity, education credential, AFQT score, and AIM score on early-term attrition.

23. AIM score and 6-month attrition correlations, by education credential, follow: High school graduates: -0.11 (0.000); GED-holders: -0.09 (0.000); Dropouts: -0.07 (0.006); ChalleNGe enlistees: -0.05 (0.11); Homeschoolers: -0.08 (0.07). In each case, the correlation is negative, meaning that those with higher AIM scores have lower attrition, but the relationship achieves statistical significance only for high school graduates, GED-holders, and dropouts. In the case of ChalleNGe enlistees, there is a 1-in-9 probability that such a relationship could occur by chance; in the case of homeschoolers, the probability is about 1 in 14. We also tested the relationship between 6-month attrition and scoring in the bottom quartile of AIM; results were consistent with those reported above.

Regression results: AIM score and attrition

Regression analysis allows us to separate the effects of AIM on attrition from the effects of other characteristics. Consider the effect of age; some research finds that older recruits perform better in the military, but older recruits also may perform better on AIM. In this case, regression analysis allows us to parse the relationship between age, AIM score, and attrition.

In our regression models, we seek to explain early-term attrition (attrition is our dependent variable). We include personal characteristics previously found to be linked to attrition, such as gender, race/ethnicity, age, fiscal year, marital status, and body mass index (BMI), as well as education credential, AFQT category, and Service. We run separate regressions for 3-, 6-, and 12-month attrition.^{24 25}

Figure 14 shows some of the predicted probabilities from our basic regression models (complete results are in table 4 of appendix B). The broken horizontal lines indicate average attrition rates for male GED-holders with average AIM scores; these lines are for comparison purposes.

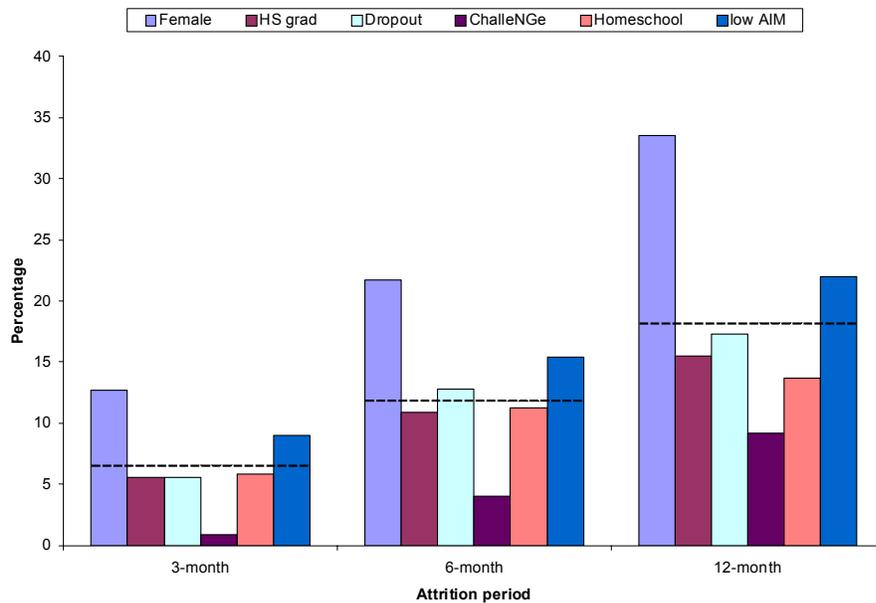
Figure 14 demonstrates that the effect of having an AIM score in the bottom quartile (i.e., a low AIM score) increases attrition, but by a relatively small amount. Specifically, those with AIM scores in the bottom quartile have higher attrition than others, but the difference is much smaller than the difference between ChalleNge graduates and GED-holders and also much smaller than the difference between

24. Attrition is a dichotomous variable (it occurs or it does not). In such cases, linear regression models yield incorrect results, so we use a logit (logistic) model. The relationship between the estimated coefficients in a logit model and the marginal effects is nonlinear, so coefficients are not indicative of the size of marginal effects. Figure 14 presents predicted probabilities; complete regression results are in appendix B.

25. BMI is defined as a person's weight in kilograms divided by the square of his or her height in meters. The Services use such measures of height and weight as a screen during enlistment. A BMI of 18.5 to 24.9 is considered normal, while a BMI of 25 to 29.9 is "overweight," a BMI of 30 or more is "obese," and a BMI of less than 18.5 is "underweight."

men and women. Thus, the blue bars at the right end of each group are similar in height to the broken lines, whereas the purple-blue bars at the left end (women’s attrition rates) are much taller and the dark maroon bars in the middle (ChalleNGe graduates) are much shorter. The figure also shows that in our sample, regression-adjusted attrition rates of high school graduates, dropouts, and homeschoolers who took AIM are roughly comparable.²⁶

Figure 14. Marginal effects from regressions explaining early-term attrition of AIM test-takers^a



a. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989). Complete regression results appear in appendix B. Dashed lines indicate average attrition rates of male GED-holders with median AIM scores.

Next, we utilize a more detailed regression model to focus on homeschoolers, with a goal of determining the regression-adjusted rela-

26. The comparable performance of dropouts and high school graduates stands in contrast with most other research on first-term attrition. This suggests that our sample of recruits with Tier 1 education credentials who took the AIM is not random.

tionship between AIM scores and homeschoolers' attrition rates.²⁷ Our regression results (presented in table 5, appendix B) indicate that *GED-holders* with AIM scores in the lowest quartile consistently have higher attrition than other GED-holders. High school diploma graduates with AIM scores in the lowest quartile have higher attrition rates than other high school diploma graduates at the 3- and 6-month points, but the difference is smaller and insignificant by 12 months. For other groups in our dataset, the results are less clear. Our results suggest that dropouts and homeschoolers with low AIM scores also *may* have higher attrition than otherwise similar enlistees with average AIM scores, but the results are not statistically significant and the effects are smaller than those observed for GED-holders and high school diploma graduates. In the case of ChalleNGe graduates, our estimated effects were even smaller, always insignificant, and sometimes not in the expected direction. Finally, we estimated a more parsimonious version of our regression on homeschoolers alone; again, our results were not statistically significant, and the estimated effects were smaller than those found for GED-holders or high school diploma graduates.

Based on all of our results, descriptive statistics as well as regression models, we find limited evidence that AIM scores can be used to predict the attrition behavior of homeschooled recruits. Although homeschoolers with the lowest AIM scores do have higher attrition than other homeschoolers, our regression results suggest that other factors may explain this. However, evidence suggests that the test is *more* likely to be effective for GED-holders than for homeschoolers (or ChalleNGe graduates).

Because of the different distribution of AIM scores between men and women, we tested the idea that AIM may predict attrition differently for men and women. In our models looking at 3- and 6-month attrition, there was some indication that men with low AIM scores had slightly lower attrition rates than women with low AIM scores, but

27. This model includes interactions between education credentials and low AIM scores; in this manner, we can determine whether the effect of having a low AIM score varies by education credential as our descriptive statistics suggest (refer back to figure 13).

there was no difference by 12 months and the earlier differences were quite small.²⁸ Overall, AIM had very similar predictive power for men and women.

AIM measures personality traits. If personality traits differ across people with different education credentials who apply to enlist, this could explain our findings that AIM seems to be more closely related to attrition behavior for those who hold GEDs than for those holding other credentials.

Of course, our samples of dropouts, ChalleNGe graduates, and homeschoolers are much smaller than our sample of GED-holders. We tested the idea that small sample sizes prevented us from discovering the relationship between AIM and performance in the course of this project (the original research plan included FY08 data only). Adding FY09 data increased the statistical power of our models with respect to high school graduates; given the estimated coefficients, however, it seems less likely that small samples are driving our results in the cases of homeschoolers and ChalleNGe graduates.

Past research indicates that AFQT scores may predict attrition behavior better for homeschoolers than for other recruits. This could be due to the nonstandard nature of homeschooling [14]. As discussed in the background section, homeschooling laws are set at the state level and vary substantially from state to state. Some states have specific requirements in terms of subject matter, hours/days in the classroom, and testing, whereas others do not even require that authorities be informed of homeschooling. On top of this, it is likely that parents choose to homeschool for a wide variety of reasons; therefore, we would expect that homeschooling curricula vary widely.

Homeschoolers who enlist are a nonrandom sample of all homeschoolers. Therefore, the relationship between AIM scores and attri-

28. The marginal effects suggested that men with low AIM scores may have, at most, attrition rates that are 20 percent lower than those of women with low AIM scores. However, this effect is much smaller than the overall difference between men's and women's attrition rates. Thus, AIM scores provide little explanation for the attrition differences between men and women.

tion for homeschoolers has few or no implications for the broader homeschooling community. But our results suggest that other factors unrelated to AIM may determine homeschoolers' early attrition rates.

Homeschoolers do not appear to be disadvantaged by AIM; in fact, they score slightly higher than many other groups (see figure 9). However, our regression results indicate that AIM is not an especially effective predictor of homeschoolers' early-term attrition behavior. Although the homeschoolers in our sample have, on average, slightly higher AFQT scores than others in our sample, it is possible that homeschoolers who leave the Service do so primarily for academic reasons, perhaps because of the tremendous variation in homeschooling curricula. Consistent with this, we find that AFQT score and attrition are more strongly (negatively) correlated for homeschoolers than for others in our sample.²⁹ In other words, those with lower AFQT scores have higher attrition, and this relationship is more pronounced among homeschoolers in our sample than among others. Of course, noncognitive aspects not picked up by AIM also could explain homeschoolers' military performance. Our data do not allow us to distinguish between these possibilities.

AIM does not seem to predict early attrition of ChalleNGe graduates. The ChalleNGe program is a quasi-military, residential program whose graduates are familiar with many aspects of bootcamp life. Past research indicates that ChalleNGe graduates tend to perform quite well in the early months of the first term; some struggle in later months. However, the overall attrition rate of ChalleNGe graduates has been dropping steadily over the past few years [17], and our results are consistent with this trend. ChalleNGe graduates as a group

29. The correlation between AFQT score and 6-month attrition is -0.0853 for homeschoolers and -0.0293 for others in our sample; the correlation between AFQT score and 12-month attrition is -0.0947 for homeschoolers and -0.0192 for others in our sample. Each correlation is statistically significant at the 0.5-percent level or better, indicating that such relationships would be expected to occur by chance no more than 1 time in 200. The coefficients in our regressions generally are consistent with this result as well, though in some cases they do not achieve statistical significance.

have lower AFQT scores than GED-holders and therefore tend to enter the military at a disadvantage in terms of cognitive skills, but the ChalleNGe program has a strong emphasis on leadership and non-cognitive skills.³⁰ This is reflected in AIM scores of ChalleNGe graduates, which are equivalent to those of other groups. This suggests that ChalleNGe graduates who enlist have fairly strong noncognitive skills. Like homeschoolers, ChalleNGe graduates may struggle later in the term for cognitive reasons or because of noncognitive aspects not picked up by AIM. In any case, AIM is unlikely to serve as a helpful screen for ChalleNGe enlistees.

It is not surprising that AIM predicts attrition for GED-holders who enlist. This group has relatively high AFQT scores, but civilian research has characterized male GED-holders in particular as lacking noncognitive skills [5]. Therefore, we would expect a noncognitive screen to be particularly effective for this group. AIM also seems to have some predictive power over high school diploma graduates in our sample, especially in the early months of service.

In summary, although it is possible that AIM scores will better predict later-term attrition for homeschoolers, or will predict attrition for dropouts with bigger samples, our results to date indicate that AIM is predictive of attrition behavior only for GED-holders (and for high school graduates in the early months of service). Although AIM score is related to attrition behavior for homeschoolers in simple correlations, the relationship does not hold up in regression models.

Implications of using AIM to determine accession eligibility

As discussed earlier, AIM's most likely use is as a cut score. For example, the Services could require all recruits, or some recruits, to achieve a given AIM score as a condition for enlistment. Using AIM in such a manner has different implications for different groups. AIM scores vary relatively little by education credential or race/ethnicity, but they vary more between men and women. (Refer back to figure

30. ChalleNGe enlistees have, on average, AFQT scores that are about 7 points lower than others in our sample; this difference is statistically significant, predicted to occur by chance less than 1 time in 10,000.

6.) Although a low AIM score predicts attrition for both men and women, setting any given minimum AIM score will have different effects on men and women. To demonstrate this point, table 2 indicates the percentage of each group that would be ineligible to enlist if specific AIM cut scores were adopted. We consider adopting a score at the 25th percentile and a score at the 10th percentile, based on the scores of all AIM test-takers in FY08 and FY09.

Table 2. Percentage of sample that would be ineligible because of low AIM scores^a

	Lowest quartile	Lowest decile
Men	24.5	10.2
Women	42.0	19.9
African-Americans	27.4	11.1
White (non-Hispanic)	25.8	10.9
Hispanic	26.5	11.6
High school graduates	29.2	13.4
GED-holders	25.7	10.8
Homeschooled	24.7	10.2
ChalleNGe	27.4	12.7
Dropouts	27.0	11.2
Cat. I	27.9	13.7
Cat. II	25.6	10.8
Cat. IIIA	25.0	10.5
Cat. IIIB	29.0	12.6
Male GED-holder	23.9	9.88
Male non-GED-holder	26.0	11.0
Female GED-holder	41.4	19.3
Female non-GED-holder	43.4	21.1
Entire sample	26.4	11.2

a. Sample includes NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

As table 2 indicates, because of the discrete scoring of AIM, about 26 percent of the sample scored in the bottom quartile and about 11 percent scored in the bottom decile. Overall, nearly 25 percent of men would be ineligible to enlist if the lowest quartile score were adopted

as a cutoff; if the lowest decile score marked the cutoff, nearly 10 percent of men would be ineligible. The percentages ineligible are roughly equal across many of the characteristics shown in table 2, but the situation is different for women. About 42 percent of women score in the bottom quartile on AIM, and about 20 percent score in the bottom decile. Thus, while AIM scores have roughly the same *predictive power* for women and men, an AIM cutoff has quite different *implications* for women than for men. AIM cut scores at the 10th or 25th percentile would disqualify a much higher percentage of women than men.

The distribution of AIM scores also differs slightly between GED-holders and others. GED-holders are slightly more likely than those holding other credentials to exceed the 10th and the 25th percentiles. This is summarized near the bottom of table 2: both men and women who do *not* hold a GED are more likely than others to score *below* the 10th or 25th percentile, while the opposite is true of GED-holders. Thus, a cut score at the 10th or 25th percentile would disqualify a lower percentage of GED-holders than others; this is a cause for concern because our findings suggest that AIM's predictive power for other groups is limited.

Also, we consider the likely implications of using AIM versus the more recently developed TTAS (Tier Two Attrition Screen). TTAS is a "whole person" measure; it is formed by combining AIM score with two ASVAB subtest scores and a BMI measure. The BMI measure is a gender-specific indicator that the potential enlistee's BMI falls in the top 5 percent *or* the bottom 5 percent of the distribution. Thus, those who are heaviest for their height and those who are lightest for their height are flagged and receive lower TTAS scores as a result. Our models include BMI indicators for underweight, overweight, and obese as well as the category of the person's AFQT score. Therefore, our models include most aspects of TTAS, although not the exact measure. We find that those with the highest AFQT scores have slightly lower attrition, whereas those who are either underweight or overweight have somewhat higher attrition. We do not test these effects to see whether they differ between men and women or between those holding different education credentials; if these effects are more constant across groups than AIM's effect, this would

indicate that TTAS is likely to better predict attrition across recruits than AIM.

Finally, ARI researchers have found that TTAS is predictive of homeschoolers' first-term attrition [24]. This result is somewhat in contrast to our results; however, our datasets differ substantially. First, the ARI data include a longer period of time, beginning in 2005 and more observations. Also, recall that TTAS includes components from the ASVAB, as well as an indicator for very high or low BMI scores. Our results, combined with those of ARI, suggest that these other components of TTAS may be especially important in explaining the attrition of homeschoolers. This, in turn, suggests that TTAS has more potential utility than AIM, especially to the extent that recruits with different education credentials tend to attrite for different reasons (i.e., cognitive versus noncognitive). This is consistent with TTAS's design as a "whole person" test; AIM, in contrast, focuses on noncognitive skills.

Conclusions

In this research, we explore the relationship between the Assessment of Individual Motivation (AIM) and early first-term attrition. Our data include all who took AIM and enlisted to active duty in FY08 and FY09. We emphasize homeschoolers and nongraduates because of the likely link between noncognitive skills and military performance. Our results suggest that AIM does measure some noncognitive skills and that the distribution of AIM scores is similar across race/ethnicity, education credential, and AFQT score in most cases. We find, however, that women score substantially lower than men on AIM.

We find evidence that AIM predicts early-term attrition, for *some* in our sample. Specifically, AIM predicts attrition for GED-holders, and also for high school diploma graduates in the early months of service. Research suggests that male GED-holders have poor noncognitive skills and that this explains their relatively poor performance in the military and the civilian labor market. Within our sample, GED-holders had average AIM scores at least as high as those of other groups, but the attrition of those GED-holders with low AIM scores was substantially and significantly higher than the attrition of GED-holders with higher AIM scores.

Our research also suggests, however, that the early-term performance of several other groups is less tied to noncognitive skills (or, at least, to those skills measured by AIM). In particular, the tie between AIM and early-term performance is weak for dropouts and homeschoolers and practically nonexistent for ChalleNGe graduates. In the case of homeschoolers, descriptive statistics indicate that those with lower AIM scores have higher attrition, but regression results suggest that other factors explain this.

Past research indicates that homeschoolers' military performance is tied more strongly to AFQT scores than the performance of others. In particular, homeschoolers who score at least 50 on the AFQT have

attrition rates generally similar to those of traditional high school graduates; homeschoolers who score lower on the AFQT have attrition rates more similar to those of GED-holders. In contrast, AIM offers only a limited opportunity to distinguish between homeschoolers with a high probability of early attrition and those with a lower probability. Taken together, these findings suggest that homeschoolers' noncognitive skills (as measured by AIM) play a relatively small role in explaining attrition. It is possible that homeschoolers, whose educational experiences vary widely, are a diverse group in terms of cognitive skills; in this case, we would expect the AFQT to serve as a useful screen, and this is what other research finds.

Graduates of the National Guard Youth ChalleNge program tend to have relatively low AFQT scores, but have AIM scores that are similar to others in our sample. Their low AFQT scores are not a surprise because ChalleNge graduates tend to be recent high school dropouts; upon entering the program, their average achievement is at the 7th grade level. Early-term attrition for this group, however, is quite low and has fallen in recent years. We expected ChalleNge graduates to score well on AIM because of the program's explicit emphasis on noncognitive skills—specifically, leadership and planning. In fact, ChalleNge graduates have AIM scores generally similar to those of GED-holders or high school graduates. It is possible that AIM does not measure the noncognitive skills developed in the ChalleNge program or that ChalleNge cadets' early-term low attrition is related to other factors (e.g., general familiarity with bootcamp). The attrition of ChalleNge graduates tends to increase compared with that of other groups between months 12 and 36; this may be related to their cognitive skills.

In summary, AIM offers the possibility of selecting those GED-holders who are most likely to succeed, but there is less evidence that the instrument will be helpful for those with other education credentials. We suggest tracking all groups throughout their first terms; longer-term analysis may uncover a stronger relationship between AIM and attrition for some other groups. At this point, however, we do not recommend using AIM alone to select among recruits holding credentials other than a GED.

Appendix A: School choice in the United States

In this section, we detail the types of schools available. Also, we provide some background on the estimated number of homeschooled students in the United States and the number or proportion of students attending each type.

Magnet schools

Magnet schools are public schools that allow enrollment based on nongeographic factors. Magnet schools tend to be clustered in or near urban areas. Some magnet schools require entrance tests; many have “themes” or areas of specialization. In general, magnet schools receive extra funding but follow the same regulations as other public schools. As of 2006, there were more than 2,700 magnet schools in the United States enrolling about 2.1 million students [25].

Charter schools

Charter schools also are funded with public dollars, but these schools are not bound by many of the requirements that other public schools face. In particular, principals at charter schools usually have a great deal of control over the process of hiring and firing teachers, and—in most cases—teachers have no collective bargaining agreement. Also, charter schools may meet for more hours per day, or more days per year, than regular public schools.

The first charter school law was passed in 1991 in Minnesota; many other states rapidly followed suit. Ten states currently do not have a charter school law, and thus have no charter schools, but most of these states are fairly small; about 93 percent of children live in a state that permits charter schools. However, charter schools are quite concentrated; more than half of all charter schools are located in only five states [25]. Charter school regulations also vary among states.

Charter school enrollments have grown dramatically in recent years. In 2004, about 3,000 charter schools served some 638,000 students; by 2009, there were over 4,600 schools serving some 1.5 million students [25, 26]. Thus, the number of students in charter schools appears to be growing more quickly than the number of students in other types of nontraditional schools (homeschools, magnet schools, and private schools).

Private schools

At one time, school choice was synonymous with private school attendance. The total number of private school students in the United States is about 5 million.³¹ Despite several experiments with vouchers (credits that can be used to pay private school tuition), the vast majority of private school students do not use them; of course, the schools are free to offer reduced tuition or scholarships to some students.

We detail these other types of nontraditional schools because homeschooling does not exist in a vacuum. Although some parents would probably choose to homeschool regardless of other choices available, it is likely that many families carefully consider and choose among all available options. Moreover, growth in one type of nontraditional school is likely to affect total enrollment in other types. For example, private school enrollments have grown very little in the past 10 to 20 years; this stagnation is likely related to the expansion of magnet, charter, and/or homeschooling options.

Number of homeschooled students in the United States

Estimates based on surveys of homeschooled children, usually done by homeschooling advocates, tend to produce numbers at the high end of the range. For example, the Homeschool Legal Defense Association (HSLDA) uses information provided by the National Home

31. Private Schools Universe Survey, <http://nces.ed.gov/surveys/pss>. The Universe Survey estimates that the number of private school students fell between 2001–2002 and 2005–2006; no figures from later years are available.

Education Research Institute to estimate that about 2 million children were homeschooled during the 2002–2003 school year [27] and that homeschooling is growing rapidly—perhaps at rates of 7 to 15 percent per year [28].

Estimates based on responses to national surveys tend to be much lower. For example, [29] estimates that there were about 850,000 homeschooled students in 1999 and, using a similar methodology, [16] estimates that there were about 1.1 million in 2003.³² Reference [30] combined information from several sources to produce perhaps the most credible estimates available; it estimated that there were about 1 million homeschooled students in 2001. All these estimates together suggest there are perhaps 1.5 million homeschooled students in the United States today.

32. These estimates, however, depend on national samples. The actual number of homeschooled students was very small (less than 300) in both cases; therefore, the confidence intervals around these estimates are quite large.

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Appendix B: Descriptive statistics and regression results

Tables 3 through 5 include descriptive statistics for our sample as well as the complete regression results reported in the text. We include regressions explaining 3-, 6-, and 12-month attrition for AIM test-takers in FY08 and FY09. Regressions explaining 12-month attrition have fewer observations because we are not yet able to observe 12 months of performance data on some who accessed during FY09. Table 3 presents descriptive statistics. Tables 4 and 5 show the estimated coefficients from our regressions and indicators of levels of statistical significance. Table 4 includes results from the basic models; table 5 has results from the models interacting education credential and low AIM score.

Table 3. Descriptive statistics, full sample ^{a, b}

Variable	Mean	Std. dev.	Minimum	Maximum
Male	0.89	0.31	0	1
Female	0.11	0.31	0	1
White (non-Hispanic)	0.73	0.44	0	1
Black (non-Hispanic)	0.094	0.29	0	1
Asian/Pacific Islander	0.013	0.11	0	1
American Indian	0.010	0.10	0	1
Other/unknown	0.056	0.23	0	1
High school graduate	0.054	0.23	0	1
College (2- or 4-year degree)	0.0012	0.035	0	1
Homeschooled	0.048	0.21	0	1
Other Tier 1 credential	0.027	0.16	0	1
GED-holder	0.70	0.46	0	1
ChalleNge graduate	0.020	0.14	0	1
Other Tier 2 credential	0.050	0.22	0	1
“Dropout” (no credential)	0.10	0.30	0	1
AFQT (percentile score)	58.7	15.9	10	99
AIM (percentile score)	50.6	10.1	1	79

a. NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989).

b. All variables, except AFQT score and AIM score, indicate the proportion of the sample with the characteristic.

Table 4. Regression explaining attrition rates, basic model^{a, b}

Variable	Attrition		
	3-month	6-month	12-month
Female	0.74*	0.74*	0.87*
Black	-0.37*	-0.40*	-0.40*
Hispanic	-0.49*	-0.51*	-0.51*
Asian/Pacific Islander	-0.53^	-0.87*	-0.92*
American Indian	-0.001	0.04	0.0094
Other/unknown	0.13	0.066	0.054
Dropout (no credential)	-0.24*	0.073	-0.037
High school graduate	-0.24^	-0.11	-0.16~
ChalleNGe graduate	-2.16*	-1.11*	-0.72*
Homeschooled	-0.18	-0.071	-0.30*
Other Tier 1 credential	-0.41^	-0.27^	-0.16
Other Tier 2 credential	-0.13	-0.025	-0.092
AFQT Cat. I	-0.55*	-0.61*	-0.39*
AFQT Cat. II	-0.12^	-0.091^	-0.06
AFQT Cat. IIIB	0.11^	0.18*	0.10^
AFQT Cat. IV	-0.22	0.34	0.41
Army	-0.36^	0.07	0.15
Married	0.17*	0.029	0.053
Age less than 19	0.088	0.12^	0.22*
Age 21 to 25	-0.20*	-0.18*	-0.21*
Age 26 to 30	-0.0042	-0.025^	-0.84
Age 31 to 35	0.29~	0.28^	0.23^
Over 35	0.40^	0.17	-0.64
Underweight	0.21~	0.23^	0.24*
Overweight	-0.016	0.041	0.051
Obese	0.17^	0.29*	0.27*
Low AIM score	0.33*	0.31*	0.27*
Fiscal year 2008	0.089	-0.051	-0.01
Constant	-2.4*	-2.1*	-1.7*
Number of observations	24,989	24,989	23,207
Pseudo R-squared	0.03	0.03	0.03

- a. Sample includes NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989). Excluded categories: male, white (non-Hispanic), GED-holder, AFQT in Category IIIA (50-64), not serving in the Army, unmarried, age 19 to 20, weight in the normal range (BMI above 18.5 and below 25); AIM score above the lowest quartile, and fiscal year 2009.
- b. Levels of statistical significance:
 ~coefficient is significant at 10 percent or better;
 ^ coefficient is significant at 5 percent or better;
 * coefficient is significant at 1 percent or better.

Table 5. Regression explaining attrition rates, model with interactions^{a, b}

Variable	Attrition		
	3-month	6-month	12-month
Female	0.74*	0.75*	0.87*
Black	-0.37*	-0.40*	-0.40*
Hispanic	-0.49*	-0.51*	-0.51*
Asian/Pacific Islander	-0.53^	-0.86*	-0.91*
American Indian	-0.003	0.036	0.0056
Other/unknown	0.13	0.066	0.055
Dropout (no credential)	-0.22~	0.12	0.0013
High school graduate	-0.32^	-0.18	-0.14
ChalleNGe graduate	-1.9*	-1.1*	-0.62*
Homeschooled	-0.093	-0.048	-0.28^
Other Tier 1 credential	-0.29~	-0.16	-0.067
Other Tier 2 credential	-0.011	0.08	0.003
AFQT Cat. I	-0.56*	-0.61*	-0.39*
AFQT Cat. II	-0.12^	-0.092^	-0.060
AFQT Cat. IIIB	0.10	0.18*	0.098^
AFQT Cat. IV	-0.19	0.37	0.44
Army	-0.36^	0.068	0.15
Married	0.17	0.028	0.052
Age less than 19	0.09	0.12^	0.22*
Age 21 to 25	-0.20*	-0.18*	-0.21*
Age 26 to 30	-0.0036	-0.024	-0.083
Age 31 to 35	0.29^	0.28^	0.24^
Over 35	0.41^	0.18	-0.056
Underweight	0.21~	0.24^	0.23*
Overweight	-0.015	0.042	0.052
Obese	0.17~	0.29*	0.27*
Low AIM, homeschooled	0.027	0.24	0.20
Low AIM, dropout	0.27	0.17	0.16
Low AIM, high school graduate	0.56*	0.48*	0.23
Low AIM, ChalleNGe	-0.48	0.28	-0.029
Low AIM, GED	0.33*	0.32*	0.29*
Fiscal year 2008	0.087	-0.051	-0.012
Constant	-2.4*	-2.1*	-1.7*
Number of observations	24,989	24,989	23,207
Pseudo R-squared	0.03	0.03	0.03

a. Sample includes NPS active-duty accessions who took AIM, FY08–FY09 (N = 24,989). Excluded categories: male, white (non-Hispanic), GED-holder, AFQT in Cat. IIIA (50-64), not serving in the Army, unmarried, aged 19 to 20, weight in the normal range (BMI above 18.5 and below 25); AIM score above the lowest quartile, and FY 2009.

b. Levels of statistical significance: ~coefficient is significant at 10 percent or better; ^ coefficient is significant at 5 percent or better; * coefficient is significant at 1 percent or better.

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References

- [1] Janice Laurence, Jennifer Naughton, and Dickie Harris. *Attrition Revisited: Identifying the Problem and Its Solutions*, 1996 (United States Army Research Institute for the Behavioral and Social Sciences, ARI Research Note 96-20)
- [2] Federico Garcia et al. *Evaluation of the Pilot Program for Home School and ChalleNGe Program Recruits*, 2004 (CNA Research Memorandum D0004598.A4)
- [3] Janice Laurence. *Education Standards for Military Enlistment and the Search for Successful Recruits*, 1984 (Human Resources Research Organization Final Report 84-4, FR-PRD-84-4)
- [4] J. Toomepuu. *Soldier Capability—Army Combat Effectiveness (SCACE), Vol. I: Main Report*, Apr 1981 (Fort Benjamin Harrison, IN, U.S. Army Soldier Support Center, ACN64024; cited in Laurence (1984))
- [5] James Heckman and Yona Rubinstein. “The Importance of Noncognitive Skills: Lessons From the GED Testing Program.” *American Economic Review* 91(2), 2001: 145–149
- [6] Samuel Bowles, Herbert Gintis, and Melissa Osborne. “The Determinants of Earnings: A Behavioral Approach.” *Journal of Economic Literature* 39(4), 2001: 1131–1176
- [7] James Heckman, Jora Stixrud, and Sergio Urzua. “The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior,” 2006 (NBER Working Paper 12006)
- [8] Leonard White and Mark Young. “Validation of a Faking-Resistant Measure of Temperament Constructs,” 2001 (paper)

presented at the annual meeting of the Society for Industrial/Organizational Psychology, San Diego, CA)

- [9] Mark Young et al. "Army Pre-Implementation Research Findings on the Assessment of Individual Motivation (AIM)," 2000 (paper presented at the annual meeting of the American Psychological Association, Washington, DC)
- [10] Arwen Hunter, Leonard White, and Mark Young. "Predicting First-Term Enlisted Attrition: The Tier Two Attrition Screen," 2008 (paper presented at meetings of the American Psychological Association, Boston, MA)
- [11] Leonard White et al. "Development of a Non-High School Diploma Graduate Pre-Enlistment Screening Model To Enhance the Future Force," 2004 (paper presented at the 24th Army Science Conference, Orlando, FL, 29 Nov through 2 Dec 2004)
- [12] Mark Young and Leonard White. "Preliminary Operational Findings From the Army's Tier Two Attrition Screen (TTAS) Measure," 2006 (paper prepared for the 25th Army Science Conference in Orlando, FL, 27-30 Nov 2006)
- [13] Leonard White, Arwen Hunter, and Mark Young. "U.S. Army's Tier Two Attrition Screen," 2007 (paper presented at the 115th annual meeting of the American Psychological Association, San Francisco, CA)
- [14] Jennie Wenger and Apriel Hodari. *Final Analysis of Evaluation of Homeschool and ChalleNGe Program Recruits*, Jan 2004 (CNA Research Memorandum D0009351.A2)
- [15] Eric Isenberg. "What Have We Learned About Homeschooling?" *Peabody Journal of Education* 82(2-3), 2007: 387-409
- [16] S. Bielick, C. Chapman, and D. Princiotta. "1.1 Million Homeschooled Students in the United States 2003," Jul 2004 (Issue Brief, U.S. Department of Education, Institute of Education Sciences, NCES 2004-15)

- [17] Jennie Wenger and Cathleen McHugh. *Attrition Rates and Performance of ChalleNGe Participants Over Time*, Apr 2006 (CNA Research Memorandum D0013758.A2)
- [18] John Tyler. "The Economic Benefits of the GED: Lessons From Recent Research," 2002 (Brown University and NBER working paper)
- [19] David Boesel, Nabeel Alsalam, and Thomas Smith. *Educational and Labor Market Performance of GED Recipients*, 1998 (Washington, DC: Office of Educational Research and Improvement, U.S. Department of Education, National Library of Education Research Synthesis, Publication NLE-98-2023)
- [20] Stephen Cameron and James Heckman. "The Nonequivalence of High School Equivalents." *Journal of Labor Economics* 11(1), Jan 1993: 1-47
- [21] James Heckman and Paul LaFontaine. *The American High School Graduation Rate: Trends and Levels*, 2007 (IZA Discussion Paper No. 3216)
- [22] Jennie Wenger and Diana Lien. *Does Education Reform Make Recruiting More Difficult?* Dec 2005 (CNA Research Memorandum D0013184.A1)
- [23] National Center for Education Statistics. *Digest of Education Statistics 2007* (Washington, DC: U.S. Department of Education, NCES Publication 2008-022)
- [24] Tonia Heffner and Leonard White. "Screening for Attrition and Performance with Non-Cognitive Measures," 2010 (paper presented to the Center for Naval Analyses, 25 May 2010)
- [25] U.S. Department of Education. *Number and Types of Public Elementary and Secondary Schools from the Common Core of Data: School Year 2005-06*, 2007 (National Center for Education Statistics Publication 2007-34)

- [26] Center for Education Reform, “National Charter School and Enrollment Statistics 2009” (available at http://www.edreform.com/_upload/CER_charter_numbers.pdf)
- [27] Brian Ray. “Research Facts on Homeschooling,” 2009 (<http://www.nheri.org/Research-Facts-on-Homeschooling.html>)
- [28] Brian Ray. *Worldwide Guide to Homeschooling: Facts and Stats on the Benefits of Homeschooling*, 2005–2006 (National Home Education Research Institute)
- [29] S. Bielick, K. Chandler, and S. P. Broughman. “Homeschooling in the United States: 1999,” 2001 (Washington, DC: U.S. Department of Education, National Center for Education Statistics Publication NCES 2001-033)
- [30] Patricia Lines. *Homeschooling*, 2001 (U.S. Department of Education, EDO-EA-01-08, ERIC Digest Number 151)

List of figures

Figure 1. Levels of homeschooling regulation vary across states	8
Figure 2. Distribution of states and school-aged children, by level of homeschool regulation	9
Figure 3. Distribution of U.S. K–12 students, by type of school	10
Figure 4. Distribution of education credentials	17
Figure 5. Distribution of AIM scores, active-duty accessions, FY08–FY09.	18
Figure 6. Distribution of AIM scores, men versus women	19
Figure 7. Distribution of AIM score by race/ethnicity	20
Figure 8. Distribution of AIM scores, by AFQT category.	20
Figure 9. Distribution of AIM scores, by education credential	21
Figure 10. First-term attrition rates, by AIM score.	24
Figure 11. Six-month attrition rates by AIM score and personal characteristics	24
Figure 12. Six-month attrition rates by AIM score and AFQT score	25
Figure 13. AIM scores and 6-month attrition rates, by education credentials	26
Figure 14. Marginal effects from regressions explaining early-term attrition of AIM test-takers	29

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List of tables

Table 1.	Descriptive statistics by AIM score	22
Table 2.	Percentage of sample that would be ineligible because of low AIM scores	34
Table 3.	Descriptive statistics, full sample ,	43
Table 4.	Regression explaining attrition rates, basic model,	44
Table 5.	Regression explaining attrition rates, model with interactions,	45

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