



Training Success for U.S. Air Force Special Operations and Combat Support Specialties

An Analysis of Recruiting, Screening, and
Development Processes

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Preface

The U.S. Air Force continues to seek ways to improve recruiting, screening, and development processes for entry into high-demand, high-attrition (HDHA) specialties, such as special operations and combat support (SO/CS) specialties. In fiscal year 2016, the Air Force asked RAND Project AIR FORCE to identify and recommend effective methods and tools for recruiting, screening, and developing candidates into HDHA specialties. This project focused on six enlisted HDHA specialties: Combat Control (CCT); Explosive Ordnance Disposal (EOD); Pararescue (PJ); Special Operations Weather Team (SOWT); Survival, Evasion, Resistance, and Escape (SERE); and Tactical Air Control Party (TACP). Previous efforts to implement new recruiting, screening, and development approaches for these specialties have yet to result in long-lasting, significant changes to entry processes. We build on these other efforts by addressing the broader challenges for implementing new approaches to HDHA-specialty recruiting, screening, and development, and by taking a holistic approach to identifying methods and tools that could fill gaps in current processes.

This report describes work that should be of interest to policy and research audiences with interests in recruiting, screening, and development processes for SO/CS specialties. The report assumes readers will have some familiarity with Air Force enlisted recruiting, screening, and development processes. The work in this report was sponsored by the Vice Commander, Air Education and Training Command (AETC/CV). This project was conducted within the Manpower, Personnel, and Training Program of RAND Project AIR FORCE.

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Summary

The U.S. Air Force’s special operations and combat support (SO/CS) specialties in the enlisted force are among the highest in demand by the service yet have persistently high rates of attrition in their initial skills training, which is called “technical training” in the Air Force. These high-demand, high-attrition (HDHA) specialties include Combat Control (CCT); Explosive Ordnance Disposal (EOD); Pararescue (PJ); Survival, Evasion, Resistance, and Escape (SERE); Special Operations Weather Team (SOWT); and Tactical Air Control Party (TACP).¹ The Air Force has conducted or sponsored several efforts to address training attrition in these specialties over the past several years, yet training attrition remains high. The reasons for high training attrition are interrelated, with size and quality of the recruiting pool, utility of screening tools, and training environment factors all playing a role.

Given the challenges in addressing HDHA-specialty training attrition, the Air Force asked RAND Project AIR FORCE to identify and recommend effective methods and tools for recruiting, screening, and developing candidates in HDHA specialties. The fiscal year 2016 project addresses three questions:

1. What factors are associated with training attrition in select Air Force HDHA specialties?
2. What, if any, are the gaps in recruiting and screening candidates to enter these select HDHA specialties?
3. What methods should the Air Force consider using to recruit, screen, and develop candidates for these select HDHA specialties?

To address these questions, we used a mixed-method approach to our data collection and analysis. We used three primary methods: (1) literature and document review, (2) discussions with subject-matter experts (SMEs) on HDHA specialties within and external to the Air Force, and (3) quantitative analyses with a central focus on predictive and network-based models. Integrating our findings across these three methods allowed us to expand on previous analytic efforts to understand HDHA-specialty training attrition and identify options for the Air Force to consider for improving HDHA-specialty recruitment, screening, and development processes.

Question 1: What Factors Are Associated with Training Attrition in Select Air Force HDHA Specialties?

We analyzed available administrative data to identify key predictors of attrition from technical training for the six Air Force specialties identified as HDHA. We included data from screening measures that were used for these specialties at the time the study was conducted, i.e.,

¹ The CCT, PJ, SOWT, and TACP specialties are also referred to collectively as Battlefield Airmen (BA).

the Physical Ability and Stamina Test (PAST; physical fitness measure), Armed Services Vocational Aptitude Battery (ASVAB; cognitive ability measure), and Tailored Adaptive Personality Assessment System (TAPAS; personality inventory). We also included data on recruits' backgrounds (e.g., high school activities), as well as demographic indicators from recruits' hometowns (e.g., unemployment rate) obtained from U.S. Census Bureau data. Using a flexible statistical model that allowed us to include more factors than traditional statistical models, we found that only fitness (i.e., PAST scores) and cognitive ability (i.e., ASVAB scores) meaningfully relate to training success for these Air Force specialties.

Because physical fitness was a strong predictor of training attrition and is more open to development than cognitive ability, we conducted a preliminary assessment of the potential impact of a notional fitness training program on training attrition. We selected the PJ pipeline for our assessment because PJ training has relatively high attrition, even among HDHA specialties. Furthermore, fitness levels play a particularly dominant role in the likelihood of PJ attrition, among all characteristics available in the data. Overall, our simulation results show that PJ candidates who meet the minimum fitness standards have a very low probability of success, but that plausible gains in fitness over a hypothetical four-week or eight-week course could meaningfully improve the prospect of success in graduating from the training pipeline. We supplemented our analysis of fitness gains by conducting a preliminary cost analysis to examine whether the cost savings from reduced attrition are big enough to outweigh the additional costs of the new course. Our findings suggest that a new course could be cost-effective if the fitness gains identified in our specific model scenarios (regarding course attendance and course length) are met.

Although we focus on physical fitness as an important factor in predicting HDHA-specialty training attrition, other factors not captured by existing administrative data might also help predict attrition. For example, we examined the Basic Water Skills Test (BWST), which Air Education and Training Command (AETC) developed for the PJ pipeline in response to information suggesting that many trainees arrive unprepared for the intense water-related training events. We performed a similar analysis with BWST, as we did with our main attrition analysis but focused on the PJ pipeline. The addition of BWST information to fitness (i.e., PAST) information improved prediction of PJ training success.

Question 2: What, If Any, Are the Gaps in Recruiting and Screening Candidates to Enter These Select HDHA Specialties?

Given our finding that factors other than those available in existing administrative data (e.g., BWST) could add to the prediction of training attrition, we sought to identify gaps in recruiting and screening assessments that, if filled, could help the Air Force address training attrition.

For our recruiting gap analysis, we originally set out to evaluate Air Force recruiting processes for HDHA specialties. However, initial discussions with Air Force Recruiting Service

(AFRS) revealed that information for an evaluation would not be readily accessible. For example, due to contract negotiations at the time of the study, we could not obtain permission to speak with field developers, who are former members of these HDHA specialties and under contract to help AFRS prepare HDHA-specialty candidates for the rigors of the pipeline before they enter basic military training. Therefore, we culled themes from discussions with AFRS and HDHA-specialty training instructors, and supplemented with background information from research on recruitment for Air Force special operations and combat support specialties and our review of publicly available information about Air Force and other services' HDHA specialties (e.g., Army Special Forces). The recruiting themes include:

- **Many students entering the training pipeline are unaware of the specialty's mission and training requirements.** Instructors provided examples of students not realizing basic requirements of the specialty. Instructors also noted that many students will work to meet minimum standards for entry (e.g., minimum PAST scores) without realizing the demands of training require working beyond the minimum standards.
- **Recruiters may lack knowledge and incentive to recruit high-quality HDHA-specialty candidates.** Instructors noted that many recruiters do not provide sufficient information about the HDHA specialties to recruits, in part because most recruiters do not come from special operations backgrounds. Instructors also mentioned hearing from students that recruiters tell them to choose these specialties as a quicker way to enter the Air Force than waiting for specialties that the recruits prefer.
- **Recruiters are required to meet unrealistic HDHA-specialty recruit quotas.** AFRS representatives expressed concerns about meeting recruit quotas (numbers) while also meeting demands for higher-quality candidates.
- **The field developer concept is not structured for success.** AFRS has recently contracted former HDHA-specialty airmen as "field developers" to help recruit for HDHA specialties. However, Air Force recruiters are ultimately responsible for Air Force HDHA-specialty recruitment and qualification decisions. That is, developers perform critical functions and offer their expert opinions on which recruits to qualify, but recruiters are the final authority on which individuals should be selected and when these individuals should be sent to basic military training (BMT).² Several course instructors argued that the power imbalance between recruiters and developers can result in recruits being sent to BMT before field developers can work with them enough to achieve a higher level of readiness for training.

Because we were limited in our review of recruiting gaps—relying mostly on challenges that training instructors identified—we focused more effort on identifying screening gaps and assessments to fill those gaps. We conducted a qualitative analysis to identify gaps in screening assessments used for Air Force HDHA specialties. First, we asked SMEs on the technical training pipelines for these specialties to provide inputs on what knowledge, skills, abilities, and

² BMT is the introductory military training that new Air Force enlisted personnel attend. After the eight weeks of BMT are completed, trainees are sent to the technical training program that aligns with their assigned Air Force occupational specialty.

other characteristics (KSAOs) are needed to succeed in training. Our analysis suggested the following six training KSAOs for Air Force HDHA specialties:

- physical fitness (has sufficient aerobic endurance, muscular strength, agility, and other factors to perform physically demanding tasks)
- persistence (willingness to keep trying, even under adverse conditions and/or failure)
- teamwork (able and willing to facilitate cooperation and positively contribute to team morale and mission effectiveness)
- stress tolerance (remaining composed under pressure, managing frustration well)
- critical thinking (can identify and analyze problems, willing to seek out and weigh information for solutions appropriately)
- water confidence (ability to be comfortable during water operations).

Existing screening instruments—ASVAB, PAST, and TAPAS—do not directly or comprehensively measure the six KSAOs. Only physical fitness is directly measured by an existing screening tool (i.e., the PAST). All of the other KSAOs are indirectly measured by existing screening instruments (e.g., ASVAB indirectly measures critical thinking).

To identify screening assessment methods to address the gaps in coverage of KSAOs, we reviewed literature on personnel screening and culled information about methods used for HDHA specialties outside the Air Force (e.g., Navy SEALs). We identified three screening methods for the Air Force to consider:

- **Biographical data (biodata) inventories:** set of questions about applicant’s previous experiences and behaviors (e.g., extracurricular activities in school)
- **Structured interviews:** interviews that involve application of predetermined rules for questions, observations, and evaluations
- **Assessment centers (or selection course):** standardized evaluation of behavior based on multiple techniques (e.g., group communication exercise) and trained observers to assess multiple KSAOs.

Each of these screening methods is promising because each one can measure multiple KSAOs (versatile), has been previously used in HDHA specialties outside the Air Force (relevant), and has been linked to job success (valid).

Question 3: What Methods Should the Air Force Consider Using to Recruit, Screen, and Develop Candidates for These Select HDHA Specialties?

Based on our study findings, we offer several recommendations for methods on improving candidate success in HDHA-specialty training. Although improved screening is often the focus of training attrition research and recommended changes, the current state of HDHA-specialty recruiting suggests improved screening is unlikely to reduce attrition while also maintaining a sufficient number of graduates. Unfortunately, information available in administrative databases is insufficient for developing sophisticated models to strategically target high-potential recruits. Taking these factors into consideration, we prioritize our recommendations to bolster Air Force

recruiting efforts given that this function limits the effectiveness of development and screening practices. Our recruiting recommendations stem from our qualitative recruiting gap analysis. We then offer recommendations for developing HDHA-specialty candidates given our quantitative analytic findings on the importance of physical fitness, which can be increased among some candidates (as shown by our simulation). We follow with screening recommendations, which are based on our qualitative screening gap analysis, as well as our quantitative findings regarding the water skills test and the limitations of existing physical ability and personality assessments. We summarize our findings and their associated recommendations for recruiting, development, and screening in Table S.1. Within each category of recommendation (e.g., recruiting) or within each subcategory (e.g., courses of action [COAs] for screening), we organize recommendations according to ease of implementation.

In addition to the recommendations in Table S.1, we offer a general recommendation to add a researcher to the BA Training Group to better integrate studies conducted by different organizations on topics relevant to BA recruiting, screening, and training. This researcher could be provided with the authority to manage future evaluation efforts on the effectiveness of recruiting efforts and could develop a centralized database that addresses limitations with current data.

Table S.1. Summary of Recommendations for Air Force HDHA-Specialty Recruiting, Development, and Screening

Category of Finding and Recommendation	Finding	Recommendation
Recruiting	- Many students entering the training pipeline are unaware of the specialty's mission and training requirements - Sister services' special operations have more comprehensive in-service recruiting - Recruiters are required to meet unrealistic HDHA-specialty recruit quotas - BA Training Group was recently established with a focus on training	- Balance marketing efforts to attract recruits with information that provides a realistic job preview - Explore opportunities to expand in-service recruiting efforts - Establish an incentive structure that rewards recruiters when HDHA-specialty candidates succeed in the initial course of entry - Expand BA Training Group concept^a to include recruitment

Category of Finding and Recommendation	Finding	Recommendation
Development	- Physical fitness is an important factor contributing to training success - Physical fitness can be developed	- Consider developing a fitness course to reduce attrition - Consider related strategies to improve physical readiness of HDHA-specialty candidates - Offer additional fitness training to HDHA-specialty candidates in BMT - Establish fitness goals associated with training success
Screening	- Current screening practices do not sufficiently measure candidate motivation - Simulation results demonstrate that additional physical preparation could decrease attrition - An expanded recruiting program may require new decision tools to prioritize eligible candidates for training - Quantitative analyses did not support using TAPAS^a; however, several limitations with the data may have impacted conclusions - Students prepare for the test (i.e., PAST) but not the training - Water confidence is a training requirement for some BA specialties but is not effectively evaluated during the screening process	- Explore feasibility of two COAs - COA 1. Consider developing a biographical data inventory and structured interview - COA 2. Consider using a two-to-three-day selection course at the end of BMT for final screening - General screening recommendations - Develop a training readiness index to rank order recruits for available training seats - Reexamine role of personality measures, such as the TAPAS, NEO-Personality Inventory (NEO-PI), and Emotional Quotient Inventory (EQ-i) - Evaluate potential benefits of upgrading physical test components on the PAST - Explore benefits of including a water skills test for specific HDHA specialties

^a AETC recently established a group for BA training by placing the training under BA leadership. More information on this group is provided in Chapter 2.

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Abbreviations

2AF	Second Air Force
AETC	Air Education and Training Command
AETC/A3T	Air Education and Training Command, Training
AF/A1	Headquarters, Air Force, Manpower, Personnel, and Services
AF/A1PT	Accession and Training Management Division
AFB	Air Force Base
AFPC	Air Force Personnel Center
AFQT	Armed Forces Qualification Test
AFRL	Air Force Research Laboratory
AFRS	Air Force Recruiting Service
AFSC	Air Force Specialty Code
AFSOC	Air Force Special Operations Command
ASVAB	Armed Services Vocational Aptitude Battery
ATC	air traffic control
BA	Battlefield Airmen
BCT	basic combat training
BORSTAR	Border Patrol Search, Trauma, and Rescue
BORTAC	Border Patrol Tactical Unit
BMT	basic military training
BSTC	Border Patrol Tactical Unit's Selection and Training Course
BUD/S	Basic Underwater Demolitions/SEAL
BWST	Basic Water Skills Test
CBP	U.S. Customs and Border Protection
CCS	Combat Control School
CCT	Combat Control
CD	coefficient of discrimination

COA	course of action
DCAR	Direct Ground Combat Definition and Assignment Rule
DEP	Delayed Entry Program
DSYX	Strategic Research and Assessment
EOD	Explosive Ordnance Disposal
EQ-i	Emotional Quotient Inventory
FBI	Federal Bureau of Investigation
FMAT	Training Branch, Financial Analysis Division, Financial Management and Comptroller
FTU	Fitness Training Units
FY	fiscal year
GBM	generalized boosted model
GTEP	Guaranteed Training Enlistment Program
HDHA	high demand, high attrition
HQ	headquarters
HRT	Hostage Rescue Team
KSAO	knowledge, skills, abilities, and other characteristics
MAGE	mechanical, administrative, general, and electronic
MARSOC	Marine Corps Forces Special Operations Command
MEPS	Military Entrance Processing Station
MMPI	Minnesota Multiple Personality Inventory
NCO	noncommissioned officer
NEO-PI	NEO-Personality Inventory
NRD	Navy Recruiting District
NSW	Naval Special Warfare
OTA	Oracle Training Administration
PAST	Physical Ability and Stamina Test
PJ	Pararescue
PST	Physical Screening Test

SA	special agent
SAT	strength aptitude test
SERE	Survival, Evasion, Resistance, and Escape
SF	special forces
SFAS	Special Forces Assessment and Selection
SIE	self-initiated elimination
SJT	subjective judgment test
SME	subject-matter expert
SO/CS	special operations and combat support
SOWT	Special Operations Weather Team
SRD	scout-recruit-develop
STO	Special Tactics Officer
STTS	Special Tactics Training Squadron
SWCC	Special Warfare Combatant-Craft Crewmen
TACP	Tactical Air Control Party
TAPAS	Tailored Adaptive Personality Assessment System
TRP	Tactical Recruiting Program
TTMS	Technical Training Management System

1. Introduction

Air Force technical training is a key component of entry-level skill development in the U.S. Air Force. After completing basic military training (BMT), enlisted personnel attend technical training to acquire the initial skills needed for their Air Force occupational specialties. Given the high costs of initial training, the Air Force continues to look for ways to reduce training attrition (i.e., students not graduating) and wash backs (i.e., students not graduating at the same time as their peers because they had to repeat sections of training for various reasons).³ Despite several efforts, the Air Force has achieved minimal, sustained gains in reducing training attrition for specialties that are high demand (mentally and physically challenging) and have high levels of training attrition—i.e., high-demand, high-attrition (HDHA) specialties. Some of these HDHA specialties include the special operations and combat support (SO/CS) specialties of Combat Control (CCT); Pararescue (PJ); Explosive Ordnance Disposal (EOD); Survival, Evasion, Resistance, and Escape (SERE); Special Operations Weather Team (SOWT); and Tactical Air Control Party (TACP).⁴ For example, training attrition for CCT, SOWT, and EOD averaged around 75 percent from fiscal years (FYs) 2011 to 2015, whereas the average training attrition rate across enlisted specialties was about 10 percent during that time period.⁵ To identify ways to address HDHA-specialty training attrition, Headquarters AETC asked RAND Project AIR FORCE to recommend methods and tools to improve the recruitment, screening, and development of HDHA-specialty candidates with a focus on reducing training attrition (i.e., finding efficiencies in technical training). Although our focus is on training attrition, we also consider other important goals related to these HDHA specialties (e.g., career field manning requirements). The project addresses three main questions:

1. What factors are associated with training attrition in select Air Force HDHA specialties?
2. What, if any, are the gaps in recruiting and screening candidates to enter these select HDHA specialties?
3. What methods should the Air Force consider using to recruit, screen, and develop candidates for these select HDHA specialties?

³ According to Manacapilli et al. (2012), initial training for enlisted personnel costs the Air Force about \$1.3 billion each year. Attrition and wash backs from initial training cost the Air Force about \$134 million each year. These estimates were based on data from FYs 2001 to 2008.

⁴ The CCT, PJ, SOWT, and TACP specialties are also referred to collectively as Battlefield Airmen (BA). These specialties, plus EOD and SERE, are collectively referred to as SO/CS specialties.

⁵ We examined training data from Air Education and Training Command's (AETC's) Technical Training Management System (TTMS) to estimate training attrition for Air Force specialties. We provide more details on historical training attrition trends for the six HDHA specialties in the next chapter of this report.

To scope our effort, we focused on the six SO/CS specialties listed above. Except where noted, we will use the term “HDHA specialty” when referring to these specialties collectively.

Overview of Air Force HDHA-Specialty Recruiting, Screening, and Training

In this section, we provide a brief overview of recruiting, screening, and training processes and practices for the six HDHA specialties in this study. At the time of this study (FY 2016), recruiting, screening, and training processes and practices were undergoing changes. One significant change began in the fall 2015, when AETC proposed the scout-recruit-develop (SRD) model for these specialties. The SRD model aims to increase the quality and quantity of future candidates for SO/CS specialties by leveraging current and former members of these specialties as scouts and developers, respectively. Elements of the SRD model are adapted from the Navy SEAL community, which uses mentors to develop candidates.

We outline key elements of the SRD model as relayed to us by subject-matter experts (SMEs) from Air Force Recruiting Service (AFRS), which supports and performs elements of the SRD model.⁶ Because the model uses the terminology of “special operations and combat support” or “SO/CS” to refer to the HDHA specialties in our study, we will use the SO/CS terminology in our description below.

Recruiting

In general, the SO/CS specialties are open to civilians, interservice transfers, and in-service transfers. However, the majority of recruits into SO/CS specialties come from the civilian population, which is the focus of the SRD model.⁷ Air Force recruiters will ultimately be responsible for SO/CS moving recruits through the SRD process, while scouts and developers will perform critical functions and offer their expert opinions to assist decisions regarding prospective applicants.

In addition to typical recruitment approaches (e.g., walk-ins to Air Force recruiting centers), recruiters in the SRD process will be expected to find events and venues that are likely to produce candidates with a propensity for SO/CS careers (e.g., Spartan races, CrossFit competitions, wrestling meets) and, when appropriate, reach out to coordinate the presence of a scout. Scouts will be current SO/CS personnel who will assist recruiters in introducing civilians to the SO/CS career fields by discussing opportunities and mission requirements at recruiting events. Scouts may also have a role with evaluating potential SO/CS candidates prior to beginning the screening process.

⁶ We provide more details about AFRS SME discussions in the Approach section of Chapter 5.

⁷ The SRD model was still in an early implementation stage at the time our study was conducted; as such, the description we provide might not fully align with how the model currently operates or will operate going forward.

Screening

For any person to apply to the Air Force, that person must first visit an Air Force recruiter who screens for basic eligibility (e.g., age, citizenship, clearance, and education). If the individual meets basic eligibility requirements, the recruiter schedules an appointment at a Military Entrance Processing Station (MEPS) so the applicant can undergo additional screening. MEPS screening includes a background check, a physical examination, a physical ability test, and completion of cognitive and noncognitive test batteries like the Armed Services Vocational Aptitude Battery (ASVAB), a test of cognitive ability, and the Tailored Adaptive Personality Assessment System (TAPAS), a personality assessment.⁸ If an individual meets the minimum standards for the Air Force and the SO/CS specialty, the individual can sign a Guaranteed Training Enlistment Program (GTEP) contract. This contract guarantees the individual an opportunity to try out for the specialty of interest, pending additional screening during the Delayed Entry Program (DEP), as well as during and after BMT. Before signing a GTEP contract, the SRD model emphasizes that recruiters provide realistic expectations for success and developmental timelines so that individuals can make informed decisions before entering the process (i.e., maintain transparency about the difficulty of succeeding in SO/CS specialties). If an individual is unsuccessful in pursuing a SO/CS career field, the Air Force retains the right to reclassify these individuals into another specialty or dismiss them from the Air Force.

Once a contract is signed, prospective SO/CS candidates will be entered into DEP so that they can physically and mentally prepare for training. While in DEP, candidates must pass the Physical Ability and Stamina Test (PAST), a physical test battery used by some of the HDHA specialties.⁹ To prepare for the PAST and the training pipeline, recruiters will put prospective SO/CS candidates in contact with a field developer (a former SO/CS airman who is contractor). Field developers will help administer the PAST to candidates. If candidates fail the PAST the first time they take it, developers are expected to recommend to recruiters whether the candidates have potential to pass the PAST and succeed in the SO/CS specialty. If a candidate is considered as having potential to pass the PAST, the developer may work to develop the candidate while in DEP. If the candidate does not have potential to pass the PAST, the developer would be expected to recommend that the recruiter work with the individual to select another specialty. For candidates who are allowed to remain for further development in DEP, developers are expected to help prepare them physically and mentally by providing guidance on safety, nutrition, and workout plans tailored to the pipeline of the SO/CS specialty.¹⁰ Ultimately, the developer provides recommendations on candidate potential, but recruiting makes the final decision on whether to send candidates to BMT.

⁸ We provide more background on current Air Force screening tools in Appendix A.

⁹ At the time of this report, EOD was not using the PAST for entry.

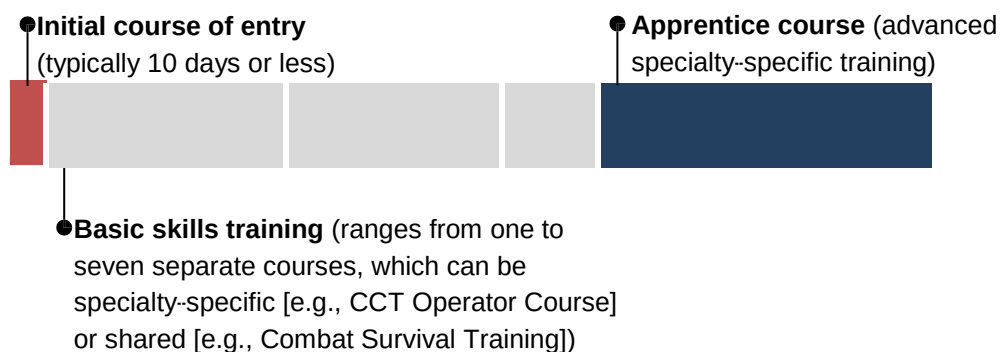
¹⁰ The specific duration that individuals are allowed to be in DEP is still under consideration.

When a prospective SO/CS candidate passes the PAST and is deemed ready for training, the recruiter will reserve a job and BMT “ship” date (i.e., date when candidates are sent to BMT). As this date approaches, candidates are expected to pass a final PAST (within 30 days of ship date) and given a final recommendation to proceed from the developer.

Training

All candidates must attend BMT with other Air Force trainees. After completion of BMT (which lasts eight and a half weeks), candidates will begin their specialty-specific technical training pipelines. Although HDHA-specialty technical training pipelines vary in content, length, and instructional approach, they have three broad commonalities. First, these pipelines are structured similarly. They all begin with a short initial course of entry, which is generally followed by basic skills training, and typically concludes with a specialty-specific course (also referred to as the apprentice course). Figure 1.1 summarizes these structural similarities.

Figure 1.1. HDHA-Specialty Technical Training Pipelines Are Structured Similarly



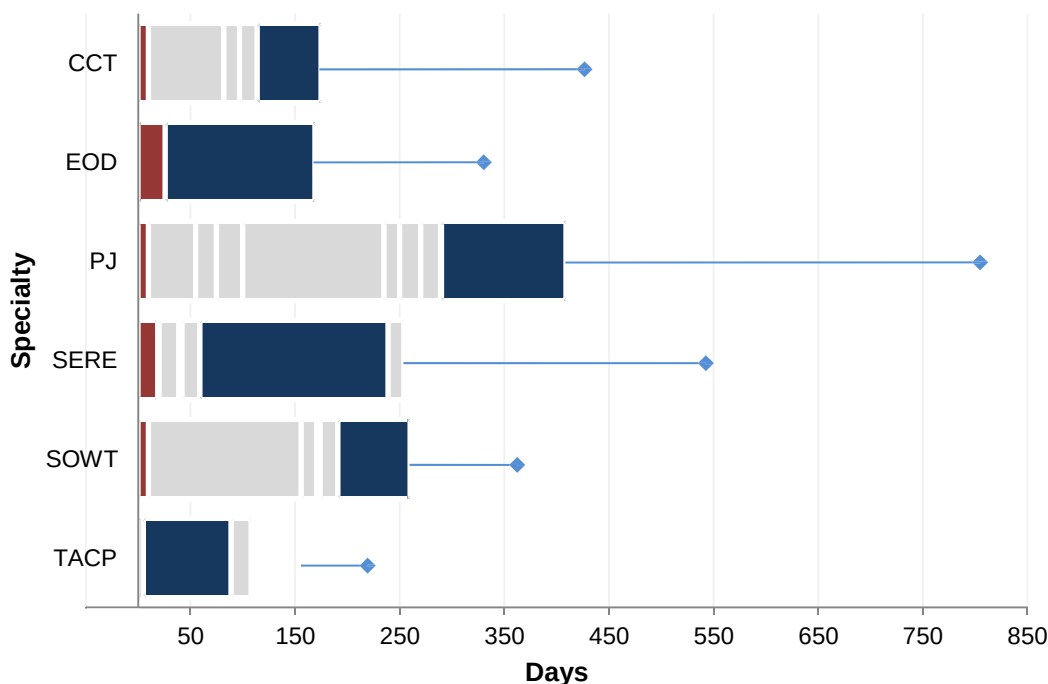
NOTE: The width of the bar represents the number of training days scheduled for a course. A white vertical line indicates the start of a new course.

Second, with some exceptions, the initial and apprentice courses have the highest attrition rates among the HDHA technical training pipeline (see Appendix B for course-specific attrition rates). Finally, completing the entire pipeline takes a long time. The actual pipeline duration extends well beyond the number of programmed technical training days. Except for TACP (whose students take an average of six months to complete technical training), the average completion time is nearly a year or longer.¹¹ Figure 1.2 presents specialty-specific information for the three pipeline commonalities and more accurately represents pipeline duration. Specifically, we differentiate the time scheduled for technical training (as indicated by the bars) and the average time to complete the pipeline (as indicated by the light blue lines). The average

¹¹ Estimates are based on Air Force TTMS data from January 2011 to December 2015.

pipeline completion time accounts for weekends, holidays, transitions between courses, and other delays (e.g., when a student must repeat a course [i.e., “wash back”] because of injury or performance).

Figure 1.2. Specialty-Specific Technical Training Pipeline Lengths



NOTE: Bars reflect programmed technical training days. Bar segments reflect courses (red = initial course, gray = basic skills training, blue = apprentice course), with white vertical lines indicating new courses. Blue lines reflect average time to complete the pipelines.

Interested readers can find more details on these training pipelines in Appendix B.

Our Approach

The overarching goal of our study was to identify ways for the Air Force to address training attrition from HDHA specialties. To meet this goal, we integrated information and findings based on our review of relevant documentation and research literature, discussions with SMEs, and analysis of quantitative recruiting, personnel, and cost data. We then developed recommendations and courses of action (COAs) for the Air Force to consider for improving HDHA-specialty training success. Below, we briefly outline our main approaches. Details about these approaches are presented in later chapters of the report and, as needed, in appendixes.

Document and Literature Reviews

As part of our initial search for information on the other services' special operations forces and civilian paramilitary organizations, we reviewed official websites, pamphlets, and other materials. As discussed in the next section, we followed up our document review with discussions.

In addition to our document review, we culled scientific literature to identify studies on improving HDHA-specialty training success. Our literature review was not limited to studies of Air Force specialties; we included studies on the other services and civilian paramilitary organizations (e.g., Federal Bureau of Investigation [FBI]). We also covered literature that described promising measures or methods for recruiting, screening, or development of HDHA-specialty candidates. Where possible, we focused on studies that provided evidence supporting the validity of tools and methods that could be useful for Air Force HDHA specialties.

Discussions with Subject--Matter Experts

We held discussions with SMEs about recruiting and training topics for Air Force HDHA specialties, other services' special operations/special forces (SF) specialties, and elite paramilitary organizations in the civilian sector. From these discussions, we aimed to identify historical and current policies, processes, and practices, as well as plans for changes in the future. We interviewed leaders, training instructors, recruiting experts, and other SMEs from the following organizations:

- Headquarters Air Force, Manpower, Personnel, and Services (AF/A1) (i.e., HDHA-specialty career field managers)
- AFRS
- Various AETC organizations¹²
- Army Special Operations Recruiting Battalion
- Army Special Warfare Center and School
- Naval Special Warfare (NSW; Navy SEALs)
- FBI—Critical Incident Response Group (FBI, undated-a), Tactical Operations Section
- U.S. Customs and Border Protection (CBP)—Special Operations Group.

We also attempted to collect information from the SRD contractor (i.e., field developers); however, due to contract renegotiations during the time of the study, we were unable to secure the permissions needed. This limited our ability to fully evaluate current and planned recruiting processes for HDHA specialties.

We provide more details on our SME discussions in Chapters 5 and 6 of the report.

¹² We held discussions with HDHA-specialty training cadre (e.g., training pipeline managers), as well as individuals who have previously or are currently conducting studies related to HDHA-specialty training. Their organizational affiliations vary and may have changed since they conducted the studies, which is why we do not list all the organizations here. We spoke with more than 20 individuals across AETC.

Quantitative Analyses

We used modeling and other quantitative techniques to analyze existing Air Force administrative data from AFRS and other Air Force sources, as well as publicly available data from the U.S. Census Bureau. Our analyses addressed questions concerning which recruit characteristics are associated with training attrition in the six HDHA specialties and how to establish targets and estimate costs for an intervention to reduce training attrition. As we will describe in later chapters, we used advanced analytic techniques to address some of the main limitations of traditional regression modeling approaches that have been used to examine training attrition.

Although we used all of the data made available to RAND, we are aware of other data that are relevant to the questions addressed in this study. We requested these data, but the steps to clean and process the data would have required resources beyond data providers' capabilities or the data were not provided out of concern for how the data would be used and interpreted.

Study Limitations

Most of the Air Force HDHA specialties in our study were previously closed to women.¹³ Therefore, our analysis and recommendations might not fully generalize to women interested in pursuing a career in one of these specialties. In particular, the Air Force would need additional data to identify the background characteristics of women with the interest to enter and motivation to succeed in these specialties. Similarly, analyses would be needed to determine how well the indicators of training success for men generalize to women. It is important to note, however, that collecting the additional data needed for these analyses will take time because of the length of these training pipelines and the expectation that fewer women will be physically qualified for these specialties (Szayna et al., 2016). Our analyses were also limited by the quality and completeness of the data available. A more detailed discussion of the data limitations is presented in Chapter 3.

Organization of This Report

In Chapter 2, we provide information on previous and ongoing efforts to improve HDHA-specialty training outcomes and the challenges of addressing training attrition for these specialties. The remainder of the report addresses the three main study questions across the topics of recruiting, screening, and development. Chapter 3 covers the first study question about

¹³ In 2013, then–Chairman of the Joint Chiefs of Staff Martin Dempsey and then–Secretary of Defense Leon Panetta issued a memorandum that rescinded the 1994 Direct Ground Combat Definition and Assignment Rule (DCAR), which excluded women from assignment to units and positions with primary missions involving direct ground combat. Special operations specialties, including those in the Air Force, were previously closed to women because of the DCAR. The memorandum gave the military services until January 2016 to develop “validated, gender-neutral occupational standards” for previously closed specialties (Dempsey and Panetta, 2013).

factors that predict training attrition; we present findings from our modeling of factors that predict attrition in HDHA-specialty training. The following chapter (Chapter 4) extends a main finding from Chapter 3 about the importance of physical fitness to training success in HDHA specialties, particularly PJ. Specifically, Chapter 4 presents findings from a policy simulation to demonstrate the potential tradeoffs of a fitness development program designed to improve candidates' chances of success in the PJ training pipeline, and provides recommendations for implementing a fitness program for HDHA specialties. Chapters 5 and 6 focus on the second study question about gaps in recruiting (Chapter 5) and screening (Chapter 6). These chapters present our qualitative gap analyses and provide recommendations for addressing gaps. Our third study question about methods to improve training success is covered by the recommendations in Chapters 4 through 7. Our final chapter (Chapter 7) briefly summarizes the study's main conclusions and implications of our findings, and offers an overarching recommendation that cuts across recruiting, screening, and development topics.

This report also includes appendices with additional information on HDHA specialties and on our study methodology. Appendix A provides details on the screening tools that were being used for the Air Force HDHA specialties at the time this study was conducted. Appendix B describes the six Air Force HDHA specialty training pipelines. Appendix C provides results from logistic regressions to supplement our results from Chapter 3. Finally, Appendix D offers information on how we calculated attrition costs and offsets for our preliminary cost analysis in Chapter 4.

2. Efforts to Improve HDHA--Specialty Training Outcomes

Policy options for improving the Air Force's ability to create high-quality HDHA-specialty operators fall into three functional areas. Policies can attempt to change the individuals drawn out of the eligible population and into the HDHA-specialty pipeline (recruiting), they can change the standards that recruits must meet before they are accepted into training (screening), or they can invest time and resources into improving or developing candidate capabilities at any point in the process (development). These three functional areas are interdependent, some activities occurring at the same time. Thus, opportunities and challenges in one area affect the other areas.

To complicate matters, different Air Force entities are involved with the three functional areas. The roles for those entities are outlined in a number of Air Force policy documents. For example, Air Force policy specifies roles and requirements for administering training. Relevant to this study, operations organizations in Headquarters AETC and Second Air Force (2AF) share a common responsibility to "[i]dentify and resolve problems associated with actual elimination rates exceeding programmed elimination rates" (Air Education and Training Command 36-2642, 2016, p. 14). Programmed elimination rates are developed by the training units under the guidance of 2AF and establish a baseline for determining how many recruits are enrolled in a specialty's training pipeline. As a general rule, more recruits are needed as the programmed elimination rate increases. The number of recruits required is also influenced by manpower requirements. However, the responsibility for providing guidance, direction, and oversight of recruiting programs falls under the authority of the Assistant Secretary of the Air Force for Manpower and Reserve Affairs (Air Force Policy Directive 36-19, 2014) with specific guidance on the procedures to recruit and select applicants provided in Air Force Instruction 36-1901 (2017). Finally, policies affecting accessions and the screening of recruits are primarily the responsibility of the Deputy Chief of Staff for Manpower, Personnel, and Services (AF/A1). Within AF/A1, the Accession and Training Management Division (AF/A1PT) provides oversight of research conducted by different Air Force units, such as the Strategic Research and Assessment arm of the Air Force Personnel Center (AFPC/DSYX), which conducts studies to evaluate the validity and effectiveness of screening tools and establish minimum entry requirements for occupational specialties.

This chapter begins with brief descriptions of prior and ongoing efforts to improve HDHA-specialty training outcomes in the Air Force. We follow the description of efforts to improve training outcomes with an outline of the main challenges in addressing training attrition for these specialties. Challenges are not limited to activities that occur during training but begin at recruitment.

Previous and Ongoing Efforts to Improve HDHA-Specialty Training Success

As we describe below, several organizations inside and outside the Air Force have been involved in efforts to improve training outcomes for HDHA specialties. Not all of these efforts have been integrated or independently evaluated in a systematic way, leading to many “stovepiped” efforts.

Studies

Air Force studies to improve HDHA-specialty training success have been conducted by several different organizations, including the Air Force Research Laboratory (AFRL), AFPC, AFRS, and HQ AETC organizations. We outline studies that are published or have been described to us by SMEs we interviewed for this project. We follow with a short description of notable studies conducted by organizations outside the Air Force but on behalf of the Air Force.

AFRL

In 2010, AFRL researchers have published at least three studies on medical and physical readiness for HDHA-specialty training. Walker et al. (2011) examined factors associated with success in the CCT training pipeline. Successful CCT trainees had higher-than-average levels of aerobic and anaerobic fitness compared with college athlete norms and higher-than-average levels of mental toughness, extraversion, and conscientiousness compared with men in the U.S. population. They also had less than average levels of neuroticism and openness to experience than U.S. males. The authors argued that identifying the profile of successful CCT training candidates will allow the Air Force to refine selection into and training for the CCT specialty.

In another AFRL study with the 720th Special Tactics Training Squadron (STTS), Walker et al. (2010) developed an eight-week fitness program for CCTs before they attend combat dive school. The authors promoted a functional fitness program and found improvements in physical fitness, and a reduction in injuries and attrition. They noted that the 720th STTS adopted several of the study recommendations, including the use of functional fitness training over a traditional fitness training regime.

An AFRL study by Nishikawa, Sjoberg, and Maupin (2010) reviewed medical reasons for HDHA-specialty training attrition, using medical and training attrition data from 2004 to 2010. The authors recommended that AETC capture more information on medical events during training, expand training attrition data collection to all HDHA-specialty training sites (including non-Air Force sites), enable medical oversight of HDHA-specialty training pipelines, and offer more details on attrition for courses with high levels of medical attrition.

HQ AETC

In the 2010–2012 time frame, AETC A2/3/10 researchers conducted studies to develop prototype screening models for HDHA specialties.¹⁴ In addition to the ASVAB and PAST, the models included such noncognitive measures as the Emotional Quotient Inventory (EQ-i)¹⁵ and Basic Water Skills Test (BWST). The researchers also developed a questionnaire to assess candidate motivations for choosing HDHA specialties. Researchers at the U.S. Air Force School of Aerospace Medicine (USAFSAM) within AFRL have continued aspects of this work, with a focus on using noncognitive tools to assist flight surgeons in addressing the suitability of HDHA-specialty trainees for operations in flight.

AFPC and AFRS

In 2013, Rose, Manley, and Weissmuller from AFPC/DSYX published a report on their development of screening models to improve success in enlisted BA and BA support specialties (i.e., HDHA specialties). The models included three factors that are used or have been used to screen HDHA-specialty recruits: cognitive ability (ASVAB), personality (TAPAS), and physical ability (PAST). The authors argue that their results show that the three factors predict training completion and are likely to “improve the qualification rates of applicants selected in each of the respective [Air Force specialties]” (p. 9). The authors recommended that the Air Force set passing scores on the measures of the three factors but also to validate the passing scores on a periodic basis. Since publication of the 2013 report, AFPC has worked with AFRS on a concept of operations (CONOPS) for optimizing the preaccession process for BA and BA support specialties (as discussed in a subsequent section “Other Efforts”).

Studies by Non–Air Force Organizations

The Air Force has also asked external organizations to study HDHA-specialty training success.¹⁶ For example, a 2011 study by Kalns et al. from Hyperion Biotechnology examined which of 54 demographic, cognitive, psychological, physical, and biological factors would predict success or failure in TACP training, using data from August 2008 to February 2009. They identified four out of 54 assessments as useful predictors: run time, number of miles run per week in the last year, a fatigue biomarker, and height.

In 2012, Manacapilli and colleagues at RAND reported on FYs 2008 and 2009 studies examining ways to reduce attrition in five select Air Force specialties, three of which were CCT,

¹⁴ We learned of the efforts in this section through interviews with SMEs at HQ AETC.

¹⁵ The EQ-i is a self-report inventory that emphasizes the emotional, personal, and social elements of intelligent behavior (Dawda and Hart, 2000).

¹⁶ Other studies have examined Air Force HDHA-specialties but were not sponsored by the Air Force. For example, in a study sponsored by the U.S. Special Operations Command (AFSOC), Harrell et al. (1999) examined barriers for minorities to participate in special operations forces. The study covered CCT and PJ specialties for the Air Force. Because this and other studies were not sponsored by the Air Force, we do not describe them here.

EOD, and PJ. They recommended specialty-specific and cross-cutting changes to address training attrition in the five specialties they examined. Examples of specialty-specific recommendations for CCT, EOD, and PJ include:

- **CCT:** Because attrition was lower in classes that included officers, consider spacing out officers across CCT classes.
- **EOD:** Send more prior service (midcareer) airmen to the EOD apprentice course since they tend to have higher graduation rates than non-prior service students.
- **PJ:** To ensure that physical fitness does not decline during BMT, use Fit Flights to maintain fitness of PJ (and CCT) trainees in BMT.

Cross-cutting issues focused on giving better career field information to recruits, adjusting training-base hours and reducing the training day, and adjusting the Phase Program¹⁷ that follows BMT. As we will discuss later in this report, some of the recommendations from the Manacapilli et al. (2012) report have not been implemented but are worth consideration.

Other Efforts

In addition to studies on HDHA-specialty training, AETC and AFSOC have efforts to improve BA recruitment, screening, and development. In 2016, AETC stood up a BA Training Group to focus on BA-specific training needs. It includes five squadrons that “consolidate and organize already existing training courses under BA leadership” (502nd Air Base Wing Public Affairs, 2016). The BA Training Group has been considering a multiweek introductory course for enlisted BA specialties. The course would prepare candidates in fitness, water confidence, and basic combat skills (e.g., how to prepare a ruck sack).

As discussed in Chapter 1, AETC recently developed the SRD model for SO/CS specialties. AFRS has also contracted a marketing firm to create marketing materials for SO/CS recruitment, including a new smartphone application that allows users to virtually experience one of a handful of SO/CS mission sets (e.g., a high-altitude jump from an aircraft). Although AFRS is working to apply the SRD model to improve recruiting of high-quality candidates into SO/CS specialties, it is unclear how well the model will work to recruit high-quality female candidates given that most of these specialties were closed to women until recently.¹⁸

Within AFSOC, the 24 Special Operations Wing has implemented a program to recruit and select individuals from other Air Force specialties¹⁹ for the CCT specialty and the SOWT specialty. The program began in FY 2010 and includes briefs to Air Force personnel at different bases on what it means to be CCT (or SOWT) and Air Force special operations forces. Candidates go through a week-long selection and assessment course, akin to the selection

¹⁷ The Phase Program no longer exists.

¹⁸ See earlier footnote about the rescinding of the 1994 DCAR.

¹⁹ Air Force personnel who are serving in one specialty and cross over to another one are referred to as “cross trainees” when they are in training for the new specialty.

process used by Special Tactics Officers (STOs), the officer counterpart to CCT. Recently, PJs began a similar program for their specialty.

Challenges in Addressing Training Attrition in HDHA Specialties

Despite the efforts to address HDHA-specialty training attrition over the years, training attrition remains high. As we noted earlier, part of the challenge in addressing training attrition is that past efforts have not been integrated in a systematic way, leading to gaps and duplicated efforts. This lack of integration is particularly problematic because recruiting, screening, and development processes affect each other and changes to one area need to be understood relative to the other two areas. Below, we describe how the utility of screening assessments—the focus of many attrition studies—is affected by recruiting and training (or development) factors. We then provide a brief description of other HDHA-specialty challenges in the area of recruiting and offer some context about training attrition challenges for HDHA specialties more generally.

Recruiting Is Crucial to Improve Utility of Screening Assessments

It is important to first understand how the three functions of recruiting, screening, and development interact in ways that affect their relative utility. Assuming that the quality of the recruiting pool does not change, the utility of a screening tool is affected primarily by three factors (Taylor and Russell, 1939): validity of the screening assessment, base rate of the outcome (e.g., training success), and the selection ratio. The most important factor is the validity, both the criterion-related validity and the incremental validity, of the screening tool. The criterion-related validity is the extent to which the screening tool predicts performance on some outcome measure, such as training attrition. A tool that strongly predicts the outcome is said to have high criterion-related validity. Because most selection systems typically use more than one screening tool, it is also important to examine a tool's incremental validity, which is the extent to which the additional assessment predicts the outcome above and beyond other screening assessments already in use. A screening assessment may have high criterion-related validity but low incremental validity, which would mean there is little value in using the additional assessment.

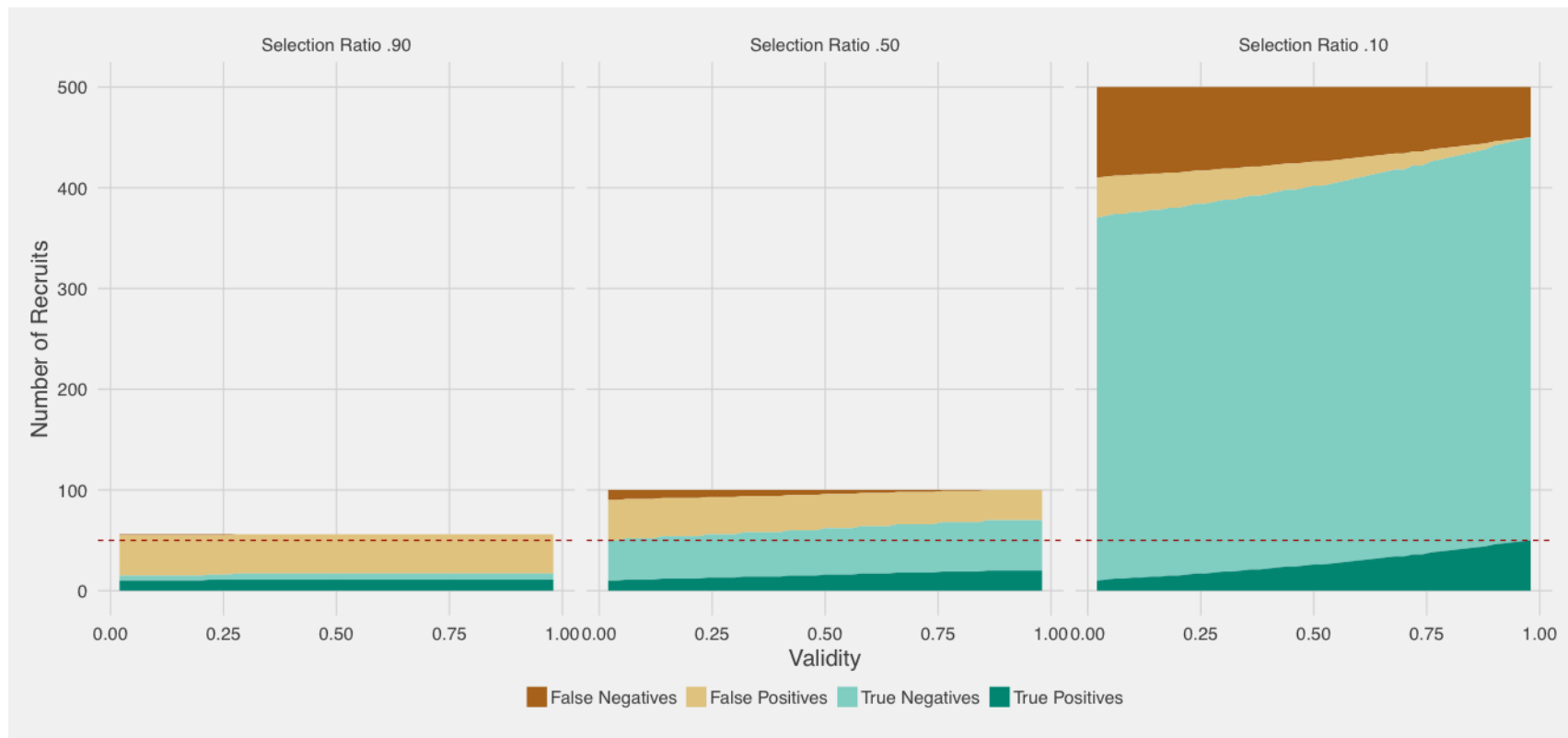
Another important factor for utility is the base rate of the outcome. In the context of the six HDHA specialties we examined in this study, the base rate of success is quite low. Screening assessments are the most valuable when the base rate is 0.50 (e.g., half of the students make it through training). When the base rate of success is either very high (e.g., 0.90) or very low (e.g., .10), the utility of screening assessments is diminished. For example, it is more difficult to identify the ten individuals out of 100 who will succeed if only 10 percent are expected to succeed than if 50 percent are expected to succeed. That is, if 50 percent were to succeed, a valid screening assessment has a good chance of identifying at least ten successful individuals when there are 50 individuals who would be successful.

The third factor affecting utility is the selection ratio, which is the percentage of candidates accepted into the pipeline. A high selection ratio indicates that a high proportion of candidates will be accepted into the pipeline. In contrast, a low selection ratio indicates a more selective screening system. In general, screening assessments will yield their greatest value when the selection ratio is low (i.e., more selective).

Putting the three factors that affect the utility of screening assessments into the context of HDHA specialties, the current conditions are not ideal for placing additional emphasis on screening assessments. Specifically, HDHA specialties have very high selection ratios and very low base rate of success. Consequently, spending additional resources to find or develop an additional screening assessment with higher criterion-related validity will yield very little in addressing the underlying problem of attrition unless significantly more recruits are identified. Adding recruits provides the opportunity for the Air Force to be more selective in who will be invited to a HDHA-specialty training pipeline. The impact of being more selective (i.e., lower selection ratios) is illustrated in Figure 2.1. This figure illustrates the selection outcomes under different recruiting and screening scenarios. Each chart is developed based on the assumption that there is a 20-percent base rate of success and that 50 positions need to be filled (dotted red line). Going from left to right, the charts show outcomes for decreasing selection ratios (0.90, 0.50, and 0.10), as indicated at the top of each chart. Results are also shown across a range of screening assessment validities, which are marked along each chart's X-axis.

Screening assessment validities are measured as correlations between the screening assessment and training success. The types of outcomes for recruits are reflected by the different color regions on the charts. There are four possible outcomes: (1) false negatives (dark brown), which represent individuals who were not selected for training but would have succeeded; (2) false positives (light brown), which represent individuals selected for training who would not succeed; (3) true negatives (light green), which represent individuals who were not selected and would not have succeeded; and (4) true positives (dark green), which represent individuals who were selected and would succeed.

Figure 2.1. Selection Outcomes Expected with a Training Success Base Rate of .20



Overall, this figure highlights the challenge of identifying qualified candidates who will fully succeed in a typical HDHA specialty's training pipeline. The first chart presents a case in which 90 percent of the recruits are selected for training. In this case, decisionmaking is not very accurate, even when the validity of a screening assessment improves. This outcome occurs primarily because few decisions are being made based on the screening assessment. The center chart presents a case in which the selection ratio improves and only 50 percent of recruits are selected for the training pipeline. In this case, decisionmaking improves considerably over the first case but mostly because of the identification of the false negatives—screening out those who will not succeed. Finally, the third chart presents an optimal yet very unlikely case in which there are ample recruits from which to screen. In this case, the validity of the screening tool has a large impact on identifying candidates who will succeed in the training pipeline.

Taking into account these factors, it is not surprising that the HDHA specialties and other similar organizations with HDHA specialties find it challenging to significantly reduce training attrition. Although there can be value in addressing gaps in screening assessments (as discussed below), additional efforts are needed to improve the size and quality of the recruiting pool. In the next section, we discuss some of the existing challenges in successfully recruiting candidates for the Air Force's HDHA specialties.

Recruiting for Air Force HDHA Specialties Is Challenging Because of Incomplete Information on Recruits and Limited Public Awareness of the Specialties

As we will discuss in more detail later in the report, the Air Force has difficulty recruiting enough candidates who can pass the screening and training requirements for the six HDHA specialties covered in this study. The recruiting challenge is not new. In a RAND report on barriers for minorities to enter special operations forces, Harrell et al. (1999, p. 37) comment that “recruiters are not very successful in screening for the qualities that ensure success in the CCT/PJ program.”

Part of the challenge is that there are gaps in the information available about recruits who will be successful in HDHA specialties. For example, many trainees lack motivation to remain in HDHA-specialty training and self-eliminate early in the pipeline. Specifically, from FYs 2011–2016, about 53 percent of eliminations from the initial training course across the six HDHA-specialty pipelines were self-initiated eliminations (SIEs). The next closest category of eliminations was performance problems (29 percent). Understanding why over half of initial-course eliminations are SIEs can help the Air Force identify solutions to reduce SIEs and save costs on lost training slots. Unfortunately, to date the work on trainee motivation in HDHA-specialty pipelines has not provided a comprehensive picture of the SIE challenge.

Another challenge for recruiting is that the six HDHA specialties in the Air Force are not as well known as other the sister services' special operations specialties (e.g., Navy SEALs, Army SF). A general lack of awareness in the general population for Air Force HDHA specialties significantly increases the difficulty in recruiting for these specialties. Even when there is an

awareness of these specialties, there may be misconceptions about the career field and training requirements. Consequently, some recruits meeting the minimum screening requirements may appear to have the potential for success, but subsequently withdraw from training because it was not what they expected. HDHA-specialty students who ultimately self-eliminate from training place further strains on recruiting to find more high-potential recruits to help HDHA specialties meet manning requirements. These challenges result in conflict between the training community, which only wants the “right” candidates and the recruiting community, which is required to meet quotas.

Limited Information on Training Environment Can Constrain the Air Force’s Ability to Identify Ways to Reduce HDHA--Specialty Training Attrition

The six HDHA specialties in our study are not alone in having high levels of attrition. Sister services’ special operations specialties also have high training attrition. According to the Navy SEAL’s recruiting website, about 75 percent to 80 percent of SEAL candidates do not make it through SEAL training (U.S. Navy SEAL + SWCC Scout Team, 2015). Army SF has high attrition (about 70 percent) from the initial selection course, Special Forces Assessment and Selection (SFAS). However, only 30 percent of those who make it through SFAS drop out of SF training (Special Forces Qualification Course [“Q course”]).²⁰

The high levels of training attrition for special operations and SF across services suggests there is something common to these specialties that keeps training attrition high. The most obvious issue is that these specialties have physically and mentally demanding training requirements, which many individuals cannot meet. Another issue involves motivation, as discussed earlier with SIEs. We also learned of issues with SIEs (known as “voluntary withdrawals” for Army SF and “drops on request” for Navy SEALs) in other special operations training pipelines. We will discuss ways to address the motivation issue in more detail in Chapter 6.

Although the physical and mental demands may explain some of the attrition from special operations training, earlier research on training attrition in the military suggests there may be other training environment factors that affect attrition. Buddin (1988) examined trends in attrition from basic and technical training for each military service for FYs 1982–1985 and found that training attrition varied by training location, length of time that recruits spent in DEP prior to training, and year, even after controlling for recruit “quality” in each cohort (e.g., controls for the Armed Forces Qualification Test [AFQT] scores, age, education level).²¹ Although Buddin could not pinpoint specific reasons for the results, he argued that they suggest that the services apply

²⁰ The Army’s Special Warfare Center and School, which runs selection and training for Army SF, provided these training attrition estimates during a February 2016 interview with the project team.

²¹ Because all Air Force BMT occurs at one location (Lackland Air Force Base [AFB]), the authors could not do a cross-location comparison for the Air Force.

training attrition policies and practices differently across locations and years. Changes in training curriculum can also affect attrition rates, even if only temporarily, as observed by Manacapilli et al. (2012). Although some curriculum changes can be traced to specific points in time, other changes may be more difficult to pinpoint.

Isolating the effects of modifications (e.g., curriculum changes, variable application of training policies) is difficult because modifications might not occur independently of other changes, can be phased in over time, and may not be well documented. For example, the EOD specialty modified its preliminary training course from a six-day, mostly academic course to a 20-day course that included physical fitness training and hands-on practical exercises in 2011 (Hawkins, 2012b).²² The reason for the change was to reduce SIEs and wash outs from the follow-on EOD apprentice course, which is run by the Navy EOD school. In our discussion with EOD SMEs, we learned that the changes started in 2011 but were phased in over time. In 2016, the Air Force had suspended the PAST for screening EOD candidates while awaiting results from a physical demands study led by the Air Force. The suspension of the PAST will likely affect the physical fitness of candidates entering the EOD pipeline. Because we did not have detailed information on training modifications over time, we did not systematically analyze how changes to HDHA-specialty training pipelines affect training attrition. As discussed in the next chapter, we included a time trend in our models to account for time-sensitive factors that affect training attrition even though we cannot specify what the time-sensitive factors include. In general, we acknowledge that a better understanding of how training modifications affect training attrition could help identify ways to reduce training attrition.

Conclusion

Although the Air Force continues to look for ways to reduce attrition from its HDHA-specialty training pipelines, previous attempts have resulted in minimal, if any, sustained improvement in graduation rates. Part of the challenge to addressing attrition has been the lack of integration in efforts within and on behalf of the Air Force. This stovepiping of efforts compounds the problem of addressing training attrition because changes to one functional area (i.e., recruiting, screening, or development) affect the other two areas. Our overview of the interdependency of recruiting, screening, and training (development) underscores the importance of coordinating across functional areas to better understand how different policy changes interact to affect attrition rates. Although some may suggest that attracting more qualified recruits will reduce attrition, a lack of systematic collection of detailed information on recruits and changes to the training environment will limit the Air Force's ability to identify ways to reduce training attrition.

²² The EOD preliminary training course has since been extended to 26 days. See Appendix A for details on the EOD training pipeline.

3. Recruit Characteristics Associated with HDHA--Specialty Training Success

In view of the persistently high training attrition in HDHA specialties, a key question for policymakers is whether changes in the characteristics of recruits entering the pipeline have the potential to reduce attrition. For example, while there is clearly a need for recruits to have high levels of cognitive ability and physical fitness, additional research is needed to explore whether recruits with particular noncognitive characteristics (e.g., personality traits) have lower attrition, even conditional on physical fitness and cognitive ability. The discovery of other characteristics that relate strongly to success in training could help to focus recruiting efforts or improve screening, which in turn could theoretically reduce attrition. This chapter adds to this body of knowledge by exploring whether other characteristics available in Air Force administrative records can improve a recruit's success forecast, conditional on knowledge of the recruit's physical fitness levels and cognitive ability.

Data Sources

Recruit Characteristics

Investigating the relationship between recruit characteristics and training success requires information from several different sources. For this study, AFRS provided information on recent HDHA-specialty recruit characteristics, including the results of the PAST and the ASVAB.²³ AFRS data also include demographic characteristics, such as age, education level, race/ethnicity, and marital/dependent status, as well as information on some high school activities the recruit participated in, waivers they received in the recruiting process, and Air Force Specialty Code (AFSC) preferences. In addition to the AFRS data, the Air Force provided recruit scores on the TAPAS, a noncognitive assessment of personality developed for the U.S. Army and used in screening at MEPS (see Appendix A for more details). The TAPAS data have sufficient information on 15 personality facets that we incorporated into this analysis. Finally, we sought to measure recruits' socioeconomic backgrounds by linking geographic information in the AFRS data to population characteristics from the U.S. Census Bureau. This permits the analysis to examine whether recruits from more educated or wealthier areas have different success prospects than other recruits, or whether recruits from highly military areas (where there may be more cultural knowledge about the demands of HDHA specialties) are more likely to succeed.

²³ To simplify language for presenting findings in this chapter, we use the shorthand term *fitness* to refer to *physical fitness*. We also use the term *aptitude* when referring to use of the ASVAB in our study. When discussing the broader concept that tests like the ASVAB measure, we use the term *cognitive ability*.

Table 3.1 provides a complete list of all variables that this analysis includes, by category. Subsequent sections will reference these categories when discussing which variables improve predictive performance.

Table 3.1. Potential Predictors of Training Success, By Category

Category
Fitness (PAST)
Pull-ups
Push-ups
Sit-ups
1.5-mile run
500-meter swim ^a
200-meter swim ^b
Aptitude (ASVAB)
Nine individual subtests ^c
Mechanical, administrative, general, and electronic (MAGE) composites ^d
AFQT composite ^e
Individual characteristics
HDHA AFSC as top preference
JROTC/Civil Air Patrol/Eagle Scout
Married/has minor dependents
Age
Race/ethnicity
Received wavier (moral, financial, physical)
Admitted drug use
Body mass index
Level of education
Full-time employment history
Previously failed a PAST event

Category
Census demographics ^g
Unemployment rate/median income
Percentage active duty or veteran
Percentage below poverty
Percentage with bachelor's degree
^a Only applies to CCT, PJ, and SOWT.
^b Only applies to SERE.
^c ASVAB subtest names are listed in Table C.1.
^d Including the composite scores in addition to the individual subtests was beneficial for predicting observations that were missing subtest scores but had composite scores.
^e AFQT is a composite of four ASVAB subtests (arithmetic reasoning, mathematics knowledge, paragraph comprehension, and word knowledge). Scores on these subtests are combined into a percentile score that is used as a basic entry qualification for enlistment.
^f TAPAS facet names are listed in Table C.2.
^g Census demographics were based on the zip code associated with each recruit's most recent high school.

Training Course Outcomes and Possible Approaches

The Air Force also provided data from two sources that we used to construct HDHA-specialty course outcomes from 2011 through 2015. AETC manages many aspects of training through a centralized architecture known as the TTMS. Among other functions, TTMS tracks individual training events that occur in AETC courses, such as enrollment, graduation, and elimination. Because many HDHA specialties require courses that are managed by other commands (or other services), we also received data from Oracle Training Administration (OTA), which the Air Force Personnel Center uses to manage all formal training throughout the Air Force.

Initially, the level of detail in the raw data seemed to permit broad possibilities for characterizing training outcomes. With the event-level data in TTMS, it is possible to reconstruct each trainee's path through the pipeline, including delays that occurred due to performance issues (i.e., "wash backs"). The data also include some test scores and more detailed information on the circumstances and reasons that surrounded wash backs and eliminations. We explored ways to exploit this rich information by modeling a recruit's path through the entire pipeline as a network with nodes for each course, and we sought to study continuous duration and reasons for elimination in addition to ultimate success/failure. However, anomalies in the data²⁴ and

²⁴ Due to the length of the training pipelines, the fact that there are many potential paths to completing each pipeline, and the prevalence of gaps in course information, the network analysis was not able to yield any additional

time/resource constraints led us to decide that focusing on elimination in the major required courses for each specialty as a dichotomous outcome was the most reliable approach.

For example, elimination reasons could have informed policy if the predictors differed according to the type of elimination. The predictors of SIEs are of particular importance because these eliminations are within the recruit's control. However, in the TTMS data, SIEs are virtually nonexistent in the TACP pipeline, but common in others. Discussions with SMEs revealed that there is subjectivity in classifying elimination reasons that likely cause coding practices to differ across pipelines and over time, leading us to question the value of attempting to model separate classes of elimination. These inconsistencies have also been noted in previous research, which examined individual student files from which the reasons are derived and still found there was insufficient information to identify factors that contributed to the elimination (Manacapilli et al., 2012). Therefore, although we explored a variety of potential ways to use this rich information, this chapter presents results examining the relationship between recruit characteristics and the likelihood of completing all courses in the pipeline.

Data Limitations

There are two significant limitations in the data that are important to keep in view. First, there are pervasive gaps in the information available throughout the data. Some of these gaps arise because trainees show up in only certain data sources (e.g., some trainees have AFRS records but no TAPAS information), while gaps within a single source are also common (e.g., some trainees in the AFRS data with PAST scores are missing ASVAB scores). The methodology is able to accommodate the gaps in information fluidly (as discussed below), but these gaps decrease the amount of recruit information entering the model and degrade predictive performance. For example, recruits who lack TAPAS information will not be better predicted by models, including TAPAS, even if TAPAS facets strongly relate to success.

Table 3.2 summarizes the patterns of missing data by showing the number of observations that occur in the course outcomes data in the first column, followed by the number and percentage of observations that could be matched to the other sources. The values in Table 3.2 show that there is a significant loss of information due to data capture processes. The analysis in this chapter includes all trainees that could be matched to a data source, restricted to cohorts with sufficient time to complete the entire pipeline.²⁵

insight. Additionally, discrepancies in trainee elimination dates, such as eliminations that occurred after the respective course end dates, deterred us from attempting to analyze training duration.

²⁵ For CCT, PJ, and SOWT, we excluded cohorts that began in 2014 or later. For TACP, SERE, and EOD, we excluded cohorts that began in 2015 or later.

Table 3.2. Number and Percentage of Observations Present Across Data Sources

Pipeline	Present in TTMS/OTA Data	At Least One Predictor Available		Present in AFRS Data		Present in TAPAS Data		Matched to Census Data	
	N	N	%	N	%	N	%	N	%
CCT	1,396	1,195	86%	1,105	79%	739	53%	990	71%
TACP	2,126	1,618	76%	1,455	68%	923	43%	1,290	61%
SERE	1,215	1,123	92%	1,066	88%	674	55%	970	80%
PJ	2,386	2,031	85%	1,861	78%	1,274	53%	1,661	70%
SOWT	308	287	93%	271	88%	161	52%	241	78%
EOD	1,927	1,673	87%	1,565	81%	1,443	75%	1,071	56%

NOTE: In order to be included in the analysis, a recruit that is present in the outcomes data (TTMS/OTA) had to be matched to at least one predictor data source. In order to be matched to Census data, the recruit needed a valid zip code associated with his or her high school of record that could be matched to a file of demographic summary statistics created from the American Community Survey.

The second limitation in the data involves the quality of some variables that the analysis includes. There is potential concern over the fitness information in the AFRS data, as fitness could change between fitness testing as a recruit and attendance in the pipeline. There could also be inconsistencies in the administration of the PAST test, as SMEs suggested that different test administrators may differ in how strictly they uphold rules for proper push-up and pull-up form, for example. In addition, TAPAS underwent several revisions over the relevant time period in the data,²⁶ and some versions of TAPAS could be less predictive of success (hence, the need for refinement). Furthermore, the aggregate background characteristics from the census data could be poor proxies for individual recruit socioeconomic backgrounds—either because some recruits differ from the average resident or because recruits could have recently moved. Such factors may result in underestimating the true relationship between these characteristics and training success.

With these limitations in view, the lack of a strong relationship between a given characteristic and success in training does not necessarily mean that the characteristic is irrelevant. For characteristics such as personality traits—where there is prior evidence that they relate to performance and related criteria in other contexts including adaptive performance (Huang et al., 2014), contextual performance (Judge et al., 2013), and organizational commitment (Choi, Oh, and Colbert, 2015)—one must also consider whether more complete data or more precise measurement would lead to different conclusions. In particular, more complete data and more precise measurement should be considered if the mechanisms causing

²⁶ We considered limiting the TAPAS information to certain versions that SMEs thought would be most effective, but we decided to use all available TAPAS information considering the large number of recruits without scores. Because the regression methodology can flexibly capture changes in the relationship between TAPAS facets and attrition over time, there was no need to specifically control for the particular TAPAS version in the model.

the missing data are related to the training outcomes or if the measurement noise is too large relative to the strength of relationship between a characteristic and outcome.

Generalized Boosted Models Address Limitations of Traditional Regression Models

We sought to examine the question of whether characteristics beyond current screening measures can improve predictions of the success likelihood for candidates before they enter training. This question requires (1) a method for predicting success prospects, and (2) a way to evaluate the quality of those predictions to see if new characteristics improve prediction accuracy.

Regarding our method for predicting success, we sought an analytic approach that would overcome the limitations of the regression methods that researchers typically use to examine training attrition. Traditional generalized linear regression models cannot handle the large number of highly correlated variables we seek to examine—forcing the researcher either to choose a subset of variables or combine them in some way. Yet we lack a strong theoretical grounding on which measures to include or how to combine them into aggregate measures, particularly with TAPAS facets. Furthermore, if there is utility in variables beyond fitness and aptitude, it is likely to involve a complex process where these additional variables interact with fitness or aptitude or violate assumptions of linearity. For example, with the personality measures captured by TAPAS, the traditional regression approach would test whether marginal increases in a given trait correlate linearly with success among candidates similar in other respects. This approach would tend to discover a strong relationship between a single trait and success, but a richer model that can detect patterns where success depends on a certain combination of traits is more desirable.²⁷ Finally, our data have many gaps, so an ideal method would handle missing data seamlessly, but traditional methods require a separate process for filling in gaps with likely values before estimation is possible. These limitations mean that if traditional methods generated a null finding, it is difficult to rule out the possibility that such a finding was an artifact of our modeling decisions and assumptions.

To overcome the challenges associated with traditional regression models, we use generalized boosted models (GBMs) to analyze the relationship between recruit characteristics and success in training (Ridgeway, Madigan, and Richardson, 1999). A GBM uses a statistical learning algorithm that slowly maps the relationship between the characteristics and success likelihood with thousands of iterations. With each iteration, the model canvasses the variable pool and selects the combination of variables that best explains the remaining patterns of success, conditional on previous iterations. When the GBM algorithm selects variables, it

²⁷ Interactions among variables may be added to the traditional linear regression approach, but at the expense of accommodating fewer variables and still with constraints to the form of the relationship.

incorporates them into the model in nonparametric combinations that can find and approximate complex multivariate relationships between the characteristics and success (for a deeper, yet intuitive, description of the GBM method, see Ridgeway, 2007; a textbook discussion can be found in Chapter 10 of Hastie, Tibshirani, and Friedman, 2009).

GBMs overcome the limitations of traditional methods in the following ways. They can handle large numbers of highly correlated variables, because they do not force any of them to be included. Instead, the potential characteristics represent options available to the learning algorithm, and the actual model includes only the pieces of information in these variables that best predict success. Regarding the fear that linear models might miss complex interactions in characteristics such as TAPAS facets, each iteration of the GBM searches the data for combinations of variables that improve predictions without assumptions of linearity. Combining the thousands of iterations into a final model can approximate the complex process by which the characteristics influence success, “just like a sequence of line segments can approximate a smooth curve” (McCaffrey, Ridgeway, and Morral, 2004). Finally, GBMs also handle missing data well. Instead of imputing missing data points, the GBM utilizes its nonparametric structure to work around them, which ensures that each recruit with a record in the data set receives the best possible prediction based on what is known about him or her. All of these attributes of GBMs help to ensure a level playing field for model comparisons that is not subject to our modeling decisions.

The drawback inherent in the GBM approach is the complexity of the model itself, which is a combination of thousands of smaller models. The GBM serves as a flexible, nonparametric tool with which to measure the maximum predicted value added by each set of variables. If this analysis were to identify new predictors that appear valuable, additional analyses would be necessary before the findings could be translated into practical recommendations for recruiting or screening.

The Coefficient of Discrimination Indicates Whether New Characteristics Improve the Quality of Predictions

With GBMs as our tool for translating each recruit’s characteristics into a prediction of success likelihood, it is also necessary to choose a metric for prediction quality to determine whether other characteristics can add predictive value to baseline predictions based on current screening measures. As is common with traditional regression approaches, we used goodness-of-fit measures to compare GBMs. A “good” model is one that forecasts high probabilities for successful recruits and low probabilities for unsuccessful recruits. In subsequent sections, we

report the coefficient of discrimination (CD) (Tjur, 2009) as a measure of goodness-of-fit.²⁸ CD values measure the average probability for the successful recruits minus the average probability for the failures. For example, the baseline pass rate across all pipelines is 25.1 percent, so a coefficient of .10 could arise for a model that predicts a 30-percent chance of success for successful recruits and a 20 percent chance for unsuccessful recruits, on average. Thus, higher CD values indicate that a particular model does a better job of predicting success and failure correctly. To answer the root question of whether new characteristics can improve predictions of training success, we can compare the CD of a GBM that includes the new characteristics to one that includes only the current screening measures.

Finally, we sought to avoid overfitting our models. Overfitting occurs when a model is too customized to the particular sample. Overfit models may show improvements in fit while degrading the actual predictive performance on future recruits. To avoid overfitting our models, we used a cross-validation process.²⁹ The goodness-of-fit (CD) values that we present were calculated using cross-validated probabilities. Cross-validation enables us to better test whether the inclusion of new variables would improve the predictive performance on future recruits.

In sum, the GBM methodology is ideally suited for testing the utility of additional recruit characteristics. It requires no assumptions about the functional form of the models, cut-off scores, or statistical significance thresholds. Instead, we rely on the algorithm to find the appropriate functional form by slowly adding trees, and then grade the performance of each model based on its predictive power. We can then feed the model more information, in the form of new characteristics, and test whether they improve cross-validated predictions.

Results

In Some Pipelines, Positive Trends Coincide with Improved Fitness

Before examining the relationship between recruit characteristics and success in training, this section summarizes some recent trends in the data. Many aspects of training in HDHA specialties make identifying trends in attrition a delicate matter. The pipelines take a long time, and delays in completion and movement across cohorts (i.e., wash backs) are common, which make pass rates by cohort noisy and unreliable indicators of trends. For example, the number of SOWT trainees associated with a given initial start date is very small (often fewer than five), so

²⁸ We also considered McFadden's pseudo- R^2 (McFadden, 1973) and area under the receiver operating characteristic curve (Hosmer, Lemeshow, and Sturdivan, 2013) as goodness-of-fit measures. Because these measures tended to agree with each other and with CD throughout the analysis, we chose to present the most intuitive measure, CD.

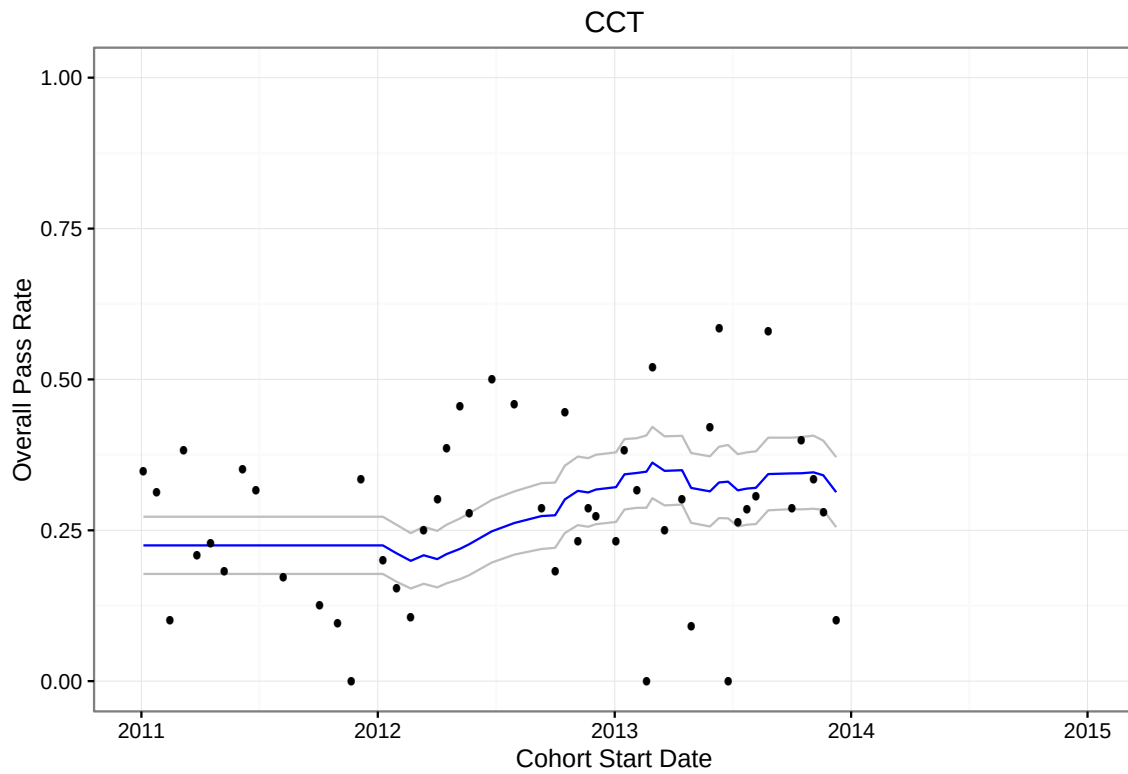
²⁹ We used a fivefold cross-validation process that involves splitting the data into five random groups, and predicting each group based on a model learned from the other four groups. Thus, new iterations are only included in the GBM if they are likely to improve the predictive performance on "new" observations that were not used to fit the model.

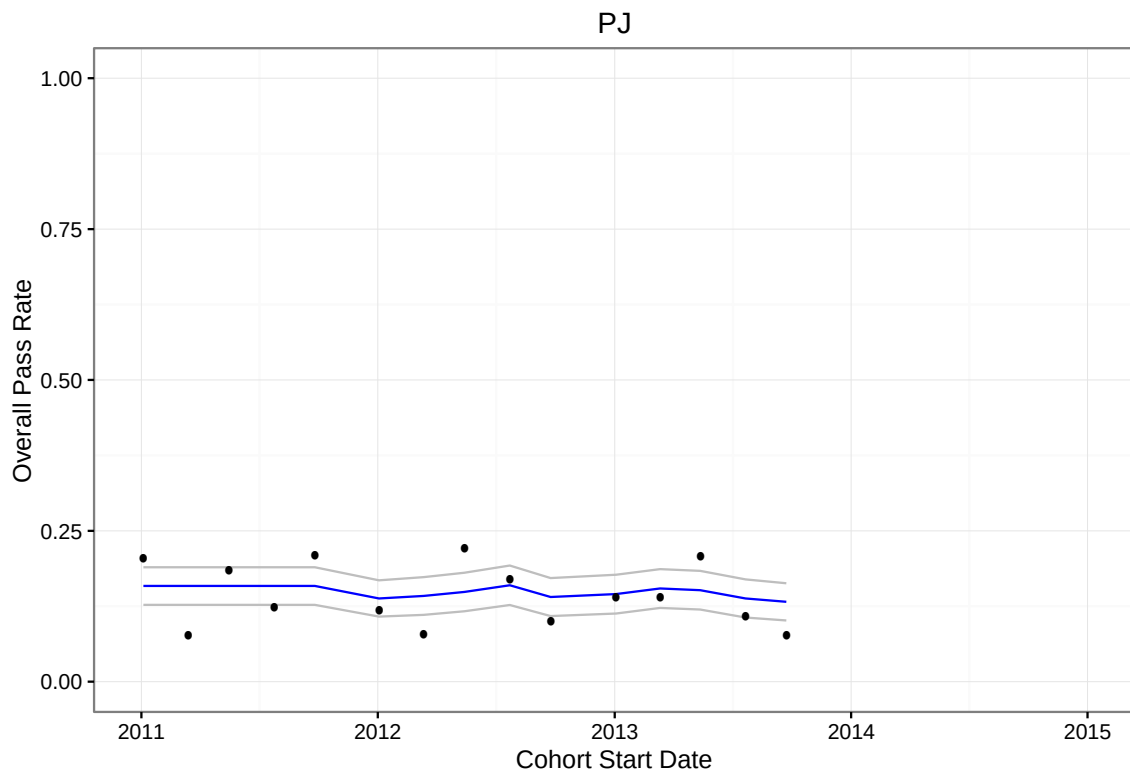
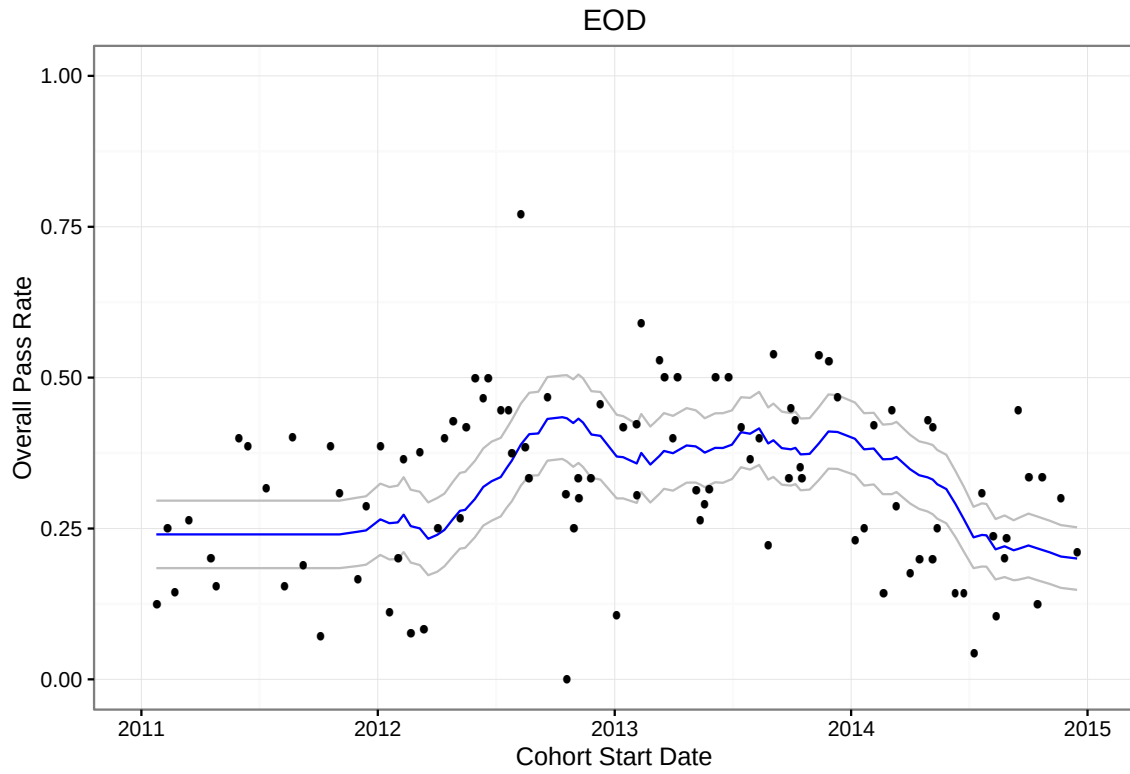
it was common to find overall completion rates of zero for cohorts when no trainees could be found to have later graduated from the three-level course. For these reasons, we present trends as rolling averages of recent cohorts (grouped by the start date of the initial training class in each pipeline), which does a better job discriminating true trends in attrition from noise in the data. Recent classes included those who received training from 2011 through 2013 for PJ, CCT, and SOWT, while TACP, SERE, and EOD results additionally include those who started training in 2014, to ensure that trainees in the data had sufficient time to complete the entire pipeline.

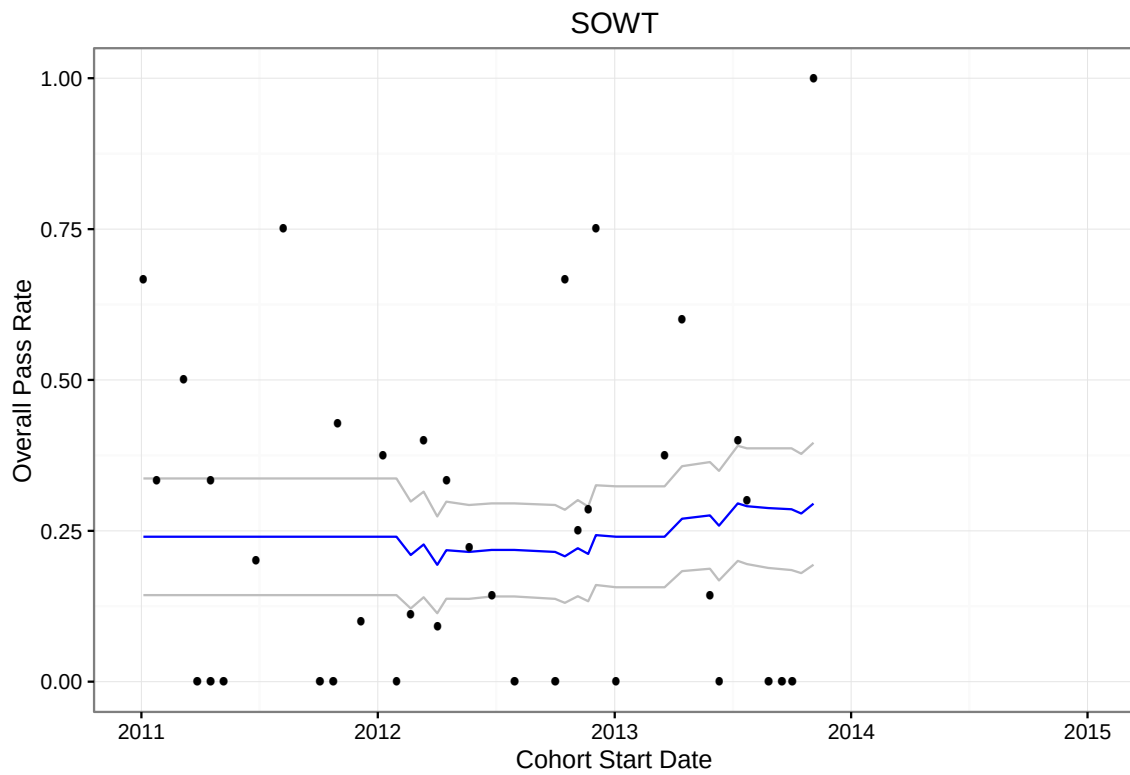
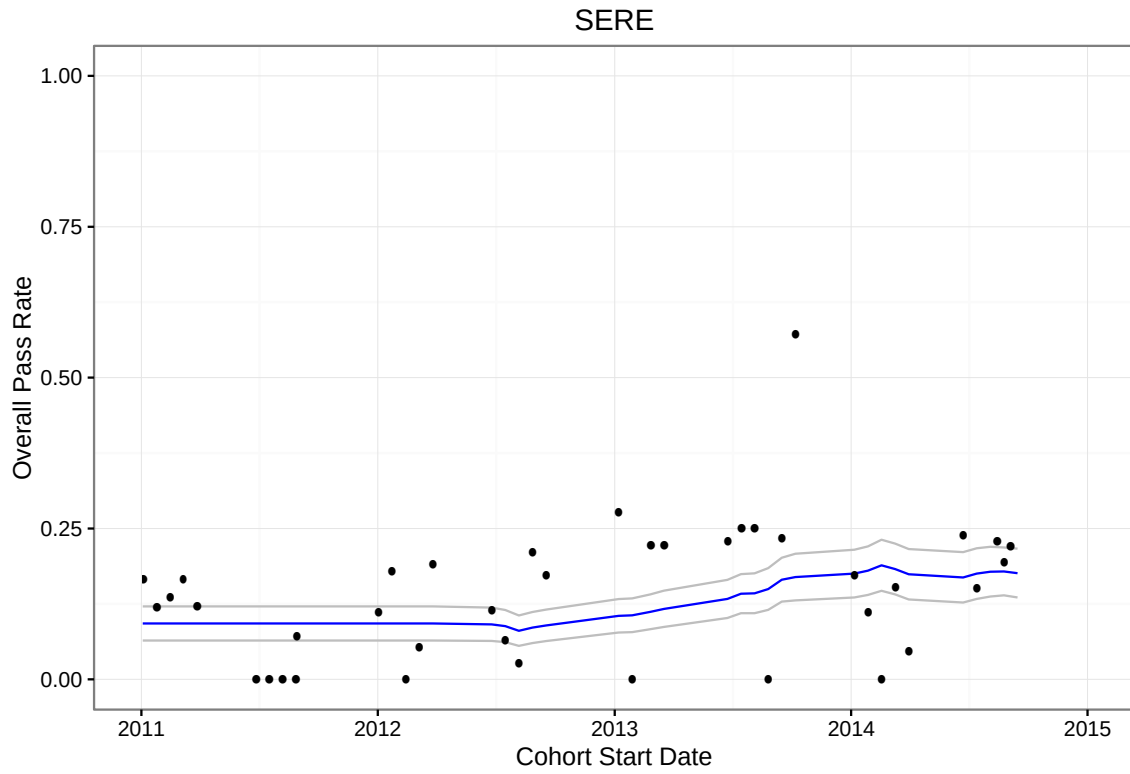
First, Figure 3.1 shows overall success rates for each cohort, as well as the trend in success probability, shown as a blue line representing a rolling average of recent classes.³⁰ Despite the noise in the cohort-specific pass rates, some clear trends are discernible. Success rates appear to be increasing among recent CCT and SERE recruits, while remaining relatively flat for PJ and SOWT recruits. TACP success rates peaked at more than 50 percent near the end of 2012, before declining precipitously through the end of 2014. The decline in success rates among EOD recruits is more recent, stretching through most of 2014.

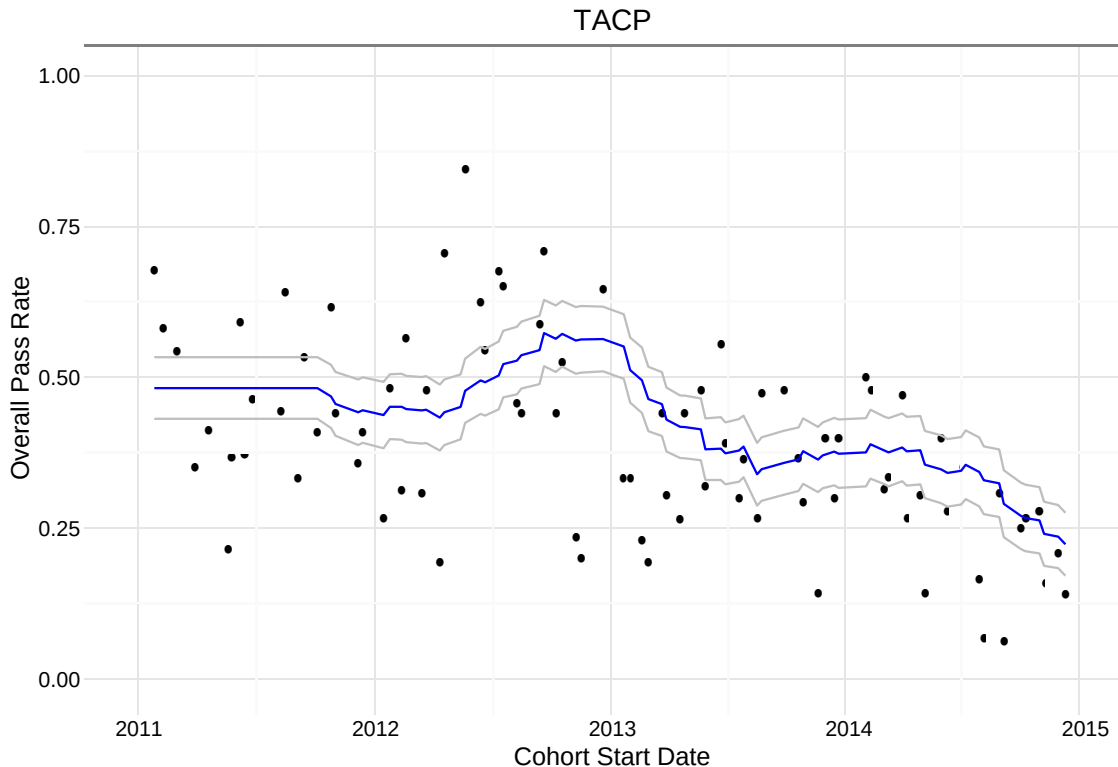
³⁰ We considered attempting to correlate changes over time with known policy changes and other external “shocks” (such as changes in local leadership). However, we could not confidently develop a comprehensive understanding of all external factors affecting the pipelines at a particular time, so we instead present the general trends over time for readers to interpret for themselves. It is notable that attrition in some pipelines is surprisingly constant over time, despite numerous efforts to improve graduation rates.

Figure 3.1. Overall Success Rates by Cohort over Time







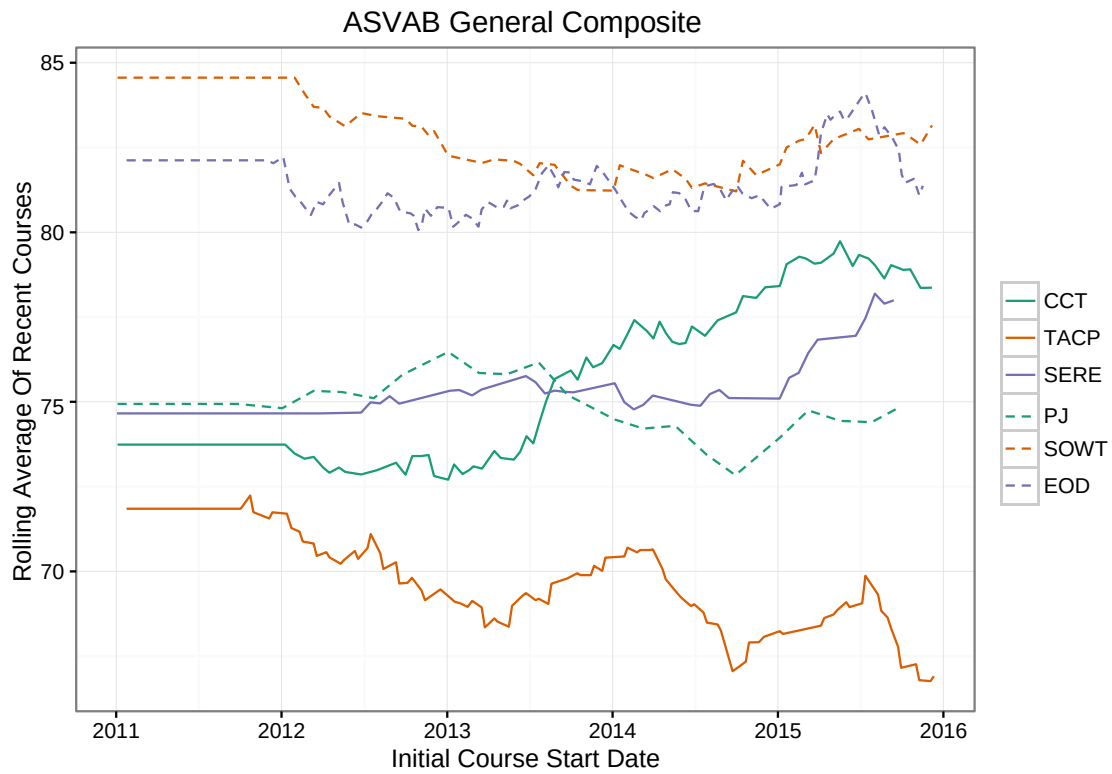


NOTE: Black dots represent class-specific overall pass rates. The blue lines represent a rolling average of the previous 15 cohorts for all AFSCs except for PJ, which shows a rolling average of the previous five cohorts. The line depicts a flat average of the first 15 cohorts (for all except PJ) or five cohorts (for PJ) for the early time periods where there are not enough cohorts to begin calculating the rolling average. 95-percent confidence intervals are shown in gray. Cohorts starting in 2014 or later were excluded from CCT, PJ, and SOWT calculations, to ensure enough time for recruits to complete the pipeline.

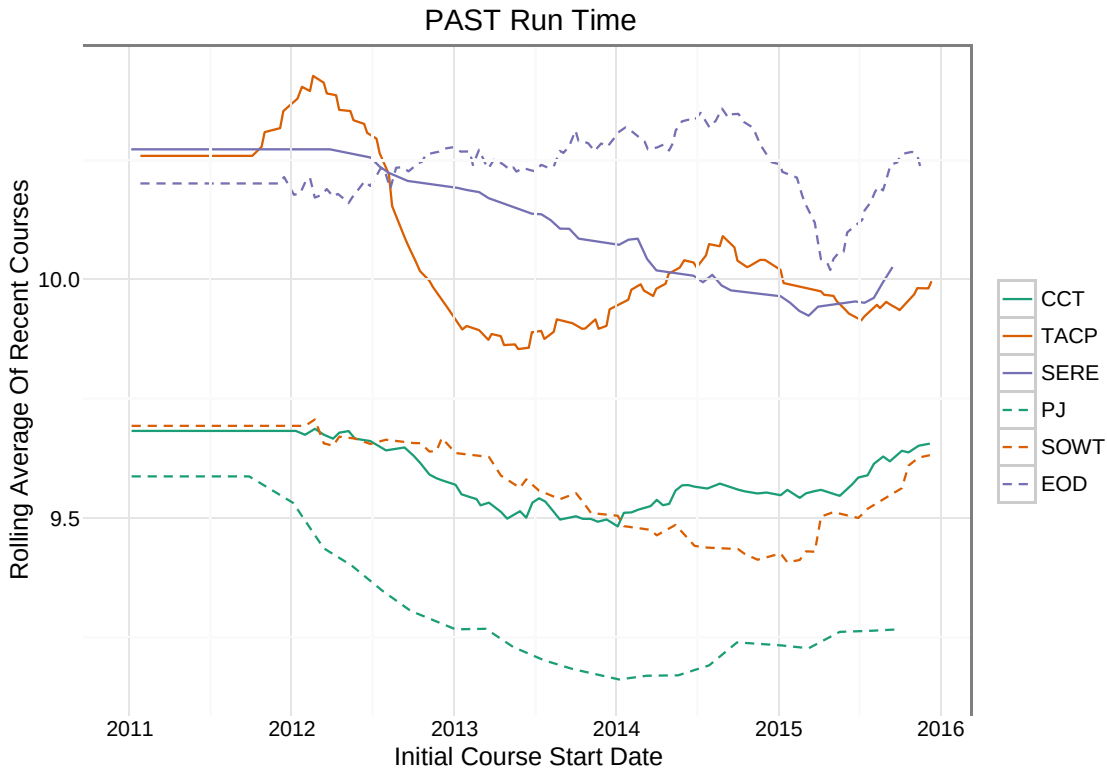
The apparent trends in Figure 3.1 coincide with interesting trends in recruit characteristics.³¹ Figure 3.2 shows recent trends in recruit aptitude (as measured by the ASVAB general composite score) and fitness (as measured by PAST 1.5-mile run times). The lines in Figure 3.2 are rolling averages, calculated in the same manner as the trends in success rates. For CCT recruits, the increase in success rates from 2012 through 2014 coincides with increases in both aptitude and fitness. The trends in TACP success rates track more closely with changes in fitness than changes in aptitude. For instance, average recruit aptitude decreased from 2012 through 2013, while fitness improved; and 2012 through 2013 was a period of increasing success rates. By contrast, fitness among TACP recruits worsened from 2013 through mid-2014, while aptitude increased, which was a period of downward trends in success rates. Finally, fitness among SERE recruits tended to increase from mid-2012 through the beginning of 2015, which coincides with a steady improvement in success rates.

³¹ While we note the concurrent changes in aptitude or fitness and success rates, the mere presence of the changes does not imply that the changes in fitness or aptitude caused the simultaneous change in success rates.

Figure 3.2. Rolling Average of Recruit Aptitude and Fitness Measures over Time



NOTE: Each line represents a rolling average of the previous 15 cohorts for all AFSCs except PJ, which shows a rolling average of the previous five cohorts.



NOTE: Each line represents a rolling average of the previous 15 cohorts for all AFSCs except PJ, which shows a rolling average of the previous five cohorts.

Perhaps as interesting as the cases in which changes in recruit characteristics coincide with changes in attrition rates is the case of PJ recruits, where there appears to be no relationship. PAST run times decreased significantly for PJ recruits between 2012 and 2014, from an average of 9 minutes, 35 seconds down to about 9 minutes, 10 seconds in 2014. Despite this improvement, PJ pass rates were relatively constant throughout the time period observed in the data.

GBM Results Point to PAST and ASVAB as Predictors of Success

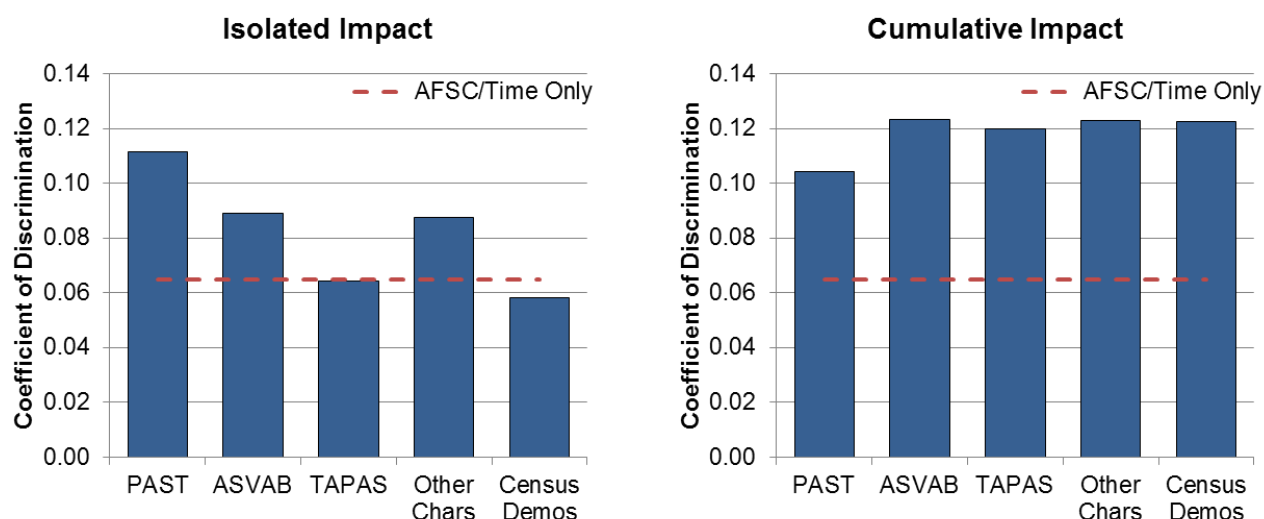
The final portion of this chapter will discuss the results of the GBM analysis determining whether the characteristics found in administrative data have the potential to improve predictive performance. To assess the importance of different types of characteristics, we fit GBMs predicting the probability of success in training with varying sets of predictors and compare the predictive performance to a baseline model that includes indicator variables for each training pipeline and the start date of the first course that the trainee attended (from which the GBM will calculate a trend in success over time). The pipeline indicator variables capture the attrition differences between specialties, while the time trend captures the net effect of external factors unique to particular cohorts (such as local leadership influence). For example, by iteratively forming trees from the AFSC indicator variables and initial course start date, the baseline model would generate predictions that look something like the rolling averages in Figure 3.1. In each

subsequent case, we sequentially add new sets of variables (e.g., all 15 TAPAS subscales) and then the GBM incorporates the information into the model with its flexible algorithm. More complex models will add other nonlinear and interactive relationships using the new variables that provide the greatest gains in predictive accuracy, while ignoring additional variables that are not strongly related to success. If including new sets of characteristics improve the model predictions relative to models containing fitness and aptitude measures (which are already used in the vetting process), then these characteristics have the capacity to improve recruiting or screening.

Figure 3.3 shows how each set of variables in the previous tables affects the GBM predictive accuracy (as measured by the CD value), relative to the baseline model (with CD depicted as a dashed line) that accounts for differences across pipelines and trends over time. The left panel shows the isolated impact of each set—the CD of a model that only includes the respective set of variables in addition to AFSC indicators and a time trend. The right panel shows the cumulative impact of adding each set of characteristics, while also including all previous characteristics.³² For example, the cumulative impact of TAPAS represents the CD of a model, including the PAST, ASVAB, and TAPAS measures. Even for variables that did not appear to improve predictions in isolation, there is still the possibility that these variables could add value to models when they interact with other factors. For example, personality traits could be important, but perhaps only for recruits with certain levels of fitness or aptitude. The cumulative impact tests whether this is the case by sequentially adding each set of variables to a GBM that includes all previous variables.

³² The order of the characteristics matters when assessing the cumulative impact. Beyond the variables currently used in screening, we chose to examine TAPAS first, because it is designed to be used in screening decisions, while we examined the other variables more for exploratory purposes.

Figure 3.3. Improvement in Cross-Validated Predictions for Each Set of Characteristics



In the GBMs that attempt to isolate the possible improvements in each set of variables, it is clear that only PAST, ASVAB, and “other characteristics” have the potential to improve predictions. Consistent with the pattern of findings from logistic regressions (see Appendix C), PAST scores have the largest impact on performance, but ASVAB scores and other characteristics each improve the CD by more than 35 percent, relative to the base model with only AFSC indicators and the time trend. By contrast, including the information from TAPAS subscale scores and background demographic variables from census data did not improve cross-validation predictions over the predictions from a basic model with AFSC and time effects.³³ In other words, a model that attempts to rate candidates on their personality traits or hometown demographics does not make better predictions than a model that assumes all candidates have the same success potential for a given time period within each AFSC.³⁴

Turning to the cumulative impact of each set of variables, PAST scores again produce a large gain in predictive performance over the base model. Conditional on PAST scores, ASVAB scores also increase the predictive performance of the GBM by about 18 percent. However, for each set of new predictors beyond ASVAB scores, the quality of predictions remains flat. This pattern indicates that making available the information for these additional predictors to the GBM does not improve the quality of predictions beyond what it could achieve with PAST scores and ASVAB alone. In the case of the TAPAS facets, including the variables in a model that already includes PAST and ASVAB scores actually slightly degrades the performance. The decline in performance could result from the frequency of missing information and the potential

³³ When including each set, the measures of fit increased slightly on all observations. The slight decrease reflects the fact that there was not enough of a signal to improve prediction in the cross-validation exercise.

³⁴ To aid interpretation of our findings, we conducted several pairwise logistic regressions to show the strength of the relationship between each characteristic and training pipeline success. See Appendix C for these results.

noise in the TAPAS variables. The cross-validation process we used requires the fitted patterns to be broadly generalizable to show a predictive improvement. Therefore, making these variables available to the algorithm could be causing the algorithm to include noisier and less-reliable pieces of information in the TAPAS scores in lieu of residual information in PAST and ASVAB scores that it would otherwise draw on.

Figure 3.3 addresses the question of whether recruiters could better target groups of individuals with specific characteristics associated with success in HDHA specialty training. The fact that certain characteristics found in the administrative records, such as age, education level, and body mass index, improve performance in isolation demonstrates that these characteristics do predict lower attrition if they are all that is known about a candidate. However, the lack of a cumulative impact (i.e., incremental validity) means that these characteristics are most likely associated with higher fitness and/or cognitive ability. Therefore, there are few characteristics available in administrative records at this time for recruiters to use for targeting high-potential HDHA-specialty candidates.

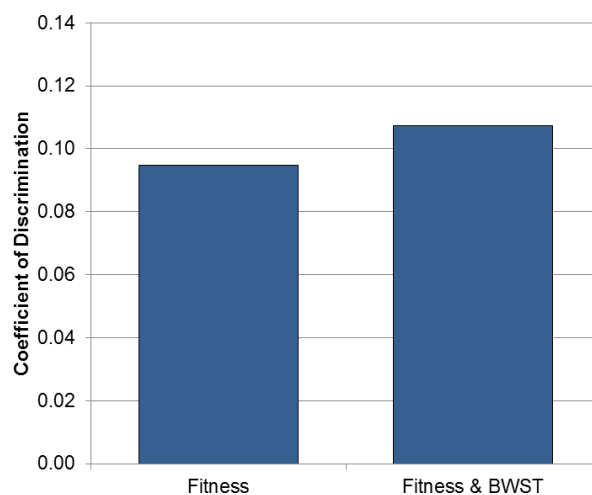
Factors Not Measured in Administrative Data Could Predict Success Potential

There is at least one example of how to improve on existing metrics as demonstrated in the PJ pipeline. The BWST, which examines a specific and critical set of skills needed for the PJ pipeline, was developed in response to data suggesting that many trainees arrive unprepared for the intense water-related training events. The BWST includes three components—a timed test in which subjects must tread water for up to three minutes without using their arms, a test recording the number of consecutive laps that subjects can swim under the pool surface without taking a breath, and a timed test in which subjects must repeatedly clear the water from a submerged snorkel and resume breathing. Unlike the demographic information in the administrative records, these tests were designed to measure specific skills needed in training that existing screening tests were not able to capture.

Figure 3.4 conducts the same exercise as before with GBMs predicting success in the PJ pipeline, comparing a model with only fitness components and a time trend to a model that adds the three BWST components.³⁵ The addition of BWST information generates a modest improvement in prediction quality, raising the CD to 0.11 from 0.095, or about 13 percent. A careful analysis of specific skills needed for success in each pipeline would serve to identify whether requiring recruits to demonstrate other critical skills could improve screening and selection across the HDHA specialties.

³⁵ Unlike the overall models, ASVAB scores did not improve the predictions in the PJ-only model.

Figure 3.4. Improvement in Cross-Validated Predictions for PJ Model with the Addition of Basic Water Skills Test



Conclusion

The presence of persistently high attrition in HDHA-specialty entry training would seem to suggest the potential for improving the production flow by changing the composition of incoming recruits or by further developing the physical and mental readiness of recruits prior to entering the pipeline. Using available administrative data, we sought to identify key predictors (particularly outside the realm of fitness and aptitude, which are already used for screening). Using a flexible statistical model as a litmus test for whether predictive improvements are possible, we find that other variables beyond fitness and aptitude do not meaningfully relate to training success. Of the two traits, only fitness is malleable—that is, it is potentially amenable to a training program. Therefore, Chapter 4 will take the example of the PJ pipeline further and examine whether reasonable gains in fitness could translate into reduced attrition.

It is perhaps surprising that TAPAS, a tool developed for screening, did not improve predictions of training success. These results reflect the general state of TAPAS throughout the time period in the data, and we acknowledge that it is possible that a particular refinement of TAPAS may perform better in the future. In addition, “other” characteristics available in the administrative records are not comprehensive of the possible characteristics (e.g., high school sports participation) that may be associated with training success. The analysis of the BWST demonstrates that there is room for improvements in identifying candidates who are likely to be successful. Subsequent findings from our qualitative analyses denote a list of the most important characteristics to HDHA-specialty training success and recommend ways to assess whether candidates possess them based on the scholarly literature and best practices from other organizations.

4. Illustrative Example of an Intervention to Reduce Attrition

The modeling results suggest that recruits with higher physical fitness and aptitude levels are more likely to succeed in training. Therefore, a natural next step is to explore ways to reduce attrition, either by recruiting fitter and smarter candidates, or attempting to improve the success prospects of HDHA-specialty candidates through development. This chapter will use the associations between recruit characteristics and success to conduct a preliminary assessment of the potential impact of a notional intervention intended to develop new candidates.

We Focus on Improving Fitness for Pararescue Candidates

If policymakers desire to increase the throughput in HDHA-specialty training pipelines, the analytical results of the previous chapters suggest that fitness may be the most promising area for policy interventions aimed at developing Air Force HDHA-specialty candidates for several reasons. Measures of fitness tend to be the most important predictors of technical training success for candidates in the six HDHA specialties, especially for PJ candidates, who have the highest risk of attrition (see Appendix C). Fitness is malleable, and prior research can help to benchmark assumptions about the gains that are possible to achieve through development of candidate fitness (e.g., Dorgo et al., 2009). Additionally, the focus on PJ fitness is more informative to current Air Force efforts already seeking to maintain or increase fitness for PJ candidates prior to the development course (such as during BMT). These efforts are also supported by recommendations from Manacapilli et al. (2012).

In contrast to fitness, recruit aptitude is less malleable, which means that raising aptitude levels among incoming recruits would require more selective recruiting. Our discussions with Air Force representatives revealed that recruiters are aware that HDHA specialties desire higher-quality recruits, yet recruiters struggle to meet their quotas under existing standards. Therefore, even if higher minimum standards could reduce attrition, the current recruiting environment may not support increased selectivity.

For example, Table 4.1 provides some illustrative information on how attrition rates vary among groups that meet different minimum thresholds for the ASVAB general composite score. The illustration examines a notional five-point and ten-point increase in the minimum score by excluding candidates who fall below each threshold, listing the new attrition rate as well as the number of successful candidates who fell below the threshold. This simple calculation shows that the gains from screening out recruits who are near the AFSC-specific minimum standards would likely be modest, at the cost of excluding a nontrivial number of potentially successful recruits.

Table 4.1. Attrition Information for Recruits Meeting Higher ASVAB General Composite Thresholds

	No Change		5-Point Increase		10-Point Increase	
	Pass Rate	Total Successful	Pass Rate	Successes Excluded	Pass Rate	Successes Excluded
All	25.1	1,372	24.6	107	25.5	196
CCT	29.1	191	29.2	2	30.5	5
TACP	36.7	483	35.5	45	36.4	85
SERE	13.9	123	14.5	15	15.6	23
PJ	13.1	148	11.7	3	12.2	9
SOWT	25.3	47	25.2	7	25.4	11
EOD	29.8	380	30.2	35	31.6	63

NOTE: Calculations include cohorts who started initial training courses from 2011–2013 for CCT, PJ, and SOWT, and 2011–2014 for TACP, SERE, and EOD.

Prior Research on Fitness Improvements Used to Simulate Changes in Attrition Levels

To simulate the change in attrition associated with improved fitness, our approach is to fit a flexible statistical model of the relationship between fitness and success using GBM, which we can then use to predict attrition levels in a hypothetical scenario where candidate fitness levels increase by some amount. With a strong relationship between fitness and training, there is almost certainly no doubt that increasing fitness will tend to lower predicted attrition (see Table 4.2). Thus, the estimated improvements must be bounded by assumptions about how much fitness improvement one could reasonably expect to gain within a certain time frame.

Table 4.2. Predicted Probability of Success for Hypothetical Candidate at Varying Fitness Levels

Fitness Level on Each PAST Event	Predicted Probability of Success
Minimum standard	4.3%
Median level	8.1%
75th percentile level	15.2%
95th percentile level	38.4%

Our initial plan for modeling fitness gains was to use data drawn from the HDHA-specialty training community; however, fitness gains from training are not systematically tracked or recorded in a manner readily available for integration into our simulation analyses. Therefore, we conducted a brief review of the literature to identify studies identifying plausible fitness gains.

No single study provided gains across all of the measures, but one did provide information on fitness gains on four tests, which closely align with PAST components, at nine weeks and 18 weeks as part of physical training programs for high school students. The study compared different training programs over an 18-week period, but we selected the fitness gains from the nine-week midpoint from the broadest training program, which included 80-minute class sessions three times a week (Dorgo et al., 2009). The gains made in this program are typical of other studies examining fitness changes following a training intervention (e.g., Courtright, 2013; Knapik et al., 2006).

Since the information from the selected study includes only aggregate fitness gains over a fixed, nine-week time period, we operationalize this information in the form of an average weekly gain in each fitness event as a function of the initial fitness level. This assumption is a coarse approximation in two ways. First, applying the average improvements equally to all recruits would ignore that relative fitness gains are likely to be smaller for fitter individuals. To account for this fact, we present results that assume different fitness “ceilings,” or points at which simulated recruits cease to improve, which will prevent unrealistic gains from continuing to accrue to recruits who are at near-peak fitness levels. We look at two alternatives for performance ceilings—one set at the 75th percentile of recruits in the data and another set at the 95th percentile (see Table 4.3).

Table 4.3. Fitness Ceilings Based on Percentiles Among Recent PJ Recruits

Event	75th Percentile	95th Percentile
1.5-mile run (m:sec)	9:03	8:31
500-meter swim (m:sec)	8:11	7:12
Sit-ups (reps)	73	83
Push-ups (reps)	67	80
Pull-ups (reps)	15	18

The second potential problem lies in the fact that fitness levels probably do not improve at a constant rate over time. In actuality, fitness is likely to improve more rapidly in the beginning of a fitness program, before leveling off (e.g., Rhea et al., 2003). This aspect of the approximation means that the results are likely to understate the gains of shorter courses. In light of these limitations, we will be explicit about the assumed rates of improvement and the magnitude of the changes in candidate fitness levels, so that future discussions and analyses can evaluate whether the simulated changes are reasonable.

One additional limitation of applying the results in Dorgo et al. (2009) is that the study did not measure improvements in swimming performance, which is extremely important to success in PJ training. As a substitute, we also apply the rate of improvement for running performance to the 500-meter swim event. This assumption is potentially conservative, as running performance

showed the smallest relative improvements in Dorgo et al. (2009), and it is also plausible, as swimming includes a combination of cardiovascular endurance and skill, which can be trained.

We examine three potential course lengths—two, four, and eight weeks. Table 4.4 shows the potential fitness improvements for each course length, compared with the average improvement over the nine-week time period in the reference population. Table 4.5 then applies these percentages to the minimum requirements for entry into the PJ pipeline to show the magnitude of the simulated effect on candidates at the margin.

Table 4.4. Simulated Fitness Improvements for Courses of Varying Lengths (Percentages)

	Two Weeks	Four Weeks	Eight Weeks	Reference Population (Nine Weeks)
Run/swim time	2.8%	5.6%	11.2%	12.6%
Sit-ups	17.3%	34.6%	69.2%	77.9%
Push-ups	9.2%	18.3%	36.6%	41.2%
Pull-ups	6.0%	12.0%	23.9%	26.9%

Table 4.5. Simulated Fitness Improvements for Candidates at Minimum Fitness Levels

	Two Weeks	Four Weeks	Eight Weeks
Run (seconds) (minimum time: 9:47)	−16	−33	−66
Swim (seconds) (minimum time: 10:07)	−17	−34	−68
Sit-ups (repetitions) (minimum: 54)	+9	+19	+37
Push-ups (repetitions) (minimum: 52)	+5	+10	+19
Pull-ups (repetitions) (minimum: 10)	+1	+1	+2

Prior Research May Not Be Generalizable to HDHA--Specialty Recruit Population

An important concern to note for this simulation is that the students in the population who Dorgo et al. (2009) examine differ significantly from the individuals that the Air Force recruits for HDHA specialties. The high school students in the reference study had significantly lower levels of fitness at the start of the program than recruits entering the PJ pipeline, so they may have experienced faster average growth in fitness than one would expect to see in a population that was relatively fit to begin with. In fact, the high school students experienced little or no growth in the second nine-week period of the reference study, and this sharp reduction in the growth rate over time creates generalizability questions for the current application. Furthermore, information available on fitness improvements among recent PJ recruits during BMT show only

marginal fitness gains over an eight-week period.³⁶ We proceed with the simulation, which we think has value as an illustration, while stressing that potential interventions should be examined in light of careful study of the expected gains in the population of HDHA-specialty recruits.

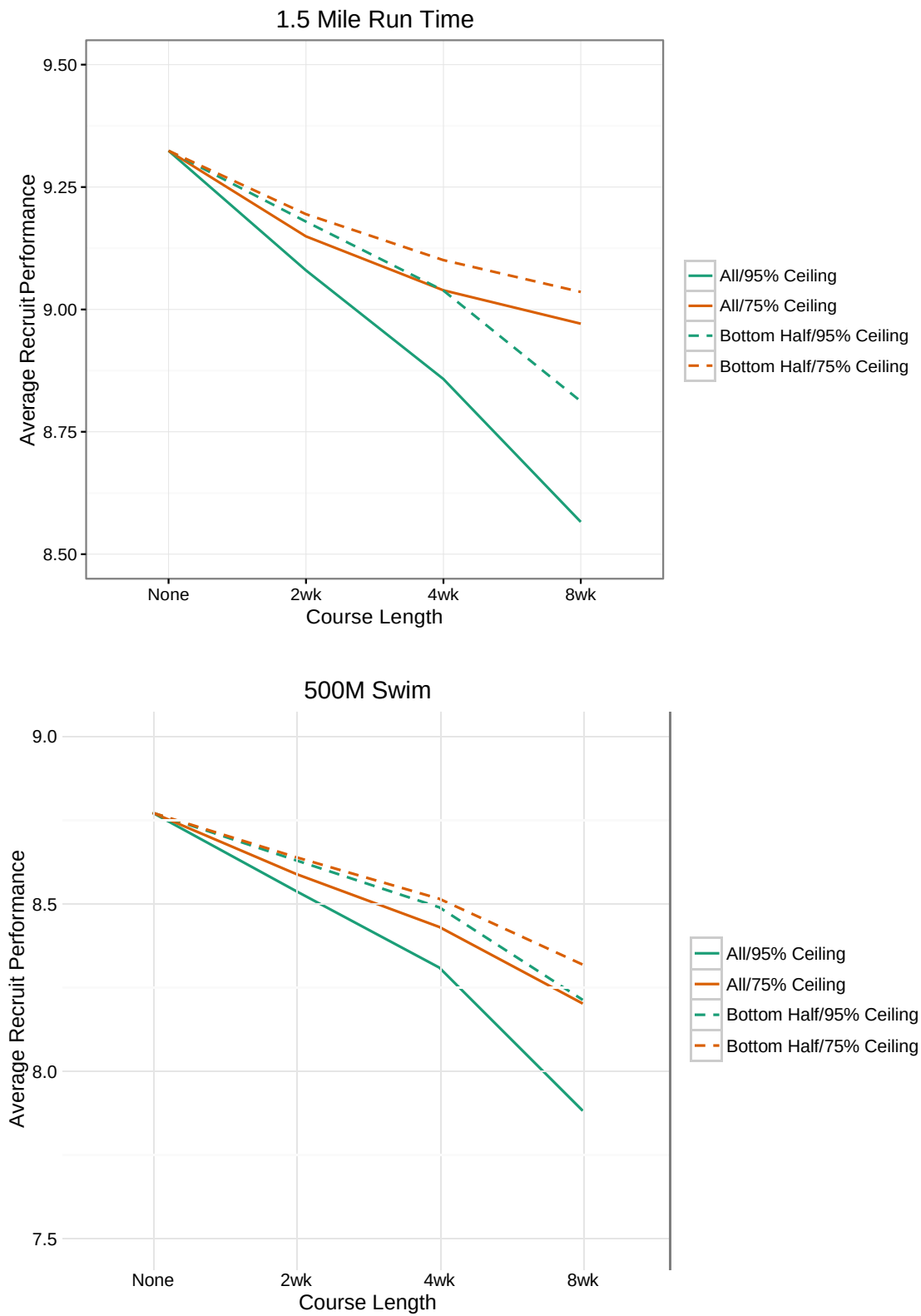
Results

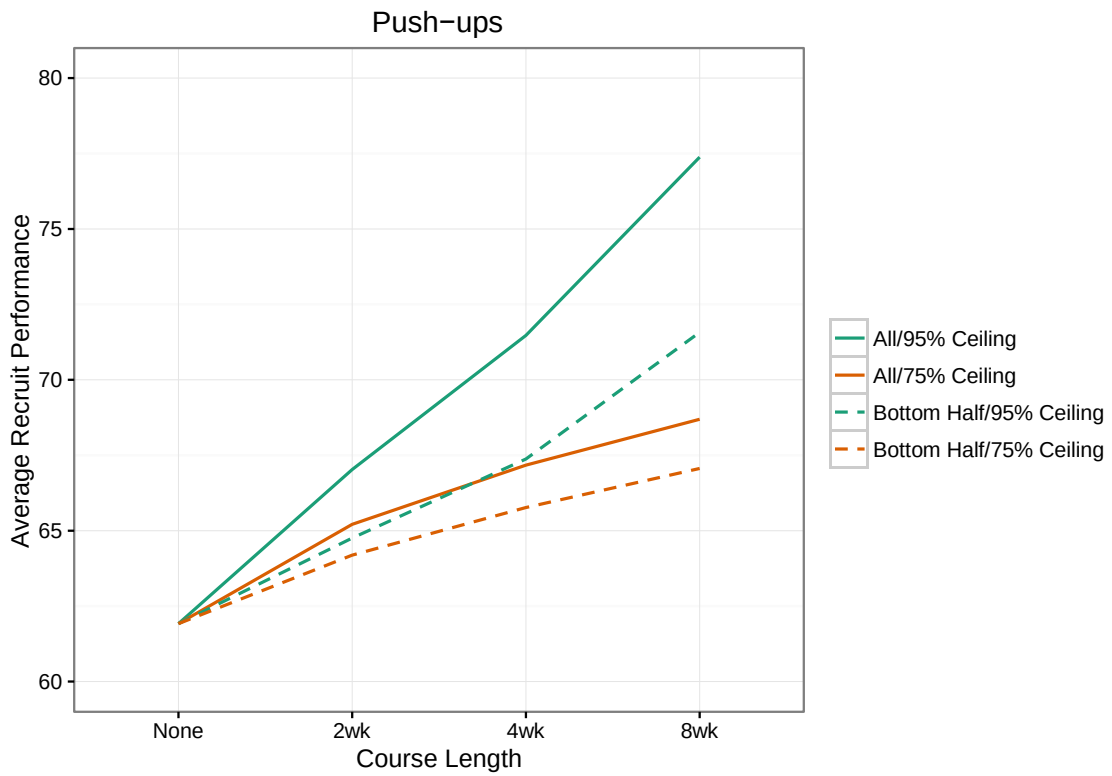
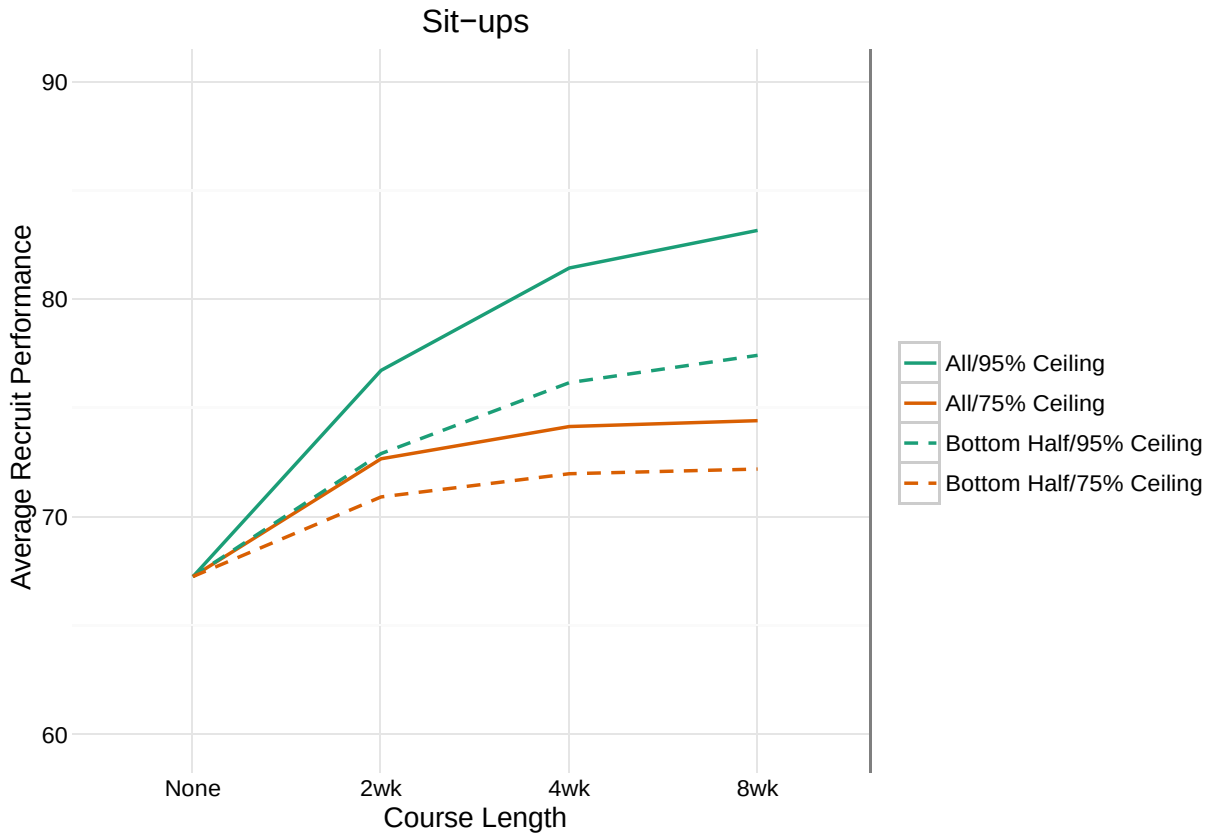
Performance Ceiling Limits Simulated Fitness Gains

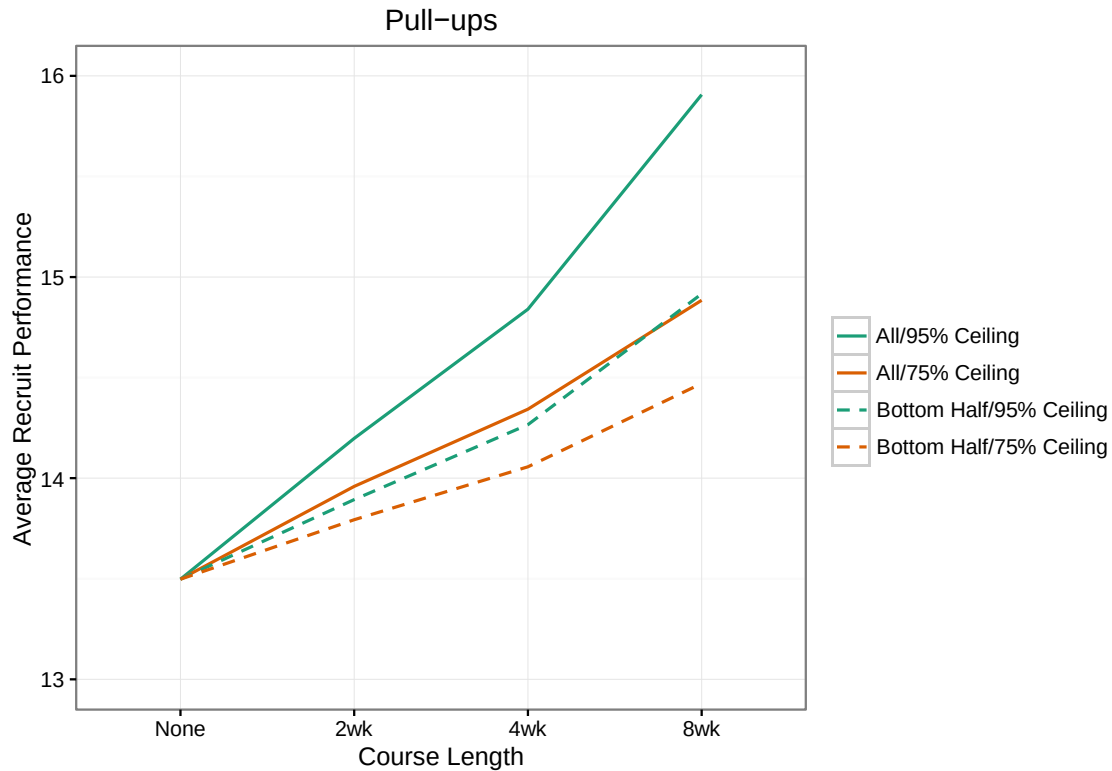
First, Figure 4.1 shows the simulated gains in fitness among the recruit population achieved by applying the average gains from prior research to each of the three potential courses under consideration. For each event, solid versus dashed lines denote whether the proposed fitness course applies to all recruits or just the bottom 50 percent in success likelihood, while the color denotes whether the improvement ceiling is the 75th percentile or the 95th percentile level in the recruit data. Naturally, the largest gains accrue in the scenario involving all recruits with the higher ceiling. This scenario (represented by the solid green line in each panel) shows average run times decreasing from 9 minutes, 19 seconds to 8 minutes, 34 seconds overall. By contrast, the most conservative scenario, where only the bottom half of recruits go through the hypothetical course and improvement ceases when recruits reach the 75th percentile in each event, only reduced the average run time down to 9 minutes, 2 seconds.

³⁶ For example, the BMT data showed only a 1.6-percent improvement in 1.5-mile run times, and a 5.1-percent improvement in pull-ups. Only a portion of recruit time in BMT is dedicated to fitness, so the gains of a potential fitness course are likely to be higher than this, but the precise levels of expected gains of such a course are unknown.

Figure 4.1. Simulated Improvement in Fitness Versus Simulated Course Length







Generally speaking, the assumed performance ceiling limits the possible fitness improvements more than the assumption regarding whether all recruits must attend the course. With both the 1.5-mile run and the push-ups, for instance, the high-ceiling improvement after an eight-week course for only the bottom half of recruits surpasses the low-ceiling improvement for an eight-week course that is required for all recruits. This result indicates that if the magnitude of the gains from the reference study are possible in the population of PJ recruits, then significant improvements in average recruit quality are possible even when focusing only on a subset of recruits.

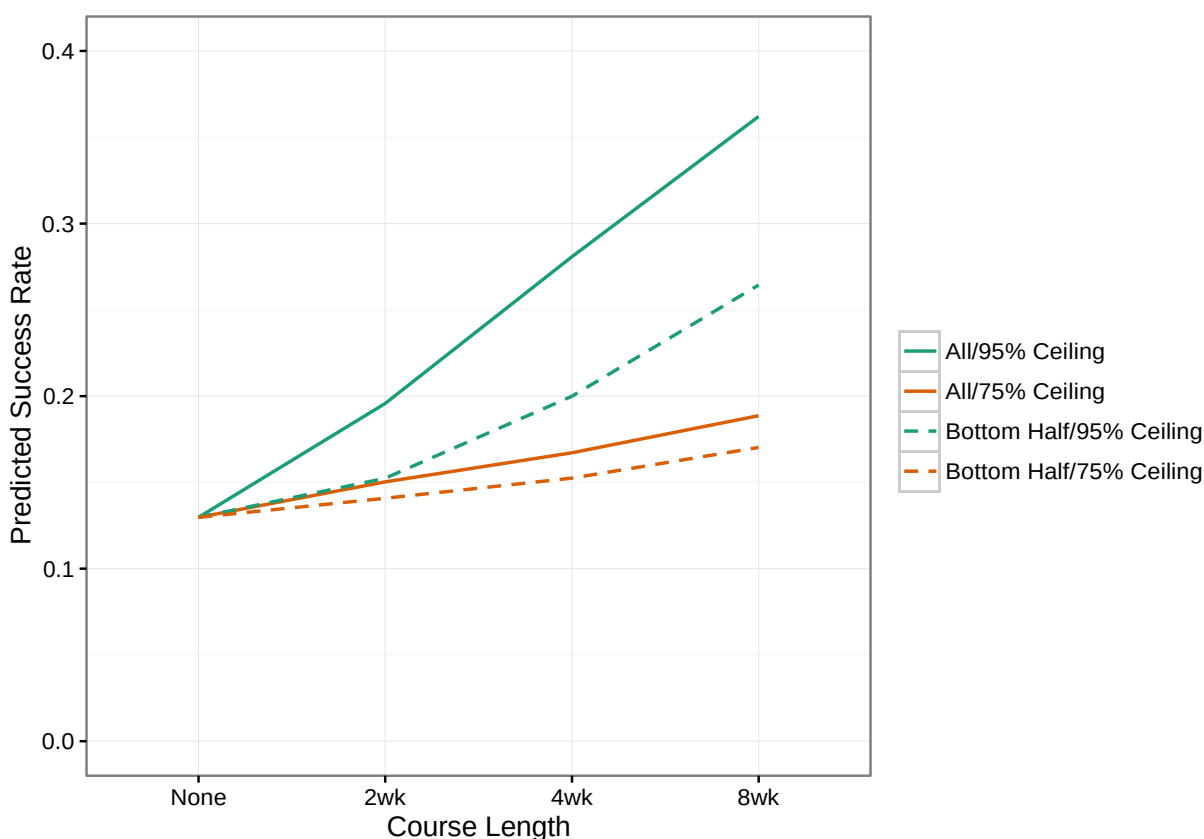
Improvements in Throughput Depend on Whether Recruit Fitness Can Reach Elite Fitness Levels

Figure 4.2 translates the simulated fitness gains into reductions in attrition, using a GBM³⁷ that includes all five PAST events and a time trend. As before, the different line colors denote the level of fitness attained before recruits plateau and the solid versus dashed lines denote scenarios varying whether the course is for all recruits or only for the bottom 50 percent. All scenarios show steady improvement in success rates with increasing course lengths, but the rate at which success prospects improve depends on the assumed performance ceiling. For example,

³⁷ With these six variables, the GBM achieved a pseudo- R^2 of 0.18, a CD of 0.13, and an area under the curve of 0.81.

for a four-week course that applies only to the bottom half of recruits, there is only a modest improvement in the success rate—to 15 percent from the baseline of 13 percent—when recruits stop improving at the 75th percentile. However, if recruits continue to improve according to the parameters of the reference study until they reach the 95th percentile of recent PJ recruits, the predicted success rate of the same course reaches 20 percent (which is a 54-percent improvement in relative terms). For the same scenario with a high ceiling, an eight-week course brings the predicted success rate up to 26 percent, which would be closer to the levels seen in the SOWT and CCT pipelines over the same time period (25 percent and 29 percent, respectively).

Figure 4.2. Predicted Change in PJ Pipeline Success Rate Associated with Simulated Courses Designed to Increase Fitness



The Cost--Effectiveness of Notional Courses Depends on Fitness Gains

Whether an attempt at an intervention designed to improve recruit fitness levels is desirable depends on many factors. A starting point in making this determination, however, is whether the cost savings from reduced attrition are high enough to outweigh the additional costs of the new course. We created a basic cost model to evaluate this question, using data from a variety of sources (see Appendix D for more details). We estimate the average cost of attrition from a combination of (1) course costs (using data provided by the Training Branch, Financial Analysis

Division, Financial Management and Comptroller of the AETC [AETC/FMAT]), (2) military pay costs for the time in training based on course lengths, casual time, and the grade distribution of trainees, and (3) attrition patterns to account for the fact that trainees who exit the pipeline sooner do not incur the costs of subsequent courses. For PJ trainees, we estimate the weighted average cost of attrition to be \$11,393 per recruit eliminated. To price the notional two-, four-, and eight-week fitness courses, we started with the military pay cost (based on the course length), and then applied a factor to boost this to cover total course costs observed for entry-level courses across the six HDHA pipelines.

Table 4.6 shows results comparing the predicted success rate for each hypothetical course with its break-even point (for both sets of performance ceiling assumptions). The break-even point is the success rate where the savings in reduced costs of attrition equal the cost of the additional course,³⁸ so if the new course increases the success rate beyond the break-even point, it is cost-effective. According to the preliminary calculations summarized in Table 4.6, a new effort designed to improve recruit fitness could be cost-effective, provided that the course is able to achieve the gains in fitness laid out in the high-ceiling scenario. If only the bottom half of recruits must attend the course, the improvements for the four-week and eight-week versions exceed their respective break-even points. In the scenario where recruit fitness improvements plateau at the 75th percentile, however, the reduction in attrition costs cannot keep pace with the estimated costs of the hypothetical course, regardless of the course length.

Table 4.6. Predicted Success Rate Versus Break-Even Point for Notional Fitness Courses

Course Attendance	Course Length	Predicted Success Rate		
		75% Ceiling	95% Ceiling	Break-Even
None	N/A	13.0%	13.0%	N/A
Bottom half	2 weeks	14.1%	15.2%	16.3%
	4 weeks	15.2%	20.0%	19.5%
	8 weeks	17.0%	26.4%	26.1%
All recruits	2 weeks	15.0%	19.6%	19.5%
	4 weeks	16.7%	28.1%	26.1%
	8 weeks	18.9%	36.2%	39.2%

NOTE: These break-even points differ from those in Appendix D because they assume a different baseline graduation rate. Appendix D uses base rates from the raw data, whereas this chapter uses the predicted base rate from the model after losing some observations when merging the outcomes data with the fitness information.

³⁸ We do not intend to imply that being below this point means the course would not be worthwhile. It could be that the benefit of increased throughput into undermanned career fields is worth some additional cost, beyond the amount saved through reduced attrition.

Courses that all recruits attend are more expensive, so greater improvements in the overall success rate are necessary to justify the added costs. The top half includes the fittest recruits, who start out closer to the ceilings, so the attrition improvements only exceed the break-even point under the high-ceiling scenario, for the two-week and four-week courses.

Finally, it is important to emphasize that a potential course need not be cost-neutral in order to be the right policy for a given HDHA specialty. A key concern regarding high attrition in HDHA specialties is that it is a barrier to healthy manning levels and not simply that it is costly. It is likely the case that the Air Force would be willing to pay a price for reduced attrition to improve career field manning. This exercise illustrates that a course effective at improving the success prospects of recruits could recoup some of its own costs, depending on the length of the course and the magnitude of its impact on attrition.

Recommendations to Develop Candidates for HDHA Specialties

Physical fitness has an important role in contributing to the successful completion of a HDHA specialty's training pipeline. In fact, physical fitness was the single most important variable in our models compared with many other possible individual characteristics and background variables. Such findings suggest that additional emphasis on candidates' physical fitness could be a useful strategy for increasing the number of candidates who succeed in training pipelines for Air Force HDHA specialties. Such a strategy is important to consider because eligible recruits are difficult to find, other HDHA organizations (e.g., Army SF) are competing for similar candidates, and fitness is quite malleable. Extending this logic, we conducted a series of additional analyses to determine how much attrition could potentially decrease if the Air Force developed a two-week, four-week, eight-week, or 16-week course devoted specifically to developing physical fitness. We also compare these different length courses in terms of their potential cost effectiveness.

Consider Developing a Fitness Course to Reduce Attrition

Our policy simulation for the PJ training pipeline suggests that implementing an entry-level course focused specifically on improving fitness could improve the rate of training success from 13 percent to more than 30 percent if all candidates completed an eight-week course dedicated to improving their fitness. In addition to estimating potential gains from a fitness course, we evaluated the potential costs for implementing a course for all candidates and for a course that would only require attendance from the bottom 50 percent of candidates on fitness. These analyses suggest that restricting the course to those candidates most in need of further fitness development could help to decrease course costs while still improving the overall passing rates. Although our modeling suggests that pass rates should increase, there are two issues that warrant further discussion.

First, fitness rates for PJs have been improving in recent years, but the overall pass rate has not shifted. Furthermore, the lack of change in pass rate cannot be attributed to cognitive ability or other characteristics included in this study. Second, individuals who show up to training less fit may be qualitatively different in other ways beyond fitness. For example, less-fit candidates may also be less motivated, which may affect if and how quickly they improve their fitness.³⁹ Consequently, any fitness interventions or courses that are implemented should be monitored closely to track whether increased fitness gains result in higher rates of training success. If training success does not improve, the Air Force should explore other plausible explanations for the lack of change in training success, such as trainee motivation, changes in training requirements, or possibly increased injury rates.

Overall, these simulations are meant to be illustrative examples because we had to make several assumptions due to limited data available for input into the modeling. These assumptions may not hold if the data are drawn from specific HDHA-specialty candidates rather than from prior research using a different population. First, we assumed that fitness gains would increase linearly over an eight-week period. Although some research suggests that fitness gains may decrease over time, the actual rate of change will depend on many factors, including starting fitness levels, motivation, and training regimen. Consequently, the Air Force should monitor the actual rate of fitness improvement for candidates in each HDHA-specialty training pipeline. These rates can then be applied to develop more precise estimates for recommending course length and determining the specific candidate population that should attend further fitness training prior to starting an HDHA-specialty training pipeline.

Consider Other Strategies to Improve Physical Readiness of HDHA--Specialty Candidates

During the course of this study, we also identified other opportunities that could further develop the physical readiness of HDHA-specialty candidates. These include providing more physical training during BMT for HDHA-specialty candidates and placing candidates into different classes based on their current fitness levels.

Offer Additional Fitness Training to HDHA--Specialty Candidates in BMT

Manacapilli et al. (2012) recommended the use of Fit Flights for CCT and PJ trainees in BMT. We reiterate this recommendation, although with an alternative specification that field

³⁹ In his analysis of Fitness Training Units (FTUs) used by the Army to remediate poor physical fitness on recruitment, Buddin (2005) found that soldiers who were assigned to FTUs had higher training attrition than soldiers with similar characteristics (e.g., same gender, race, age) but who did not attend FTUs before going to basic combat training (BCT). Buddin notes that FTU participants were less likely to attrit for physical fitness reasons and more likely to attrit for performance or conduct issues than similar peers. He speculates that FTU soldiers who attrit from BCT may have experienced stigma and frustration from attending FTUs, which would affect their performance or conduct at BCT. He also speculates that some recruits may be too unfit to condition and should be screened out of the Army before BCT.

developers could be used to work with HDHA-specialty BMT trainees instead of the use of Fit Flights. If field developers were used, coordination between AFRS/2AF and BMT leadership would be required to determine when and how often field developers would have access to HDHA-specialty candidates during BMT training. If additional training opportunities are possible, field developers could emphasize fitness goals that are associated with success to encourage trainees to fully prepare for their HDHA-specialty training pipeline. Furthermore, field developers could teach and reinforce the proper form and technique required of trainees in the pipeline. Some instructors indicated that trainees often begin training with very poor form, which can affect how quickly they progress during training.

Establish Fitness Goals Associated with Training and Occupational Success

Our analysis suggests that the minimum fitness requirements on the PAST are not associated with high probabilities of training success. Therefore, we recommend that the Air Force establish fitness goals for each pipeline that are based on occupational requirements and reflect target thresholds tied to higher probabilities of success. For example, the probability of success for a PJ recruit meeting the minimum PAST standard is only 4.3 percent, while recruits at the median and 75th percentile have an 8.1 percent and a 15.2 percent probability of succeeding, respectively. The fitness levels associated with target thresholds should be communicated and widely reinforced throughout the recruiting community to encourage performance well above the minimum PAST criteria. Furthermore, these thresholds could be used in combination with other fitness development courses as training exit criteria that would need to be met prior to proceeding to the initial course of entry.

Conclusion

Given the strong relationship between recruit fitness and training success in HDHA specialties, this chapter sought to examine whether a hypothetical program designed to improve fitness from the baseline levels observed in the data could translate to higher training throughput, using the PJ pipeline as an illustrative example. Our results show that recruits who meet the minimum fitness standards have a very low probability of success, but that plausible gains in fitness over a hypothetical four-week or eight-week course could meaningfully improve success prospects. The results also show that the cost savings of reduced attrition could offset the additional cost of the hypothetical course, if the course sufficiently improves fitness levels.

Still, these results should be viewed with caution, as they could easily be undone if there are important unobservable factors that differ between the recruits who arrive fit and recruits who are made fit by the hypothetical course. For example, recruits arriving unfit may be less motivated to complete training compared with recruits arriving fit. Furthermore, the training pipeline is a complex system, and unforeseen changes in the dynamics—such as those caused by

changes in command and instructors⁴⁰—could cause the results of implementation to differ from predictions based on historical data. As an example of this pitfall, consider that the current analysis models the relationship between pre-enlistment fitness and success, without accounting for recruit fitness improvements throughout the training pipeline. Thus, fitness gains from an intervention could simply replace gains that would have happened during BMT or the early stages of the pipeline without shifting the success potential of less-fit recruits. Finally, the improvement gains were drawn from a study using a different population, which may overestimate the gains that could be made with PJ recruits who would typically be at a higher starting level of fitness. Thus, although we state that the Air Force should consider developing a fitness course to reduce training attrition, a thorough examination of all possible strategies for improving fitness should be considered.

⁴⁰ Essentially, these results rely on the assumption that the mechanisms determining success remain stable after a broad increase in recruit fitness. However, the result of such a large change in the composition of recruits could affect the system in unpredictable ways. For example, group dynamics and instructor interactions could adjust to an overall shift in recruit fitness levels in a way that affects the success rates for a given level of fitness, which would undermine the predictions of the simulation.

5. Identifying Gaps in HDHA--Specialty Recruiting

Our quantitative analyses demonstrated the importance of physical fitness to success in the HDHA specialties we examined. However, we acknowledge that there are other factors not systematically captured by recruiting and screening processes that could be important for HDHA-specialty training success. This chapter provides findings from our qualitative review and analysis of the gaps in HDHA-specialty recruiting. To begin, we explored issues affecting recruiting processes; however, the information available to provide strategic recommendations for recruiting was limited by two factors. First, we were not able to secure permission to meet or discuss recruiting efforts of the SRD contractor (i.e., field developers). Given the SRD model is a significant part of current plans to recruit and develop candidates for HDHA specialties, our analyses are limited to inputs from a small group of Air Force SMEs. Second, our data analysis was restricted to information that was included in the AFRS database or was publicly available. Therefore, specific factors to facilitate targeted recruiting efforts were limited to the data that were available at the time of analysis. Based on this information, we offer recommendations for the Air Force to consider for addressing potential gaps in recruiting for HDHA specialties.

Approach

Our main approach for the recruiting gap analysis was to discuss recruiting challenges and potential solutions to those challenges with SMEs. SMEs included representatives from AFRS, training instructors from Air Force HDHA-specialty training pipelines, and organizational representatives from HDHA specialties outside the Air Force. Below, we offer a short description of our approach with each SME group.

In addition to SME discussions, we reviewed publicly available information about Air Force and other services' HDHA specialties (e.g., Navy SEALs) to get a sense for marketing and recruiting materials available to the public. Where applicable, we also cite information from prior research studies on recruitment for Air Force special operations specialties.

Air Force Recruiting Services

We met face-to-face with approximately five representatives from AFRS at the beginning and end of the project, as well as communicated with them many times electronically throughout the project's duration. These experts were primarily Air Force civilians and officers with responsibility to support and contribute to the execution of the SRD model. Our conversations with AFRS were originally intended to gather information for evaluating the effectiveness of recruiting efforts. However, during the course of our initial discussions, it became evident that information needed for an evaluation would not be readily available (e.g., access to field

developers). Therefore, we supplemented our discussions with AFRS by speaking with HDHA-specialty training instructors, who relayed their knowledge about recruiting issues from talking with students about their recent recruiting experiences.

Air Force HDHA--Specialty Training Instructors

We held discussions with training instructors in person or by phone to discuss student knowledge, skills, abilities, and other characteristics (KSAOs) associated with success in their training courses, as well as other factors that affect success (or attrition). The primary goal of these discussions was to aid in our analysis of screening gaps for Air Force HDHA specialties, which we describe in the next chapter. Our secondary goal was to identify potential recruiting factors that could affect candidate success in training, which is the focus of this chapter.

As shown in Appendix B, some HDHA-specialty training courses have low attrition rates, less than 10 percent. Therefore, we focused on discussions with instructors of courses with attrition of approximately 10 percent or higher. In total, we received inputs from 29 instructors across the following eight courses: CCT Selection, CCT Operator, CCT Apprentice, EOD Preliminary, EOD Apprentice, PJ Indoctrination, PJ Apprentice, and TACP Preparation.⁴¹ With the exception of two individuals (both Captains, O-3), the instructors were enlisted operators ranging from Staff Sergeant (SSgt, E-5) to Chief Master Sergeant (CMSgt, E-9). Discussions ranged from 45 minutes to two hours.

Sister Services' Special Operations and Federal Agencies with Paramilitary Assets

We met with SMEs outside the Air Force who represent HDHA specialties. Specifically, we met with representatives from the following organizations:⁴²

- **Army SF:** About five representatives from the Special Operations Recruiting Battalion (two officers, one senior enlisted, and two civilians involved in managing the marketing and recruitment of soldiers for Army SF) and about six representatives from the Special Warfare Center and School (mostly senior enlisted or warrant officers who manage aspects of the SF training pipeline).
- **Navy SEALs:** One SME who was currently serving as a Navy SEAL & SWCC Scout Team Operations Officer.
- **CBP's Border Patrol Tactical Unit (BORTAC) and Border Patrol Search, Trauma, and Rescue (BORSTAR) units:** Four individuals, including commanders from BORTAC and BORSTAR.

⁴¹ Unfortunately, due to mutual scheduling conflicts, we did not connect with SERE instructors. SOWT students attend the same courses as CCT students; while we recognize the SOWT and CCT career fields have different job responsibilities, their training requirements overlap. Moreover, there was one SOWT instructor for the CCT Operator Course. Taken together, we believe that we likely captured the most noteworthy issues.

⁴² We attempted to include Marine Corps Forces Special Operations Command (MARSOC) Critical Skills Operators in our review; however, MARSOC was unable to secure the necessary approvals to communicate with the RAND team in the required time frame.

- **FBI's Hostage Rescue Team (HRT):** one organizational psychologist involved in selection processes.

The purpose of these discussions was to gather information on these organizations' recruiting, screening, and development processes to generate ideas for assessments or methods that the Air Force might consider using for the six Air Force HDHA specialties included in our study.

Air Force Representatives Perceive a Range of Recruiting Challenges

Drawing on our meetings with course instructors and AFRS representatives, this section describes what SMEs perceive as major recruiting challenges for HDHA-specialties. These challenges are:

- Many students entering the training pipeline are unaware of the specialty's mission and training requirements.
- Recruiters may lack knowledge and incentive to recruit high quality HDHA-specialty candidates.
- Recruiters are required to meet unrealistic HDHA-specialty recruit quotas.
- The field developer concept is not structured for success.

Each of these challenges is discussed in more detail below and, when appropriate, relevant findings from other project-related efforts are included. We caution the reader that the challenges we cite are not based on the perspectives of SRD field developers and recruiters. Therefore, we cannot comment on whether they would agree with each challenge.

Many Students Entering the Training Pipeline Are Unaware of the Specialty's Mission and Training Requirements

Course instructors from each specialty represented in our discussions expressed frustration that many students entering the training pipeline are largely unaware of their mission sets and training requirements. Two extreme examples that instructors provided are: (1) an EOD candidate did not realize that EOD technicians dealt with explosives and (2) a PJ candidate chose the PJ career field because he wanted to become an astronaut. In general, as one instructor from the CCT Selection Course put it, "many students don't have a clue of what they are getting themselves into; when they look at the CFETP [Career Field Education and Training Plan], they are shocked." Prior research suggests that lack of knowledge about these specialties is an old problem. Specifically, a CCT from one of the focus groups in Harrell et al.'s (1999) study stated, "the average airman doesn't have the mindset for our kind of job. Those people are in the Navy, Marines, or Army in their special ops—most people don't know about combat control or pararescue" (p. 50).

A related issue raised during our instructor meetings was that many students physically prepare for the entry standards (i.e., the PAST) but not for the course or the course's exit

standards (likely because they do not know them). As a CCT Apprentice Course instructor noted: “The PAST is just the minimum, students should crush that.” A PJ Course instructor further illustrated this challenge by stating, “Most of the time students are not coming in fresh to events. For example, students may run 1.5 miles *to* the track and *then* have to run 3 miles for time. A lot of students train for one day of testing as compared to training for the course.” As we demonstrated in our quantitative analyses in Chapters 3 and 4, candidates have higher probabilities to succeed in training for these specialties if they reach fitness targets above the PAST minimum standards.

Taken together, the apparent lack of knowledge among recruits mirrors the larger unfamiliarity among the general public (and within the services, including the Air Force) that the Air Force maintains special operations capabilities. As one CCT Apprentice Course instructor succinctly said, “The AFSOC model is quiet professionals, but I think we are too quiet.” Certainly, a highly desired characteristic of all the special operations community (e.g., SEALs, SFs) is quiet professionalism, yet this may present challenges for recruiting and efforts to increase awareness about Air Force special operations capabilities should be considered.

Because of the Navy SEAL’s recent marketing and recruiting efforts⁴³ and highly publicized operational successes, the Navy SEALs are now a well-recognized special operations community. During our meeting with SEAL representatives, they highlighted their ongoing attention to maintaining a comprehensive, informative, and up-to-date website (U.S. Navy SEAL + SWCC Scout Team, undated-a). The website provides a large amount of information. In addition to detailed text and video-based accounts of the training requirements and career field, the website hosts an interactive platform to allow individuals to input their physical fitness test scores and see how they compare with the top 300 at Basic Underwater Demolitions/SEAL (BUD/S).⁴⁴ Moreover, there is a section entitled “What are your chances of Hell Week Success?” To answer this question, the website states that “a three-year Naval Special Warfare study, comprised of thousands of SEAL candidates, has identified the speeds, distances and reps that correspond to success at BUD/S” (U.S. Navy SEAL + SWCC Scout Team, 2016).

As noted in Chapter 1, AFRS has been making efforts to improve recruiting of Air Force HDHA specialties with its SRD model. AFRS dedicates resources for developing online marketing (including social media) for HDHA specialties, or what AFRS refers to as SO/CS specialties. Marketing tools include a smartphone app that allows users to go on missions (e.g., high-altitude jump) in a virtual reality environment. However, compared with the Navy SEAL website, the official Air Force website does not have the same level of information about SO/CS specialties (e.g., training pipeline requirements).

⁴³Recent recruiting efforts refer to a number of initiatives to include the creation of the SEAL-SWCC Scout Team, initiation of the SEAL Mentors program, and production of a big-screen movie, ultimately entitled the *Act of Valor*.

⁴⁴This is referred to as the Physical Screening Test [PST] Calculator (U.S. Navy SEAL + SWCC Scout Team, undated-b).

Recruiters May Lack Knowledge and Incentives to Recruit High--Quality HDHA--Specialty Candidates

Instructors also noted a general unfamiliarity of the training requirements among recruiters. For instance, a CCT Selection Course instructor mentioned that “recruiters don’t really know what it takes because they don’t have the experiences to know what it takes to get through the pipeline.” An EOD Preliminary Course instructor said there is a “general misconception among recruiting that EOD does not do any physical training” and “EOD are not allowed to be recruiters because we are a constrained career field (i.e., we are critically manned).” To try and dispel these misperceptions, these EOD instructors set up a Facebook page answering such questions as “What should I expect?” and “What are the days like?”

Instructors also expressed frustration that some candidates reveal that recruiters told them they could more quickly enter the Air Force by agreeing to enter one of the HDHA specialties than by waiting for slots in specialties they preferred. An EOD Preliminary Course instructor provided details on this issue.

EOD is an easy access ticket to the Air Force. Some recruits actually want a maintenance job [or some non-HDHA job]; however, the wait time can be a year or more. If you want to get on the plane to get to San Antonio, then you take an EOD slot. After completing five days of training, you can get fast tracked into another Air Force job. Trainees tell us this at the house keeping brief.⁴⁵

A CCT Selection Course instructor highlighted that “recruiters will tell guys that you will have to wait one year for a job or if you go the BA route [sic] you can get the job that you want more quickly (i.e., you get reclassified).”

The challenge with recruiter incentives not aligning with ensuring the best candidates for a specialty is not new or unique to these specialties (see, for example, U.S. General Accounting Office, 1997). The high number of SIEs, in particular for these HDHA specialties, suggests that the Air Force might need to develop specific incentives for recruiting high-quality candidates. As we will discuss below, the anticipated benefits of the SRD model may fall short if recruiting incentives are not well aligned with the needs of these HDHA specialties.

Recruiters Are Required to Meet Challenging Quotas for HDHA Specialties

AFRS representatives expressed frustration on the challenge of meeting quotas for HDHA specialties. Among the HDHA-specialty communities, there is a strong desire to increase the quality of HDHA-specialty recruits; however, the recruiting requirements have not been reduced. AFRS SMEs expressed concern that the attrition and manning numbers that the Air Force uses to determine recruiting objectives might not accurately reflect the manning needs of the HDHA

⁴⁵ The housekeeping brief is a brief that occurs prior to the start of the EOD Preliminary Course. Instructors have a list of over 20 items that they review (e.g., when you have to salute, when you wear a hat). Instructors also ask, “Who knows that they do NOT want to be EOD?” Out of 20 plus students, a couple students raise their hands in response.

specialties. The high recruiting numbers, combined with limited resources, imposes difficult dilemmas for recruiters. If quality is the priority, then the recruiting numbers should perhaps be relaxed until the effects of other initiatives are realized (e.g., creating a larger recruiting pool). If the numbers are not relaxed, recruiters will continue to send individuals to training who just meet the minimum requirements (e.g., minimum scores on the PAST). This issue highlights the problem with the term *qualified*, which carries different meanings for recruiters and the HDHA-specialty community. For recruiters, *qualified* means that the recruit meets the minimum requirements. For the HDHA-specialty community, *qualified* is often interpreted to mean that the recruit is likely to succeed in the pipeline.

The Field Developer Concept Is Not Structured for Success

According to conversations with AFRS, the role of the field developer is to

- prepare candidates, both physically and mentally, for Course of Initial Entry
- administer the PAST
- make recommendations about candidates' readiness to recruiters (start program, continue in program, ship to BMT).

To clarify, Air Force recruiters are ultimately responsible for Air Force HDHA-specialty recruitment and qualification. That is, developers will perform critical functions and offer their expert opinions, but recruiters are the final authority on which individuals should be selected and when these individuals should be shipped to BMT.

Unfortunately, as indicated at the beginning of this chapter, we were not able to meet with the developers (i.e., the contractors for the SRD model) because of stipulations associated with contract renegotiations. Therefore, our information was collected through course instructors who indicated that the current distribution of power is problematic. For instance, a TACP Preparation Course instructor said, "A field developer will write [Person X] is not ready to start the TACP pipeline and doesn't want to be here; however, recruiting services will send them anyways." A PJ Indoctrination instructor emphasized this point, stating: "Recruiters have taken all the power away from the developers." As discussed in the previous paragraph, AFRS is pressured to fill HDHA-specialty recruiting quotas, so recruiters will send candidates who meet the minimum standards rather than waiting to develop candidates to improve their chances of succeeding in the training pipelines.

Recommendations to Improve Recruiting

Recognizing that recruiting may not have sufficient funding for increasing efforts to market and target HDHA-specialty recruits, we offer the following general recommendations to improve the awareness of HDHA specialties in the Air Force and to minimize the extent to which recruits with a low probability of success are encouraged to pursue a HDHA specialty. We organize the recommendations from easier to more difficult to implement. The first two recommendations do

not require significant changes to current recruiting policy and practice, whereas the last two recommendations would require significant changes to recruiting policy and practice.

Balance Marketing Efforts to Attract Recruits with Information that Provides a Realistic Job Preview

One of the common findings from our discussions with training instructors is that recruits often do not have sufficient awareness of the specialty or the training requirements. Consequently, some recruits appear to get their first real introduction to the specialty when they attend the initial course of entry.⁴⁶ Providing additional information during the recruiting process that is not only designed to attract recruits but is also balanced with accurate information about the training demands may help to address some of these problems. This recommendation parallels comments made by one of the training instructors, who said, “We almost want to have a stair step process. First, we need to have a cool product to get them interested and then we need to transition to a realistic preview of what actually happens—we get trashed a lot. It is a lot of hard work.” Providing too many unattractive details too early in the recruiting process can have a negative impact. We recommend exploring ways to frame the less-attractive details in a way that encourages recruits to see the “challenge” and gains that can be made in pursuit of a HDHA specialty, rather than on the information that will be perceived as a threat (e.g., failure rates). Indeed, research suggests that framing difficult goals as challenging rather than threatening may improve performance (Locke and Latham, 2006).

We recognize that the Air Force has developed an app that potential recruits can download and engage in different types of missions (e.g., high-altitude jump). As the Air Force continues with these efforts, we encourage the Air Force to establish a system to evaluate how well the product is working. For example, the Air Force could collect and monitor the number of downloads and level of active engagement with the app. Additional information could also be provided on how to pursue a HDHA specialty and whom to contact for more information.

Similarly, a website that provides detailed information such as entry requirements, training pipeline requirements, and career field and mission duties can play an important role in attracting future recruits, providing accurate information about the career field, and providing important information about how to best prepare for the rigors and demands of a HDHA-specialty training pipeline. For example, the website could emphasize fitness goals using thresholds associated with higher probabilities of success, to convey the importance of preparing to a level of fitness above the minimum requirements to maximize chances of training success. This is a strategy that is currently used by the Navy SEALs to communicate that selection for a training slot is a competitive process and encourage recruits to train above the minimum requirements.

⁴⁶ We are unaware of efforts to determine the source of this issue. It is possible that recruiters may lack sufficient information about these career fields. It is also possible that recruits are acquiring inaccurate information about these career fields from unofficial sources (e.g., blogs).

Explore Opportunities to Expand In--Service Recruiting Efforts

As discussed earlier, many other organizations with HDHA specialties rely heavily on recruiting internal candidates from other specialties within their organizations. The recruitment of such cross-trainees is often used by the Army, FBI, and CBP. Recent AFPC/DSYX efforts have also shown that there might be a sizable pool of personnel who meet minimum eligibility requirements. Cross-trainees for PJ and CCT must go through a selection course to be accepted to the training pipeline. Although we expect candidates selected from cross-trainee selection programs will have higher rates of training success, actual success rates for cross-trainees to HDHA specialties are not well tracked or known. Therefore, a prudent approach would be for the Air Force to first evaluate the success of cross-trainee selection courses and then explore options for expansion if selected candidates are succeeding in training.

Establish an Incentive Structure that Rewards Recruiters when HDHA--Specialty Candidates Succeed in the Initial Course of Entry

AFRS and 2AF are attempting to bridge the gap between recruiting and BMT with their SRD model. However, the decision to qualify a HDHA-specialty candidate still rests with recruiting squadrons. Recruiters' incentives do not necessarily align with ensuring candidates are physically and mentally ready for the demands of training for an HDHA specialty. Therefore, developing a system for rewarding recruiters for HDHA-specialty training success should promote further collaboration and communication between recruiting and the SRD contractors. The call for research and implementation of incentive structures for recruiters is not new (U.S. General Accounting Office, 1997; Oken and Asch, 1997); however, research is still lacking on how best to incentivize recruiters for bringing in quality recruits. Therefore, the Air Force should explore different incentive structures that can be used to encourage recruiters to sign recruits who have a high probability of succeeding in HDHA specialties. Specifically, recruiters could be rewarded for signing recruits who successfully complete the initial course of entry, as suggested by Harrell et al. (1999) in their study of minority barriers to special operations forces. Alternatively, incentives could be tied directly to recruit quality, which could be defined by the probability of success for a specific pipeline. For example, more points could be provided for identifying recruits with fitness levels associated with a high probability of succeeding in the pipeline.

Ensuring that recruiters are rewarded for producing successful candidates is potentially foundational for the successful implementation of other recommendations. When recruiting incentives are not aligned with training goals, recruiters may respond strategically to efforts designed to reduce attrition by sending less-qualified recruits. For example, an analysis may find that boosting recruit fitness with a new development course could reduce attrition, but then recruiters might respond by sending less-fit recruits, while banking on the new course to make up the difference, erasing the potential for a net reduction in attrition.

Expand BA Training Group Concept to Include Recruitment

As noted in Chapter 2, AETC recently established a BA training group. Because AETC is the functional authority for AFRS, AETC can expand on the training group concept to include a BA recruiting element. The recruiting element and training group should have a common chain of command to ensure communication and cooperation between recruiters and training cadre. A dedicated recruiting element could increase opportunities for developing marketing and recruiting materials specific to HDHA organizations. Although AFRS has been developing such materials, a BA recruiting element could expand on those efforts. For example, some Facebook sites have been developed for different HDHA specialties, but the time taken to develop and manage these sites are “taken out of hide” because AFRS does not currently have the capabilities (funding or personnel) to manage independent efforts for each specialty.

Conclusion

This chapter presented the findings from our qualitative review and analysis of the gaps in Air Force HDHA-specialty recruiting. Based primarily on inputs from training instructors and AFRS representatives, we identified perceived recruiting challenges for HDHA specialties. Because we were limited in our evaluation of recruiting practices, we added a short discussion on ways to validate the recruiting challenges identified by SMEs. We concluded the chapter with recommendations to address recruiting gaps for HDHA specialties.

6. Identifying Gaps in HDHA--Specialty Screening

This chapter provides findings from our qualitative review and analysis of the gaps in HDHA-specialty screening. To identify screening gaps, we first identified training KSAOs considered important for success in training for HDHA specialties. Next, we considered various methods of assessment (e.g., structured interviews) that could be used to measure those KSAOs, while taking into account assessment instruments already in use (e.g., ASVAB). Then, we noted which areas of HDHA-specialty training KSAOs are not directly assessed during screening and which assessment methods could fill these assessment gaps. We conclude with recommendations to address gaps in screening information.

Approach

Our gap analysis relied on our review and analysis of different sources of information. We reviewed existing materials (e.g., websites, official documents) and the research literature to provide context for training KSAOs in HDHA specialties and to identify additional assessments (e.g., structured interviews) that may be relevant to the HDHA context. We also solicited information from SMEs to identify training performance requirements, student KSAOs associated with training success, and assessments for HDHA specialties. SMEs included training instructors from Air Force HDHA-specialty training pipelines, operational psychologists, and organizational representatives from HDHA specialties outside the Air Force. Below, we offer a short description of our approach with the training instructors and psychologists. We do not describe the organizational representatives outside the Air Force here because they were described in full in the “Approach” section of Chapter 5.

Air Force HDHA--Specialty Training Instructors

As noted in Chapter 5, we held discussions with training instructors primarily to discuss student KSAOs associated with success in their training courses, as well as other factors that affect success or attrition. To provide context for each discussion, we asked instructors to rate the importance of existing assessments (e.g., PAST events, ASVAB components). These assessments were grouped into the following categories: physical fitness, cognitive ability, personality, and “other.” The “other” category included anthropometrics (e.g., percentage of body fat) and water skills or confidence, and allowed instructors to add characteristics not otherwise specified by the existing assessments. Because the ratings were meant to provide structure to the discussions and the number of instructors by course was small (i.e., seven or less), we do not cite the quantitative results.

Operational Psychologists

Five operational psychologists who support the Air Force's special operations community⁴⁷ were asked to evaluate the usefulness of physical demands associated with 27 training requirements (e.g., land navigation) to develop 18 KSAOs (e.g., leadership).⁴⁸ For example, the psychologists were asked: "How useful are the physical demands of land navigation to develop leadership?" The training requirements were identified through an extensive review of training documentation and discussions with training SMEs; the KSAOs were derived from research literature on job performance (e.g., Bartram, 2005; Viswesvaran, 2001). We examined which training requirements developed the most KSAOs.

Screening Gap Analysis Started by Identifying Six Training KSAOs for HDHA Specialties

Based on our analysis of inputs from the two groups of Air Force SMEs (i.e., operational psychologists and training instructors), we identified five training KSAOs for the six Air Force HDHA specialties. We added a sixth KSAO, water skills or confidence, based on the findings of our quantitative analysis of water skills or confidence presented in Chapter 3.⁴⁹ We acknowledge that there may be other KSAOs critical to training success, such as integrity; however, these were not identified as critical issues, at this time, and therefore not included. The six domains are defined in Table 6.1.

Table 6.1. Training KSAOs for Air Force HDHA Specialties

Training KSAOs	Definition
Physical fitness	Ability to perform and excel in physically demanding tasks required by the job. Demonstrates a high level of physical readiness at all times. Includes aerobic endurance, muscular endurance, muscular strength, anaerobic power, agility, balance, coordination, and flexibility
Persistence	Continues to keep trying, even under adverse conditions and/or failure. Will not quit. Behavior is driven by internal rewards.
Teamwork	Facilitates cooperation and positively contributes to morale and mission effectiveness. Motivates team members to accomplish group goals by fostering commitment, pride, trust, and group identity; can accept criticism and feedback (e.g., "thick skin"). Works well with different personalities and styles; considers others' opinions and alters own opinion when appropriate. Follows the direction of others to contribute to team goals and avoids actions that undermine leadership's authority.

⁴⁷ All but one psychologist was stationed at an AFSOC unit.

⁴⁸ The training requirements fall into four broad categories: water skills (e.g., underwater swimming), leadership and teamwork (e.g., team building exercises), calisthenics (e.g., push-ups), and mission-specific training (e.g., land navigation).

⁴⁹ Water confidence is only relevant for PJs, CCTs, and SOWTs.

Training KSAOs	Definition
Stress tolerance	Remains composed under pressure (e.g., demanding workload;; dangerous or emergency situations). Does not overreact to unexpected news, situations, or obstacles. Ability to flex. Manages frustration well (e.g., seeking constructive solutions rather than blame). Acts as a calming influence on others. Able to overcome fears (e.g., closed spaces, darkness, and heights).
Critical thinking	Identifies and analyzes problems;; seeks out appropriate information, weighs relevance and accuracy of information;; recognizes assumptions. Generates and evaluates the strength and weaknesses of various solutions, as well as their potential implications to team members, equipment, and the mission. Rapidly adapts to new information;; when necessary, comes up with creative solutions (e.g., under resource constraints).
Water skills or confidence	Reflects one's ability to be comfortable, remain composed, and avoid impulses (e.g., nose breathing), which may detract from successful performance during water operations.

Out of the 18 KSAOs that the operational psychologists considered in their ratings, the first five training KSAOs in Table 6.1 were linked to the largest number of training requirements. These five KSAOs were also mentioned, directly or indirectly, during discussions with course instructors. Course instructors rated existing assessments, which indirectly supported the importance of physical fitness, personality, and cognitive ability to course success. For example, personality constructs (e.g., conscientiousness, agreeableness) have been linked to positive teamwork behaviors (Hogan and Holland, 2003; Morgeson, Reider, and Campion, 2005). During the subsequent conversation, course instructors specifically emphasized the importance of persistence, teamwork, and stress tolerance. We provide a sample of supporting quotes from the instructors in Table 6.2.

Table 6.2. Illustrative Quotes from Air Force HDHA-Specialty Course Instructors

Training KSAOs	Supporting Comments
Persistence	• "If there was one word to sum up success in this course it is commitment ... It's living through the grind and putting out every day." [PJ Indoctrination Course] • "You have to have a mindset of 'I will not quit.' In one bad moment, you can wash away all the things you have been doing well in the pipeline. Some of these events just suck;; for instance, rucking with gas mask, pushing a [high mobility multipurpose wheeled vehicle], and carrying a litter. Stress Inoculation Training is a marathon event of suck. You have to push through." [CCT Apprentice Course] • "It's usually the ones that are intrinsically motivated ... the ones that are used to working through adversity." [EOD Preliminary Course]
Teamwork	• "Those that are NOT a team player do not do well." [CCT Selection Course] • "The guys in the 'middle' who have the social skills and interact with others to be part of the team, and that equates to team cohesion. You don't have to be the guy who's liked by everybody but they definitely don't want to be the guy who's closed-off and doesn't participate because he's socially inept and can't interact on a certain level." [PJ Apprentice Course] • "You need to fit in and be an asset to your team ... You don't have to be the smartest or most physically fit, but you do need to be able to contribute to team's success." [CCT Apprentice Course]

Training KSAOs	Supporting Comments
Stress Tolerance	• “We first started Stress Inoculation Training, or rather it was reintroduced to the course 2 years ago, and as time has passed, we’ve had more attrition. What we’ve noticed is that guys in the pipeline talk. You may be here at CCS [Combat Control School], but you still have your buddy at Keesler. These guys talk to their buddies. It builds up and makes the event bigger than what it is. It exacerbates the anxiety by just waiting. We’ve had guys wash back and go back to Keesler (for 10 weeks), then they come back and quit here before Stress Inoculation Training even begins. We ask them—why did you quit? They say, I started seeing all the same stuff and it got real.” [CCT Operator Course] • “Those that can handle stressful situations do better.” [EOD Preliminary Course] • “You need to be able to perform under stress.” [EOD Apprentice Course]

Next, the Level of Coverage Offered by Existing Screening Assessments Was Determined

Having identified the training KSAOs, we now examine the level of coverage afforded by the primary screening assessments used by the Air Force to screen for HDHA specialties. Specifically, the Air Force currently uses or has recently used the PAST, ASVAB, and TAPAS as screening instruments for HDHA specialties. As shown in Table 6.3, only physical fitness is directly assessed by a screening assessment, the PAST, used by the Air Force. The other five KSAOs are only indirectly assessed, by ASVAB and TAPAS.

Table 6.3. Gaps in Coverage of Air Force HDHA-Specialty Training KSAOs

Coverage	Physical Fitness	Persistence/ Motivation	Teamwork	Stress Tolerance	Critical Thinking	Water Skills or Confidence
Direct	✓					
Indirect		✓	✓	✓	✓	✓

The PAST measures the domains of physical fitness through the completion of several events, which include pull-ups, sit-ups, push-ups, run, freestyle swim, and an underwater swim.⁵⁰ Accordingly, we classify the PAST as a direct measure of physical fitness. Although the PAST could be linked to water skills or confidence, we recognize that the PAST swim test does not fully capture water skills or confidence.

The ASVAB measures the broad cognitive domain of verbal, math, science and technical, and spatial abilities (Roberts et al., 2000; Skinner et al., 2007).⁵¹ Although these domains are

⁵⁰ The swim components are only required for PJs, CCTs, and SOWTs.

⁵¹ The specific domain and subtests include verbal (word knowledge, paragraph comprehension), math (arithmetic reasoning, mathematics knowledge), science and technical (general science, electronics information, auto information, shop information, mechanical comprehension), and spatial (assembling objects).

clearly related to critical thinking, the ASVAB does not comprehensively measure critical thinking.⁵² Therefore, we consider the ASVAB as a partial measure of critical thinking.

TAPAS examines 15 subdimensions of the five primary personality dimensions,⁵³ as well as physical conditioning, through a forced choice, computer adaptive test (Nye et al., 2012). Some of the TAPAS dimensions tap into the KSAOs in Table 6.3 (e.g., adjustment dimension covers aspects of stress tolerance). However, the TAPAS relies on self-report responses and does not fully cover the KSAOs in Table 6.3.

Finally, Three Methods That Could Offer Fuller Coverage of Training KSAOs Were Identified

Because we determined gaps in current screening methods, we turned our attention to identifying potential assessment methods that could augment current methods. Methods are the specific assessment techniques used to collect information about the predictors of training KSAOs (e.g., cognitive ability test, personality test). It is critical to differentiate between the KSAOs and the method (Arthur and Villado, 2008) because a single KSAO can be assessed through multiple methods and conversely a single method can assess multiple KSAOs. Furthermore, for a given method, there are many possible assessment instruments. For example, there are many cognitive ability tests, such as the ASVAB, Multidimensional Aptitude Battery (MAB), Wonderlic Personnel Test (Wonderlic, 2012), and Wechsler Adult Intelligence Scale-IV (Wechsler, 2008). The purpose of this section is to indicate which methods the Air Force may benefit from implementing to assess the Air Force HDHA-specialty training KSAOs.

In reviewing potential screening assessments, we focused on those that could examine the training KSAOs that are only indirectly assessed. Specifically, we identified biographical data (biodata) inventories, structured interviews, and assessment centers as promising options. We selected these three methods because of their ability to cover a variety of KSAOs and their potential relevance to the HDHA-specialty context.⁵⁴ Below, we describe each method, noting

⁵² Examples of instruments that are designed specifically for critical thinking include the Watson-Glaser Critical Thinking Appraisal (Watson and Glaser, 1980), California Critical Thinking Skills Test (Facione, 1990), Cornell Critical Thinking Test, Level Z (Ennis and Millman, 2005), the Ennis-Weir Critical Thinking Essay Test (Ennis and Weir, 1985), and the Halpern Critical Thinking Assessment (Halpern, 2010). However, most critical-thinking tests were not designed with military populations, so more research is needed to determine whether they can add anything beyond ASVAB for predicting important training outcomes in the military.

⁵³ The five primary personality dimensions with their correspondingly subdimensions are extraversion (dominance, sociability, attention seeking), agreeableness (generosity, cooperation), conscientiousness (achievement, order, self-control, non-delinquency), emotional stability (adjustment, even-tempered, optimism), and openness to experience (intellectual efficiency, tolerance).

⁵⁴ We originally reviewed two other methods, subjective judgment tests (SJTs) and work samples. We do not include SJTs because biodata instruments can cover similar KSAOs and work samples can be included as part of assessment centers.

empirical support for the method's use in personnel screening. We also identify which constructs each method has evaluated in the past, and how it has been used for HDHA specialties.

Biographical Data (Biodata) Inventory

Description

Biographical data (biodata) inventories consist of multiple items that primarily involves presenting applicants with a series of questions regarding their previous behaviors and experiences (Mumford, Barrett, and Hester, 2012). The questions asked in a particular employment setting depend on the job attributes of interest. For example, if a job involves the need for physical fitness or strength, a biodata measure may include a question regarding the number of sports an applicant participated in during high school (e.g., Farmer, 2007). Biodata inventories have a long history in personnel selection (e.g., Stokes, 1999) and have received meta-analytic support as producing information that can predict important job outcomes, i.e., demonstrating criterion-related validity (Hunter and Hunter, 1994; Reilly and Chao, 1982; Schmidt and Hunter, 1998; Schmitt et al., 1984). Biodata is based on the theory that the best predictor of future behavior is relevant past behavior (Breugh, 2009; Mumford and Stokes, 1992; Stokes and Mumford, 1994).

Mael (1991) compiled a list of *possible* biodata attributes found in the literature; we emphasize the word *possible* because there is tremendous variation among the types of biodata items.⁵⁵ As a result, biodata inventories now commonly assess a wide range of factors, including life experiences, personality, interests, opinions, and abilities (Breugh, 2009). In Chapter 5, we elaborate on how the Air Force could use a biodata inventory. We limit biodata items to life experience and interests, in line with traditional conceptualizations.

Use of Biographical Data Inventories in HDHA Specialties

Among the HDHA organizations reviewed, the FBI is the only one that currently administers a biodata inventory, and the FBI does this during its Phase I special agent (SA) screening process (FBI, undated-b). The FBI's (1997) biodata inventory consists of 47 questions, lasts 45 minutes, and measures the following constructs:

- ability to organize, plan, and prioritize
- ability to maintain a positive image
- ability to evaluate information and make judgment decisions
- initiative and motivation

⁵⁵As Mael (1991) presents on p. 773, examples of this variability include such attributes as objectivity (objective: "How many hours did you study for your real-estate license test?"; subjective "Would you describe yourself as shy?"), controllability (controllable: "How many tries did it take you to pass the CPA exam?"; noncontrollable: "How many brothers and sisters do you have?"), and verifiability (verifiable: "What was your grade point average in college?"; nonverifiable "How many servings of fresh vegetable do you eat every day?"). Mael concludes that the only requirement of a biodata item is to be historical (i.e., the item asks about past behavior).

- ability to adapt to changing situations
- physical requirements.

While the FBI uses a biodata inventory as a screening tool, it could be used for other purposes. Specifically, a biodata inventory could be used to collect data that will help decisionmakers obtain a more comprehensive profile of the applicant pool and/or successful students. This information could, in turn, inform recruiting efforts.

Although not currently used as a screening tool in the other HDHA specialties, research has examined the use of biodata inventories for predicting performance of Army SF soldiers. This research has demonstrated that biodata indicators of intellectual openness, tolerance for ambiguity, achievement orientation, and fitness motivation are predictive of performance ratings during final training into the SF (Kilcullen et al., 2002). We also note that biodata has been of interest to the U.S. military, more generally, for personnel screening for several decades (Knapik et al., 2004). Over time, various biodata measures have been implemented, modified, and abandoned by the different services.⁵⁶ Today, the U.S. military continues to utilize various biodata items (e.g., Knapik et al., 2004; Air Education and Training Command 36-2642, 2016), and researchers continue to assess the efficacy of different biodata measures in predicting U.S. military performance and attrition. For example, the Air Force administers the Lackland Behavioral Questionnaire, a biodata instrument, at the beginning of BMT to identify and assist at-risk trainees. Items included in this questionnaire address trainees' behavioral histories, including previous history of mental health concerns (e.g., attempted suicide), drug use (e.g., number of times used marijuana), and school experiences (e.g., required to attend alternative school). The measure has been shown to predict early separation due to unsuitability and mental health diagnosis while in service (Garb et al., 2013).

Structured Interview

Description

The employment interview is defined as “a personally interactive process of one or more people asking questions orally to another person and evaluating the answers for the purpose of determining the qualifications of that person in order to make employment decisions” (Levashina et al., 2014, p. 243). The interview is one of the most commonly used methods for assessing job candidates (Macan, 2009) and received a tremendous amount of research attention. Comprehensive reviews continue to be published regularly⁵⁷ and several meta-analyses have

⁵⁶ Examples of previous biodata measures administered by the U.S. military include the History Opinion Inventory, Military Service Inventory, Recruit Background Questionnaire, Military Applicant Profile, Educational and Biographical Information Survey, and the Armed Services Adaptability Profile (Laurence and Means, 1985).

⁵⁷ Examples include: Arvey and Campion, 1982; Harris, 1989; Levashina et al., 2014; Posthuma, Morgeson, and Campion, 2002; Ulrich and Trumbo, 1965; Wagner, 1949; and Wright, 1969.

been conducted on the topic.⁵⁸ Consistently and convincingly, this extensive body of research concludes that structured interviews are more reliable and valid than unstructured interviews, and structured interviews demonstrate criterion-related validity. Broadly defined, a structured interview involves establishing and purposefully applying a set of predetermined rules for questions, observations, and evaluations. Components of structured interviews include basing questions on a job analysis, asking the same questions, developing questions systematically,⁵⁹ using an anchored rating scale, rating each question, and providing interviewer training (see Campion et al., 1997 for a discussion of components; Levashina et al., 2014).

Structured interviews can measure different constructs. Huffcutt et al. (2001) constructed a comprehensive classification of seven categories of constructs that have been assessed during the employment interview: (1) personality tendencies, (2) applied social skills, (3) mental capability, (4) knowledge and skills, (5) interests and preferences, (6) organizational fit, and (7) physical attributes. These authors reviewed 47 studies with 338 ratings to determine how frequently the constructs are rated in employment interviews. They found that personality tendencies and applied social skills were rated most often. For personality, conscientiousness was the most commonly rated construct (e.g., responsibility, dependability, initiative, and persistence). For applied social skills, the area of interpersonal skills was the most rated construct (e.g., interpersonal relations, social skills, team focus, and the ability to work with people).

Use of Structured Interviews in HDHA Specialties

Both the Navy SEALs and FBI HRT use the structured interview method during the screening process. Interestingly, the interview appears to serve dual purposes: collect information about the applicant and ensure that the applicant is knowledgeable about the requirements of training and the career. Former or current operators (i.e., someone who is extremely familiar with HDHA specialty) conduct the interview.

For the SEALs, the Naval Special Warfare (NSW) Mentors administer the interview and serve as the assessors.⁶⁰ Below are questions from the Naval Military Personnel Manual

⁵⁸ Examples include: Conway, Jako, and Goodman, 1995; Huffcutt and Arthur, 1994; Huffcutt, Conway, Roth, and Klehe, 2004; Hunter and Hunter, 1984; Latham and Sue-Chan, 1999; Marchese and Muchinsky, 1993; McDaniel, Whetzel, Schmidt, and Maurer, 1994; Reilly and Chao, 1982; Schmidt and Rader, 1999; Schmidt and Zimmerman, 2004.

⁵⁹ There are four general types of questions: behavioral, situational, knowledge-based, and background (Campion, Palmer, and Campion, 1997). Behavioral questions ask candidates to describe their past behavior, whereas situational questions ask candidates to describe how they would respond to a hypothetical situation (i.e., their future behavior). Knowledge-based questions ask if candidates know a particular body of information and background questions pose questions about candidates' prior experiences (e.g., work, education). Behavioral and situational questions types are the most commonly assessed; meta-analytic studies (Day and Carroll, 2003; Gibb and Taylor, 2003; Klehe and Latham, 2006) find that both types predict job performance.

⁶⁰ NSW Mentors are aligned to the Navy Recruiting Districts (NRDs); that is, there are 26 NRDs and thus 26 NSW Mentors. NSW Mentors are former operators in one of the five career specialties associated with NSW special operations. The primary role of NSW Mentors is to provide a realistic preview of a SEAL lifestyle and guidance on

1220-300 (2014), which is the official Special Warfare Operator (SO) rating (also referred to as the “SEAL package”). Along with other information, the NSW Mentors submit this package to the Navy Personnel Command (NPC) for consideration of a SEAL contract:

Interview conducted by: (name, rank, position, command, date). (Interviewer should include any significant findings pertinent to selection/non-selection of member for requested training.)

1. Does the applicant totally understand the mission and scope of the program? Yes/No
2. Does the applicant fully understand the training regimen during initial training and what will be expected of them? Yes/No
3. Is the applicant’s motivation for entry into the rating a sincere desire for personal growth and achievement, and not solely for the money or as a method to escape their present circumstances, etc.? Yes/No
4. Does the applicant have the ability to adapt to the requirements of the desired community? Yes/No
1. Is the applicant mentally prepared for the arduous training? Yes/No
(Naval Military Personnel Manual 1220-300, 2014)

For the FBI HRT, applicants must first apply to the FBI as SAs and serve a minimum of two years as a SA before applying to HRT. During Phase II of their initial organizational screening (for SA), active FBI SAs administer a structured interview and serve as the assessors. The interview consists of 15 questions, lasts one hour, and measures the following constructs (FBI, 1997):

- ability to communicate orally
- ability to organize, plan, and prioritize
- ability to relate effectively with others
- ability to maintain a positive image
- ability to evaluate information and make judgment decisions
- initiative and motivation
- ability to adapt to changing situations
- integrity
- physical requirements.

proper physical and mental preparation. In addition, NSW Mentors assess if a prospective SEAL candidate has the potential to succeed, administer the PST, coordinate completion of the Computerized Special Operations Resilience Test (C-SORT), assist in preparing the SEAL package, and submit the SEAL package for consideration. The frequency and medium of interaction (i.e., face-to-face, telephone, email) depends on a number of factors, such as the NSW Mentor’s personal preference for communication, distance from the prospective candidate, and likelihood for a prospective candidate to succeed.

Individuals who apply for the Tactical Recruiting Program (TRP)⁶¹ are also contacted by active HRT operators, who conduct a semistructured interview. The purpose of this interview is for HRT operators to share information about HRT (e.g., expectations of training, life on the team) and to better understand the tactical experience level of the candidates.

Assessment Center

Description

An assessment center is a comprehensive, standardized evaluation of behavior that uses multiple techniques and trained observers to assess multiple constructs (Rupp et al., 2015). Assessment centers have received a tremendous amount of researcher and practitioner attention with many meta-analyses demonstrating criterion-related validity⁶² with the most recent meta-analysis offering criterion-related and construct validity evidence (Hoffman et al., 2015). As we describe earlier in this report, criterion-related validity is the extent to which results from an assessment (e.g., assessment center) predict performance on an outcome measure (e.g., training attrition). Construct validity refers to the degree to which an assessment tool measures the construct (e.g., persistence) it is designed to measure. According to Rupp et al. (2015), assessment centers must have the following ten features:

1. Job-relevant behavioral constructs are based on a systematic process (e.g., job analysis, competency modeling).
2. They must have multiple assessment methods (e.g., work samples, structured interviews, cognitive ability tests).
3. At least some job-related simulation(s) (i.e., work samples) are involved.
4. Assessment center components are linked to behavioral constructs (i.e., a matrix mapping of which domains are assessed during which exercises).
5. Behaviors assessed are classified to behavioral domains.
6. Multiple assessors must observe and evaluate each assessed individual.
7. Assessors must receive thorough training and demonstrate certain performance levels.
8. Behaviors are recorded and scored according to a systematic process.
9. Observations and/or ratings of assessee's behaviors are integrated.
10. The procedures for administering all aspects must be standardized so all assessee's have the same opportunities to demonstrate behaviors of relevant behavioral constructs.

⁶¹ The FBI initiated the TRP in response to a perceived problem of HRT manning. TRP seeks to attract non-FBI employees with prior tactical experience (either military or law enforcement) to first become an SA and then, ultimately, serve on the HRT. Individuals who meet the TRP standards would be eligible for HRT after two years of investigative SA experience, as opposed to the typical three years. Entering the FBI through the TRP does not guarantee the individual will become a HRT operator nor does it require that the individual must apply for the HRT.

⁶² Examples include: Aamodt (2004); Arthur et al. (2003); Gaugler et al. (1987); Hermelin, Lievens, and Robertson (2007); Hunter and Hunter (1984); Meriac, Hoffman, and Woehr (2014); and Schmitt et al. (1984).

As inferred from the features above, assessment centers are designed to measure multiple KSAOs. Arthur et al. (2003) examined 34 articles with 168 assessment center labels and collapsed them into the following set of six dimensions:

- communication
- consideration and awareness of others
- drive
- influencing others
- organizing and planning
- problem-solving.

Use of Assessment Centers in HDHA Specialties

The Army SF, FBI, and CBP use selection courses, which closely align with how assessment centers are constructed. Respectively, these would be the Army's SFAS, the FBI's HRT Selection, and CBP BORTAC's Selection and Training Course (BSTC).

SFAS, which lasts approximately three weeks and conducted almost monthly, is considered the primary mechanism to identify candidates for the SF Qualification Course. As stated in the Army course overview, "this program allows SF an opportunity to assess each soldier's capabilities by testing his physical, emotional, and mental stamina" (U.S. Army Recruiting Command, undated). Some of the assessments include physical assessments (e.g., Army Physical Fitness Test), behavioral simulations (e.g., compass course, land navigation), and personality tests (Minnesota Multiple Personality Inventory [MMPI]) (U.S. Army Recruiting Command, 2006). All tasks are performed in a neutral environment with limited information and cadre do not offer performance feedback; rather, cadre's sole responsibility is to assess candidates based on their SFAS performance.

The FBI's HRT Selection, which lasts approximately two weeks and is conducted twice a year, is also considered the primary selection mechanism for HRT. Some of the assessments include physical fitness tests (e.g., timed runs), job-skills test (e.g., firearms tests), and other behavioral simulations. If an individual completes the course, then he or she will earn the opportunity to be evaluated by the board. That is, not all candidates who complete the HRT selection course will be selected for HRT.

CPB BORTAC's BSTC is modeled after SFAS (CPB, 2014). The BSTC can last up to one month and is conducted once a year. Some of the assessments at BSTC include physical fitness tests (e.g., timed runs), job-skills test (e.g., firearms tests), and other behavioral simulations. BSTC consists of four phases; at the end of each phase, BORTAC convenes a board to determine the candidates' suitability. Similar to HRT Selection, simply surviving the evolutions does not translate into being selected.

Recommendations and COAs to Improve Screening

As discussed in Chapter 2, there is very little value that can be gained from additional or even more valid screening assessments if the selection ratio is high and the base rate of success is low. Consequently, the following recommendations are made based on the assumption that additional recruiting and marketing efforts will yield more recruits from which additional screening can be used to select candidates who have the highest probability of succeeding in a HDHA-specialty training pipeline. The objective of such screening measures should be to address areas not currently being measured by existing measures. These gaps include motivation and characteristics related to teamwork and stress tolerance.

To address existing deficiencies in the current screening process, we offer two COAs that involve consideration of three assessment tools: biodata inventory, structured interview, and selection course (i.e., assessment center). Each of the proposed assessments has been shown to have moderate to high validity and relatively low levels of adverse impact,⁶³ suggesting that these tools could provide added benefits for screening HDHA-specialty recruits (see Table 6.4).

Table 6.4. Evaluation of Assessment Methods on Four Key Criteria for Existing and Proposed Assessments

Assessment Method	Validity	Adverse Impact	Costs (Develop/ Administer)	Applicant Reactions
Assessment centers	Moderate to high	Low to moderate, depending on exercise	High/high	More favorable
Biographical data inventories	Moderate	Low to high for different types	High/low	Less favorable
Structured interviews	High	Low	High/high	More favorable
Physical fitness tests	Moderate to high	High (against females and older workers)	High/high	More favorable
Cognitive ability tests	High	High (against minorities)	Low/low	Somewhat favorable
Personality tests	Low to moderate	Low	Low/low	Less favorable

SOURCE: Table adapted from Pulakos (2005).

⁶³ Adverse impact suggests that there are average subgroup mean differences on the assessment tool. That is, on average, one subgroup scores significantly better than another subgroup. It is important to note, however, that the existence of adverse impact does not necessarily mean that a test is biased against one subgroup. Some tests, such as physical fitness tests, can result in high levels of adverse impact against women, even when the tests are job-related and unbiased.

Structured interviews and assessment centers are also generally well received by potential recruits. That is, they tend to view these assessments as job-related and fair decisionmaking tools. One of the primary drawbacks is that each proposed assessment typically costs more to develop and to administer than such traditional assessments as cognitive ability or personality assessments. We explore these tradeoffs in more detail when we summarize the benefits of each assessment in two COAs presented below. The COAs are listed from easier to implement to more difficult to implement.

Regardless of which assessment methods are considered, validation studies would be needed to determine whether the chosen method(s) measure what they are designed to measure (construct validity), are representative of the content that should be measured (content validity), and predict important outcomes (criterion-related validity).

In addition to the two screening assessment COAs, we offer four general screening recommendations that are related to our study findings but do not map onto our discussion of the three screening methods. Like the COAs, the general screening recommendations are organized from easier to harder implementation.

COA 1: Consider Developing a Biographical Data Inventory and Structured Interview

Biographical Data Inventory

Biodata inventory has been shown to be a valid predictor of future performance. Although quite expensive to develop, the administration costs are typically lower and more similar to other group-administered tests (e.g., cognitive ability tests). There are at least two other important benefits that can be gained from a biodata inventory. First, the inventory could be tailored to the requirements of each HDHA specialty. That is, the final pool of items retained for each specialty would be selected specifically because they predict future training performance for recruits to that specialty. Some items may overlap but others may be important predictors of performance for specific requirements such as water confidence. The inventory can also be updated to reflect changes in the recruit population over time, which is helpful to identify if the types of biographical history events predicting training success change over time.

Developing a biodata inventory for each specific HDHA specialty also provides important information that could be used to develop profiles that may facilitate recruiting efforts. Our discussions with training instructors and AFRS suggested that there was a general understanding that successful HDHA-specialty recruits are physically active in high school. However, the specific sports, number of sports, or even general health behaviors may provide other important markers for which candidates are likely to be most successful. Such profiles have been developed for the Navy SEALs and could prove equally useful for marketing and recruiting efforts for Air Force HDHA specialties.

Although biodata inventories could prove useful for recruiting and screening for HDHA specialties, there are two primary drawbacks, including development costs and the concern for

“faking” responses. There is considerable debate in the scientific and professional communities as to the extent to which faking occurs and is harmful to the validity of self-report instruments. There are steps that can be taken during the development and administration of a biodata inventory that have been shown to reduce the extent to which recruits fake their responses. For example, biodata items can be developed to be more verifiable (e.g., high school grades versus number of books read).

Structured Interview

Another assessment tool that has flexibility in the types of constructs that can be measured is a structured interview. Incorporation of a structured interview early in the recruiting process can help measure recruits’ interests, motivation, and, in general, to gauge their understanding and knowledge of career field and training requirements. Ideally, the interviewers would be one or more individuals with experience from the career field; however, we recognize that some HDHA specialties are constrained and cannot commit personnel resources to recruiting functions. Therefore, recruiters and SRD contractors may need to be used as interviewers. Another option could be to use retired HDHA operators to conduct these interviews.

There are several benefits to the implementation of a valid structured interview. First, as previously discussed, structured interviews can be designed to measure a range of constructs and can also address a candidate’s motivation for pursuing a HDHA specialty. Although the SRD program is designed to help ensure candidates are truly interested, motivated, and prepared to enter a HDHA-specialty training pipeline, discussions with training instructors indicated that some recruits are still showing up with misconceptions about the specialty and, in some cases, are being told that pursuing a HDHA specialty is the fastest way to get into a training pipeline for another career field. A structured interview could not only be used to ask questions specifically addressing this problem, but could also provide opportunities for interviewers to share additional information about the career field and training requirements.

COA 2: Consider Using a 2--to--3--Day Selection Course at the End of BMT for Final Screening

A selection course (i.e., assessment center) could be modeled off the selection courses used to select Air Force officers into HDHA specialties (e.g., STOs and Combat Rescue Officers). Several other HDHA-specialty organizations, such as the FBI and Army SF, also use a selection course as a final screening tool before offering candidates a training slot. There are many benefits to be gained from implementing a selection course. First, selection course events can be designed to provide important information about a candidate’s motivation and desire to be in a HDHA specialty. The course can also provide benefits similar to a realistic job preview. That is, participation in the selection course can allow candidates to determine whether a HDHA specialty is really what they want to pursue. Furthermore, exposing candidates to a small preview of HDHA-specialty training requirements could help to address many of the misconceptions that

recruits may have about the specialty (e.g., not knowing that water was a significant part of training for PJs).

A selection course can also address the assessment gaps by providing a more direct measure of characteristics not well covered by existing screening tools, such as teamwork, leadership, stress tolerance. Consequently, the Air Force would not need to rely on imprecise forecasting but would be able to obtain samples of candidates' performance and behaviors required in training and in the career field. More specifically, exercises can be designed to approximate the physical and mental challenges that will be faced in training and in the career field. However, it is important that these exercises be appropriately scaled in terms of demands to allow for adequate opportunity for candidates to express their motivation and other abilities, but not so demanding that candidates will be overwhelmed before they have received the appropriate training to prepare for and manage training demands.

Another advantage of a selection course is that it provides an opportunity for training instructors (cadre) to be part of the decisionmaking process, which will promote buy-in and commitment among the HDHA-specialty and training community since selected recruits will have been vetted. Other advantages of a selection course are more indirect. For example, a selection course provides an excellent opportunity for administering and testing other assessment tools that can be used to improve future recruiting and screening efforts.

If the Air Force chooses to implement a selection course, it could explore options for targeting BMT trainees who have been assigned to a non-HDHA specialty but otherwise meet and perhaps exceed the minimum requirements for a HDHA specialty. The implications for manpower and training planning for the non-HDHA specialties would need to be fully explored prior to implementation of this recommendation. Furthermore, the Air Force would need to explore the relative costs of developing and implementing a selection course. Although it would be the most expensive option, the administration costs will depend greatly on the length of the course. Nonetheless, the benefits of implementing a selection course may partially offset costs in the long run by reducing the number of reclassifications when candidates do not successfully complete a HDHA-specialty training pipeline.

General Screening Recommendations

As noted previously, we provide four general screening recommendations ordered from relatively easy to implement to harder to implement.

Develop a Training Readiness Index to Rank Order Recruits for Available Training Seats

Top-down selection systems that accept the candidates with the highest probability of success will generally result in better training outcomes compared to selection systems that treat all candidates meeting minimum eligibility requirements equally. We recommend rank ordering recruits using a training readiness index that incorporates a weighted composite of physical fitness (PAST) and cognitive ability (ASVAB). This recommendation will be most useful when

there are more qualified recruits than training seats available, which will allow the Air Force to be more selective in filling training seats.

Reexamine Role of Personality Measures

As previously discussed, personality measures have been shown to be valid predictors of future performance, both in concurrent studies using existing employees and in predictive validation studies using actual job applicants (Ones et al., 2007). However, the TAPAS did not contribute to the prediction of training success in a manner consistent with prior research, which has generally shown that personality can contribute small to moderate gains in the explanation of training success⁶⁴ (Barrick and Mount, 2001). There may be several plausible explanations for this finding. First, the training demands in the high attrition courses heavily emphasize physical fitness; therefore, the role of personality may not play a significant role in determining why specific individuals do not succeed in HDHA-specialty training. Physical fitness and exercise behaviors are also correlated with aspects of personality, such as self-discipline and emotional stability (Courneya and Hellsten, 1998; Hogan, 1989). Therefore, physical fitness may capture the elements of personality that could contribute to the explanation in HDHA-specialty training success. This explanation, however, seems unlikely because TAPAS did not improve predictions of training outcomes when considered independently of physical fitness.

Another factor that may affect our interpretation of TAPAS results is that it was undergoing development during the period for which we analyzed the data. It is possible that some versions of the instrument may perform better than others. Although we recommend continued review and evaluation of the relative value of TAPAS or other personality instruments for predicting training success or other important outcomes (e.g., leadership), any incremental validity gained from using personality measures would likely be small given the current recruiting and training challenges facing HDHA-specialties.

Any instrument that is considered should be fully evaluated in a high-stakes selection context (i.e., recruits rather than technical training students) and cross-validated with multiple cohorts. Other noncognitive instruments that have been considered by the Air Force for screening enlisted applicants include the NEO-Personality Inventory (NEO-PI) (Koltko-Rivera and Niebuhr, 2004) and the EQ-i (Dawda and Hart, 2000).⁶⁵ The cross-validation process is needed to ensure that models are not overfit, which occurs when a model is too customized to the particular sample. Overfit models may show improvements in fit while degrading the actual predictive performance on future recruits.

⁶⁴ The 90-percent credibility intervals for conscientiousness range from .05 to .41.

⁶⁵ See Appendix B for more details.

Evaluate Potential Benefits of Upgrading Physical Test Components on the PAST

Although the PAST was found to be the strongest predictor of training outcomes in our study, there may be opportunities for further strengthening that relationship with a more comprehensive physical test battery. Similar to Army studies (e.g., Furbay et al., 2015), prior Air Force efforts in FY 2015 demonstrated that such improvements could be made through the development of tests and standards that are designed using occupationally specific information about important physically demanding tasks performed by airmen in the target specialty. We suggest building on this work by evaluating the relative benefits of augmenting or replacing specific PAST events.

Explore Benefits of Including a Water Skills Test for Specific HDHA Specialties

We conducted an exploratory analysis of the water skills test for PJs. Preliminary evidence suggests that recruits' scores on this test could provide valuable information in determining future success in the training pipeline. We recommend conducting further analysis and evaluation of the water skills test for the other HDHA specialties that require water confidence training, which include the CCT, SOWT, and SERE specialties. Evaluation activities should be conducted to establish test measurement properties, including test-retest reliability and the extent to which this test is a valid indicator of success for each pipeline, above and beyond existing assessments. Further analysis should also explore the extent to which water skills are trainable constructs. If water skills are found to be highly trainable, the Air Force could identify ways to incorporate water skills training prior to selection to ensure that individuals can learn the skills required to succeed in the training pipeline. If an analysis shows that water skills are more stable constructs, the Air Force can explore this test as an additional screening assessment.

Conclusion

This chapter presents the findings from our qualitative review and analysis of the gaps in Air Force HDHA-specialty screening. We started by identifying six training KSAOs necessary for success in HDHA specialties. We then examined whether these KSAOs were evaluated by the assessment instruments that have been used by the Air Force (PAST, ASVAB, and TAPAS). Indeed, all the KSAOs were evaluated; however, only physical fitness was directly evaluated. That is, the ASVAB and TAPAS were not designed to specifically measure the remaining five KSAOs. Based on these deficiencies, we reviewed widely known assessment methods in personnel selection and presented three methods that could be considered for implementation in the near future because of their versatility and relevance. We also provided other screening recommendations, including a system for rank-ordering recruits for available training seats, potential reevaluation or revision of existing assessments, and development of new assessments.

7. Conclusions and Implications

In this chapter, we summarize the main conclusions and implications of our study. We start by addressing the three main questions that the Air Force asked the RAND team to address:

1. What factors are associated with training attrition in select Air Force HDHA specialties?
2. What, if any, are the gaps in recruiting and screening candidates to enter these select HDHA specialties?
3. What methods should the Air Force consider using to recruit, screen, and develop candidates for these select HDHA specialties?

Next, we acknowledge that limitations of the administrative data used in the study precluded analysis of additional factors that might affect training attrition. We follow with an overarching recommendation to address the data limitations we outline. We conclude with a call for coordination and cooperation among Air Force stakeholders involved in efforts to improve success of candidates in Air Force HDHA-specialty training.

Question 1: What Factors Are Associated with Training Attrition in Select Air Force HDHA Specialties?

We analyzed available administrative data to identify key predictors of training attrition (including predictors outside the realm of fitness and aptitude, which are already used for screening). Using a flexible statistical model as a litmus test for whether predictive improvements are possible, we find that other factors beyond fitness and aptitude do not meaningfully relate to training success. However, the lack of model improvement with the addition of new characteristics available in the administrative data does not mean that predictive improvements are impossible. Rather, these results indicate that existing fitness and aptitude metrics are the only variables currently available that significantly improve predictions. It is still possible and desirable to improve the quality of pre-training screening metrics. As one example of a potential improvement to existing screening metrics, we found that the BWST can improve prediction of PJ training success.

Question 2: What, If Any, Are the Gaps in Recruiting and Screening Candidates to Enter These Select HDHA Specialties?

In our study, we originally set out to evaluate Air Force recruiting processes for HDHA specialties. However, initial discussions with AFRS revealed that information for an evaluation would not be readily accessible. For example, we could not obtain permission to speak with the SRD contractors (i.e., field developers) because of contract negotiations at the time of the study.

Therefore, we culled themes from discussions with AFRS and HDHA-specialty training instructors. These themes include:

- Many students entering the training pipeline are unaware of the specialty's mission and training requirements.
- Recruiters may lack knowledge and incentive to recruit high quality HDHA-specialty candidates.
- Recruiters are required to meet unrealistic HDHA-specialty recruit quotas.
- The field developer concept is not structured for success.

Because we were limited in our review of recruiting gaps, we focused more effort on identifying screening gaps and assessments to fill those gaps. We conducted a qualitative analysis to identify gaps in screening assessments used for Air Force HDHA specialties. This analysis suggested the following six training KSAOs for Air Force HDHA specialties: physical fitness, persistence, teamwork, stress tolerance, critical thinking, and water confidence. Existing screening instruments—ASVAB, PAST, and TAPAS—do not directly nor comprehensively measure the six KSAOs. Only physical fitness is directly measured by an existing screening tool (i.e., the PAST). All of the other KSAOs are indirectly measured by existing screening instruments (e.g., ASVAB indirectly measures critical thinking).

To identify screening assessment methods, we reviewed literature on personnel screening and culled information about methods used for HDHA specialties outside the Air Force (e.g., Navy SEALs). We identified three assessment methods for the Air Force to consider: biographical data (biodata) inventories, structured interviews, and assessment centers (or selection course). Each of these assessment methods is promising because each one can measure multiple KSAOs (versatile), has been previously used in HDHA specialties outside the Air Force (relevant), and has been shown to produce valid results in personnel selection contexts (valid).

Question 3: What Methods Should the Air Force Consider Using to Recruit, Screen, and Develop Candidates for These Select HDHA Specialties?

Based on our study findings, we offer several recommendations of methods for improving candidate success in HDHA-specialty training. We group our primary recommendations into three functional areas: recruiting, screening, and development. Policies to improve candidate success can attempt to change the individuals drawn out of the eligible population and into each HDHA-specialty pipeline (recruiting); change the standards that recruits must meet before they are accepted into training (screening); and/or invest time and resources into recruit capabilities at any point in the process (development). These functional areas are interdependent, so that challenges in one area limit the potential impact of policies in another area.

Although improved screening is often the focus of training attrition research, the current state of recruiting places HDHA specialties in a situation in which improved screening is unlikely to reduce attrition while maintaining a sufficient number of graduates. However, existing

information available in administrative databases is currently insufficient for developing sophisticated models to strategically target high-potential recruits. To address this deficiency, the Air Force could develop biodata inventories based on the interests and activities of successful HDHA candidates. Such tools can be used to guide both recruiting and screening efforts. Once successful candidates are identified, efforts should focus on maintaining candidates' interests, providing realistic previews of job and training requirements, and providing support to develop physical fitness to target thresholds, which should improve their probability of success.

Limitations of Existing Data

The study evaluated data that were extracted from recruiting and training databases. Unfortunately, there was a considerable amount of missing data. Although we used a robust methodology that can effectively handle missing data, future efforts should attempt to locate and identify the reasons for the missing data. There were also several questions that we could not directly address with the data available. For example, the TTMS (training attrition) codes do not necessarily represent the actual reasons for attrition. Different training command policies affect the interpretation for how the codes should be used. Consequently, an analysis to identify the relationship between different predictors and attrition reason was not possible. Understanding the various reasons that individuals self-eliminate is critical to identify how best to incorporate additional assessments. Other questions that we could not examine include the extent to which changes in command, training requirements, or the demand signal for HDHA personnel affect attrition rates. Addressing such questions may further help to identify possible causes for attrition.

We also provided an illustrative example of how fitness gains from a development course could translate into higher probabilities of success. However, the data used to simulate the possible gains in success were drawn from a high school population. Although high school students are close in age to HDHA-specialty recruits, more precise estimates could be developed by documenting physical fitness gains that occur between critical transition periods. For example, the PAST can be administered when each candidate is a recruit, followed by BMT-Week 0, BMT-Week 8 (graduation), and the start of initial course of entry (in technical training).

Data Limitations Can Be Addressed by Hiring an Experienced Researcher into the Battlefield Airmen Training Group

An experienced researcher who is part of the BA Training Group can be provided with the authority to lead future evaluation efforts addressing effectiveness of recruiting efforts, as well as training efficiency and attrition. Centralizing the authority for studies aimed at improving recruiting, screening, and training for HDHA-specialty positions will help to ensure that research efforts are integrated, well-managed, and address the needs of HDHA specialties. In the past,

research efforts have been executed by many different organizations within and outside the Air Force. Although such diversity can provide different perspectives, it can also inhibit collaboration, data sharing, and changes that are required to address challenging issues. Furthermore, data from prior and even current efforts are not stored in a way to allow for continuous improvement by building on prior lessons learned.

At a minimum, the position should require someone who is trained in data collection, data management, and statistical analysis. This person should be provided with the authority and tasked to develop a research database to address limitations of existing data. For example, the database should contain detailed information for the following:

- HDHA-specialty recruit characteristics (e.g., abilities, interests, background)
- Training performance, including progression through the pipeline (e.g., wash backs), performance scores on critical training events, and performance ratings from training instructors and/or peers
- Details about attrition for candidates that do not succeed, which should include the following:
 - The date a decision was made that the recruit will be eliminated rather than current administrative date of elimination that is currently recorded
 - Specific reason for elimination that provides sufficient details to develop more precise and accurate categories for elimination than TTMS currently provides
 - Additional details on contributing factors, such as performance deficiency in a specific event or several other students self-eliminated at same time
- Details on changes to recruiting, screening, and training policies and practices, including nature and time frame of changes.

In addition to data collection, data management, and statistical analysis, the researcher should review materials on previous studies related to training outcomes for HDHA specialties, and consider the merits of recommendations from previous studies that have not been (fully) implemented. For example, Manacapilli et al. (2012) and our interviews suggest that courses with one or more officers or noncommissioned officers (NCOs) have higher percentages of students complete the courses compared with courses without any officers or NCOs. Manacapilli et al. recommended that officer candidates be spread out among training courses as a way to improve training attrition. This idea has merit, but would require additional assessment by the Air Force to determine its feasibility. The goals of reviewing previous research are to avoid duplication of research effort and to understand what conditions affect whether recommendations are adopted.

Overall Conclusion

Given the high rates of training attrition that have been consistently observed in similar organizations with HDHA specialties, we do not expect that training attrition can be completely eliminated. However, improvements can be made by modifying recruiting efforts to more

strategically target high-potential candidates, developing more comprehensive screening tools, and further developing recruits' physical fitness.

In closing, we recognize the complexity of coordinating across the multiple Air Force units and organizations that have influence over one or more components of the recruiting, screening, and training lifecycle for HDHA specialties. To have the best chance for addressing training attrition, substantial coordination and support will be required across these multiple functional communities in the Air Force, including AF/A1PT, AFPC/DSYX, AFRS, AETC/A3T, and AETC/2AF. This coordination should enable opportunities to systematically implement and evaluate the recommendations provided in this report.

Appendix A. Current Screening Tools for Air Force HDHA Specialties

In addition to meeting several basic qualifications that are required of those who enlist into the service (Air Force Instruction 36-2002, 2017; Department of Defense Instruction 1304.26, 2015), the Air Force requires that those who are specifically applying to HDHA specialties meet several additional standards. These additional standards have been implemented, in part, to address issues with retention of airmen in select HDHA specialties during training and first-term enlistment (White et al., 2014). These include, but are not limited to, minimum scores on screening tools addressing physical fitness, cognitive domains, and noncognitive domains (Chappelle et al., 2015; Robson and Manacapilli, 2014). In this appendix, we briefly describe several tools used for screening applicants for select HDHA specialties in the Air Force.

Physical Fitness Assessment

For entry into the six HDHA career fields in our study, candidates must meet several minimum physical fitness standards.⁶⁶ They must pass a standard military physical and Class III Flight Physical. They must also pass a strength aptitude test (SAT) that is given to many, but not all, of those applying for enlistment into the Air Force. Notably, the minimum physical standards for those applying to HDHA specialties are higher than those applying to other career fields that utilize the SAT. For example, within the SAT, all enlisted applicants must be able to lift 40 pounds on an incremental lift machine, but those applying to HDHA specialties must be able to lift 50 or more pounds on this machine (Sims et al., 2014).

Those applying to the six HDHA specialties must also complete an additional physical assessment, known as the PAST (Air Force, 2013). The PAST involves completion of several events, and candidates must pass all assessed events to be classified as passing the full assessment (Air Force, 2013). PAST events include the following (U.S. Air Force, 2013):

- 2 x 25-meter underwater swim (PJ/CCT/SOWT only)
- surface swim
 - 500-meter surface swim (PJ/CCT/SOWT only)
 - 200-meter surface swim (SERE only)
- 1.5-mile run (All)
- calisthenics (All)
 - pull-ups (2 minutes)

⁶⁶ They must also have normal color vision; at least 20/70 vision in both eyes, correctable to 20/20; a minimum height of 4'10" and maximum height of 6'8"; and no more than 250 pounds (the maximum weight for jump school).

- sit-ups (2 minutes)
- push-ups (2 minutes)
- 3-mile rucksack march with 50 pounds (CCT/SOWT retrainees who have accomplished air traffic control [ATC]/weather course only)

The specific events assessed and requirements to pass each event vary by career field. The PAST may be administered by CCT personnel, PJ personnel, or a designated recruiting squadron representative familiar with the assessment.

Initial research suggests that when used with other screening tools, such as the ASVAB and TAPAS, scores on PAST events may assist with predicting training pass rates for HDHA specialties (Acosta, Rose, and Manley, 2014). Similarly, research also suggests that runtime for 1.5 miles, an event included in the PAST, is a statistically significant predictor of TACP training success or failure (Kalns et al., 2011). Physical screening assessments that are more tailored to specific occupations may better assist with addressing HDHA-specialty training attrition. Therefore, the Air Force is currently considering new assessments of physical ability that may ultimately replace the PAST.

Cognitive Domain Assessment

In addition to meeting minimum physical fitness standards, those applying to enlist into select HDHA specialties must demonstrate minimum scores on cognitive domain assessments. These domains are assessed through use of the ASVAB. The ASVAB includes several tests that measure the following broad domains: verbal, math, science and technical, and spatial (Roberts et al., 2000; Skinner et al., 2007). Within the verbal domain, the test measures word knowledge and paragraph comprehension, and within the math domain, the test measures arithmetic reasoning and mathematics knowledge. Within the science and technical domain, the test measures general science, electronics, auto and shop information, and mechanical comprehension, and within the spatial domain, the test measures assembling objects (see Table A.1; Defense Manpower Data Center, undated). The AFQT, a tool used to screen all those applying to enlist, involves scores on a subset of the ASVAB assessments, which are arithmetic reasoning, mathematics knowledge, paragraph comprehension, and word knowledge.

Table A.1. ASVAB Tests and Domains

Domain	Test	Description
Verbal	Word knowledge	Ability to identify synonyms for words and select the correct meaning of words in context
	Paragraph comprehension	Ability to obtain information from short passages of text
Math	Arithmetic reasoning	Ability to solve word problems involving arithmetic
	Mathematics knowledge	Knowledge of mathematics principles that are taught in high school
Science and technical	General science	Knowledge of physical and biological sciences
	Electronics information	Knowledge of electricity and electronics
	Auto information	Knowledge of automobile technology
	Shop information	Knowledge of shop terminology, tools, and practices
	Mechanical comprehension	Knowledge of mechanical and physical principles
Spatial	Assembling objects	Ability to evaluate how an object will appear after its parts are assembled

The ASVAB can be administered under different conditions. At the MEPS, a computerized adaptive test is administered to applicants. The test is tailored to each test-taker, such that the difficulty of subsequent items depends on the test-taker's responses to earlier items (Defense Manpower Data Center, undated). A paper-and-pencil version of the test is also available to use in locations that do not have computers. Finally, a paper-and-pencil version of the test may be given to 10th, 11th, or 12th graders or those in post-secondary schools as part of the ASVAB Career Exploration Program (Department of Defense, 2016).

Standard scores on the ASVAB subtests have a fixed mean of 50 and a standard deviation of 10 (Segall, 2004). For example, if someone received a score of 60, he or she scored one standard deviation above the mean. Scores on the AFQT are normed against a nationally representative sample of youth ages 18 to 23 years old and students expected to enroll in 10th, 11th, or 12th grades (Department of Defense, 2016). AFQT scores range from 1 to 99. If someone received a score of 60, he or she scored as well as or better than 60 percent of the nationally representative sample. For enlistment in the Air Force, high school graduates must achieve an AFQT score of at least 36 and those who possess a general education degree (GED) or high school equivalency certificate must achieve a score of 65 or higher (Air Force Instruction 36-2002, 2017).

For particular career fields, the Air Force considers MAGE composite scores, which are also calculated using ASVAB subtest scores (see Table A.2; Sellman, 2004; Skinner et al., 2007). To enlist in select HDHA specialties in the Air Force, scores on certain MAGE composites, such as general, mechanical, and electronic, must also be met (Manley et al., 2015). For example, CCTs must achieve a score of 55 on the mechanical composite and a score of 55 general composite,

and those applying for SOWT must achieve a score of 66 on the general composite and 50 on the electronics composite.

Table A.2. MAGE Composites

Composite	Calculation
Mechanical (M)	Arithmetic reasoning + mechanical comprehension + auto information + shop information + 2*(working knowledge + paragraph comprehension)
Administrative (A)	Mathematical knowledge + (working knowledge + paragraph comprehension)
General (G)	Arithmetic reasoning + (working knowledge + paragraph comprehension)
Electronic (E)	General science + arithmetic reasoning + mathematical knowledge + electronics information

Multiple studies across the services have demonstrated that scores on the ASVAB and its composites are predictive of training outcomes and job performance (Carretta, 2014; Sellman, 2004; Skinner et al., 2007; Air Force Instruction 36-2605, 2008; White et al., 2014). Scores on ASVAB composites also appear to be predictive of success or attrition in certain HDHA-specialty training pipelines (e.g., Kalns et al., 2011). The services, including the Air Force, continue to conduct research to determine minimum test cut scores to use for the services and for career fields in each service that may best assist with reducing attrition and increasing observed performance (e.g., Manley et al., 2015).

Noncognitive Domain Assessment

In addition to physical fitness and cognitive domains, the Air Force has considered personality traits when screening for certain career fields, and the service has recently used the TAPAS for screening into certain HDHA specialties (U.S. Air Force, 2016a; U.S. Air Force, 2016b). The TAPAS is a personality assessment that was originally developed for the Army (Dragow et al., 2012; Nye et al., 2014). The assessment builds from the Big Five personality dimensions, which are extraversion, agreeableness, conscientiousness, emotional stability (i.e., neuroticism), and openness to experience; and it can examine 21 proposed subdimensions across each of these five primary personality dimensions.⁶⁷ The TAPAS also includes a sixth dimension of physical conditioning, which assesses the extent to which individuals engage in activities that maintain their physical fitness (Stark et al., 2014).

The TAPAS is a computer-based assessment, administered at MEPS, that utilizes multidimensional pairwise preference items to assess the aforementioned personality dimensions and subdimensions. These items involve presenting participants with two statements that are

⁶⁷ A particular version of TAPAS may contain fewer than 21 subdimensions because the instrument becomes excessively long when measuring a high number of subdimensions.

designed to be approximately equal in terms of social desirability and extremity, with the aim of reducing participants' ability to provide misleading item responses (Drasgow et al., 2012). An individual must select which of the two statements is more like them. The test is adaptive, such that subsequent test items presented to the individual will be determined by the responses they provide to earlier items (Stark et al., 2014).

Most research on the TAPAS has been conducted with the Army. TAPAS developers report finding that several TAPAS dimensions are significantly related to selection and attrition from the Army's Special Operations Forces assessment and selection course, including adjustment (i.e., ability/inability to handle stress) and responsibility (i.e., reliability or lack of reliability; Nye et al., 2014). However, this study has limitations, including the use of a nonadaptive version of the TAPAS in a nonapplicant (i.e., "low stakes") setting, making it unclear whether an adaptive version in an applicant setting would yield similar results for a special operations population. The Air Force has also been assessing the use of the TAPAS for enlistment screening since 2009. Comparisons of Army and Air Force samples show similar responses across the services (Stark et al., 2014), and as mentioned previously, initial research suggests that, used with other measures, the TAPAS might assist with Air Force HDHA-specialty selection and classification (Acosta et al., 2014). However, additional studies are required to fully evaluate the potential of TAPAS as a screening tool.

Other Noncognitive Domain Assessments

Although not currently used as part of Air Force screening, several other noncognitive domain assessments have been considered for use as part of screening applicants for enlistment. For example, the EQ-i is a self-report inventory that emphasizes the emotional, personal, and social elements of intelligent behavior (Dawda and Hart, 2000). Recent research explored use of this measure for screening of ATC candidates, and when considered with ASVAB scores, this research found that those who passed and those who failed training showed significantly different scores on the assessment (Chappelle et al., 2015). Notably, this research did not include the TAPAS assessment, so the contribution of the EQ-i above and beyond the TAPAS in predicting attrition is unclear. In addition, earlier research on the EQ-i conducted with TACP candidates found that most EQ-i scores were not associated with success or failure in the TACP training pipeline (Kalns et al., 2011).

Researchers have also considered use of personality assessments other than the TAPAS for use in enlisted military screening, including versions of the MMPI (e.g., Carbone et al., 1999) and the NEO-PI (e.g., Koltko-Rivera and Niebuhr, 2004). However, concerns over applicants providing misleading responses to pre-existing assessments, including pre-existing personality assessments, contributed to development and implementation of the TAPAS, eliminating or reducing use of other personality measures in screening (Drasgow et al., 2012).

Summary

The Air Force utilizes several assessments as part of screening applicants for select HDHA specialties. Physical screening tools utilized by the service are the SAT and PAST. The ASVAB and various composites involving responses to this assessment are used to address cognitive domains, and the TAPAS has recently been used to address noncognitive domains. Prior research on these assessments suggests they might assist in reducing attrition during training and first-term enlistment.

Appendix B. Technical Training for Air Force HDHA Specialties

This appendix presents additional information about the jobs and training for CCT, EOD, PJ, SERE, SOWT, and TACP. Each section begins with a summary of job duties and responsibilities as documented in the *Air Force Enlisted Classification Directory: The Official Guide to the Air Force Enlisted Classification Codes* (AFPC, 2016). Next, we provide a general overview of technical training to include some course objectives, major evaluations,⁶⁸ and other relevant information (e.g., recent changes in the pipeline). Each overview is accompanied by a figure (adapted from figures provided by AETC/A3, 2014) consisting of course-specific information (name, duration, location, success rate) and summary statistics (total technical training days, average completion time, and average cost per graduate).⁶⁹ Note that the total technical training days differ from the average completion time because the former does not account for weekends, holidays, and potential delays.

Combat Control (CCT)

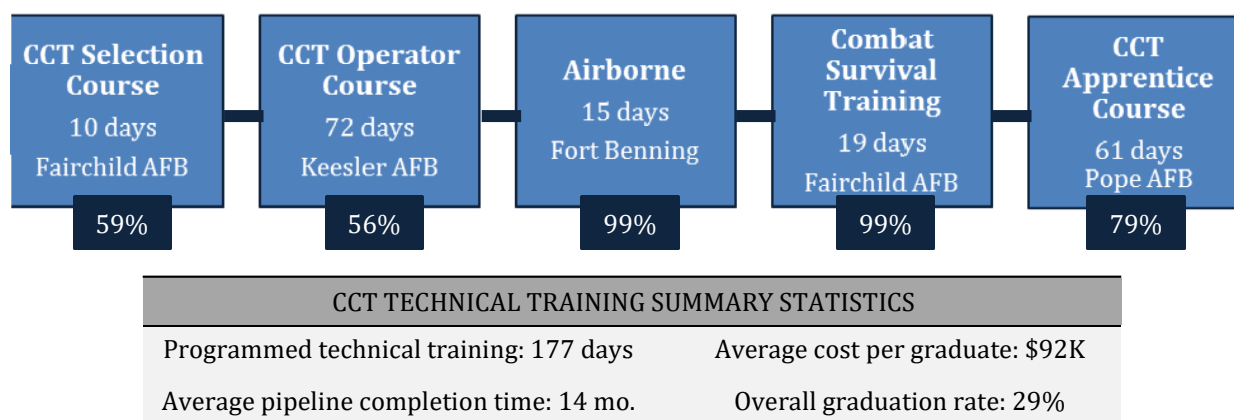
Provides command, control, communications, intelligence, surveillance and reconnaissance (C3ISR) to assist, control and enable the application of manned and unmanned, lethal and non-lethal airpower in all geographic and environmental conditions across the full spectrum of military operations. Includes terminal control (air traffic control [ATC]) and targeting, and control of air strikes (including close air support [CAS]) and use of visual and electronic aids to control airheads and enable precision navigation. Provides long-range voice and data command and control and communications. Performs tactical level surveillance and reconnaissance functions, fusing organic and remote-controlled technologies and manned platforms to build the common operating picture (COP) (AFPC, 2016, p. 43).

⁶⁸ Training events can be classified into two groups: (1) go/no-go events and (2) other training events. Go/no-go events require trainees to meet or exceed a distinct benchmark (e.g., five miles under 35 minutes). This type of event is considered a “hardline,” such that the trainee is typically disqualified from training if a trainee fails to meet the standard. Depending on the course, a trainee may receive one or multiple attempts to meet the standard. The other training events are not subject to the same strict level of assessment as the go/no-go events; however, failure to properly complete any training event can result in a “failure to train.” Trainees are typically allowed only two failures before they are disqualified from the program. Additionally, trainee performance in other events is evaluated and/or documented by instructors, which informs the overall assessment of trainee performance (the “whole-person assessment”). “Major evaluations” refers to a brief overview of the go/no-go events.

⁶⁹ With the exception of success rates (which was RAND’s analysis of Air Force TTMS data from January 2011 to December 2015), AETC/A3T provided course-specific information for CCTs, PJs, SOWT, and TACP. Information for EOD and SERE was based on personal communication with EOD leadership and Air Force-sponsored websites.

CCT technical training requires 177 days of instruction, which includes five courses at four different locations (see Figure B.1) (U.S. Air Force, undated-a). The CCT Selection Course (conducted at Lackland AFB) is a ten-day orientation course intended to prepare airmen for the rigors of the training pipeline (e.g., proper nutrition and exercise technique, career field history).⁷⁰ Next, CCT students travel to Keesler AFB for the Combat Operator Course (also referred to as ATC), which instructs on ATC fundamentals (e.g., aircraft recognition, communication procedures). After completing airborne and combat survival, CCT students attend the CCT Apprentice Course (also referred to as CCS), which provides final CCT qualifications. On average, it takes 14 months to complete the training pipeline and costs approximately \$92,000 to train a CCT. Although not part of the technical training pipeline, it is worth noting that after the Apprentice Course, CCTs must complete advanced skills training (approximately 12 months) administered by AFSOC.

Figure B.1. CCT Technical Training Pipeline



SOURCE: Figure adapted from AETC/A3 (2014).

NOTE: Course graduation and pipeline completion estimates are based on RAND's analysis of Air Force TTMS data from January 2011 to December 2015.

Explosive Ordnance Disposal (EOD)

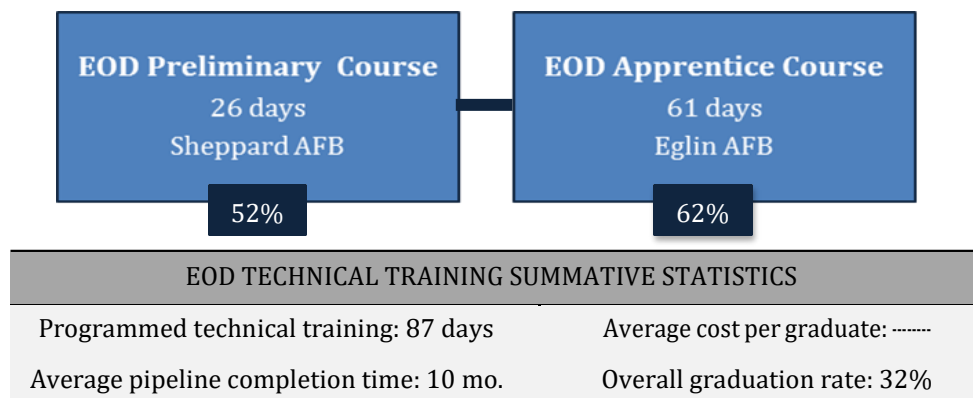
Performs explosive ordnance disposal (EOD) operations to protect personnel, resources, and the environment from the effects of hazardous explosive ordnance (EO), improvised explosive devices (IED) and weapons of mass destruction (WMD) which may include; incendiary, chemical, biological, radiological, and nuclear (CBRN) hazards. Employs specialized tools, techniques and personal protective equipment to detect/identify EOD objectives and to accomplish diagnostics, monitoring, evaluation, interrogation, mitigation, render safe, recovery, and disposal operations on ordnance/devices delivered, placed, or made dangerous by accident/incident or other circumstance. Utilizes and maintains advanced equipment, such as, robotics, x-ray, landmine and CBRN detection

⁷⁰ SOWT students also attend this course.

equipment. Transports demolition explosives and equipment to authorized disposal areas, fabricates explosive demolition charges, and disposes of hazardous devices, ordnance and explosives. EOD may be employed alone or as part of an [Air Force], Joint, Interagency, or Coalition force, to support Combatant Commander and/or Air Force objectives. Provides rapid response capability and operates in five geographic disciplines: mountain, desert, arctic, urban and jungle, day or night, to include austere combat environments independent of an established airbase or its perimeter defenses in mounted, dismounted and limited airborne/aerial insertion operations. EOD at the five, seven, and nine level plan, organize, and direct EOD operations (AFPC, 2016, p. 221).

EOD technical training requires 87 days of instruction. The training pipeline (see Figure B.2) includes two courses at two locations. The EOD Preliminary Course, conducted at Sheppard AFB, is meant to provide an overview of EOD history, provide introductory training on explosives, and perform physical training. Recently, this course has undergone changes. In 2012, the course extended from a six-day course to 20 days (Hawkins, 2012a),⁷¹ and then, in 2016, the course extended to 26 days.⁷² EOD students then attend the Apprentice Course to learn the technical knowledge and skills required to be an EOD technician. The Apprentice Course is administered by the Naval School Explosive Ordnance Disposal at Eglin AFB. On average, the pipeline takes ten months to complete.

Figure B.2. EOD Technical Training Pipeline



SOURCE: Figure adapted from AETC/A3 (2014).

NOTE: Course graduation and pipeline completion estimates are based on RAND's analysis of Air Force TTMS data from January 2011 to December 2015.

⁷¹ This extension is credited with decreasing the attrition rates in the Apprentice Course, because the attrition occurs in the Preliminary Course.

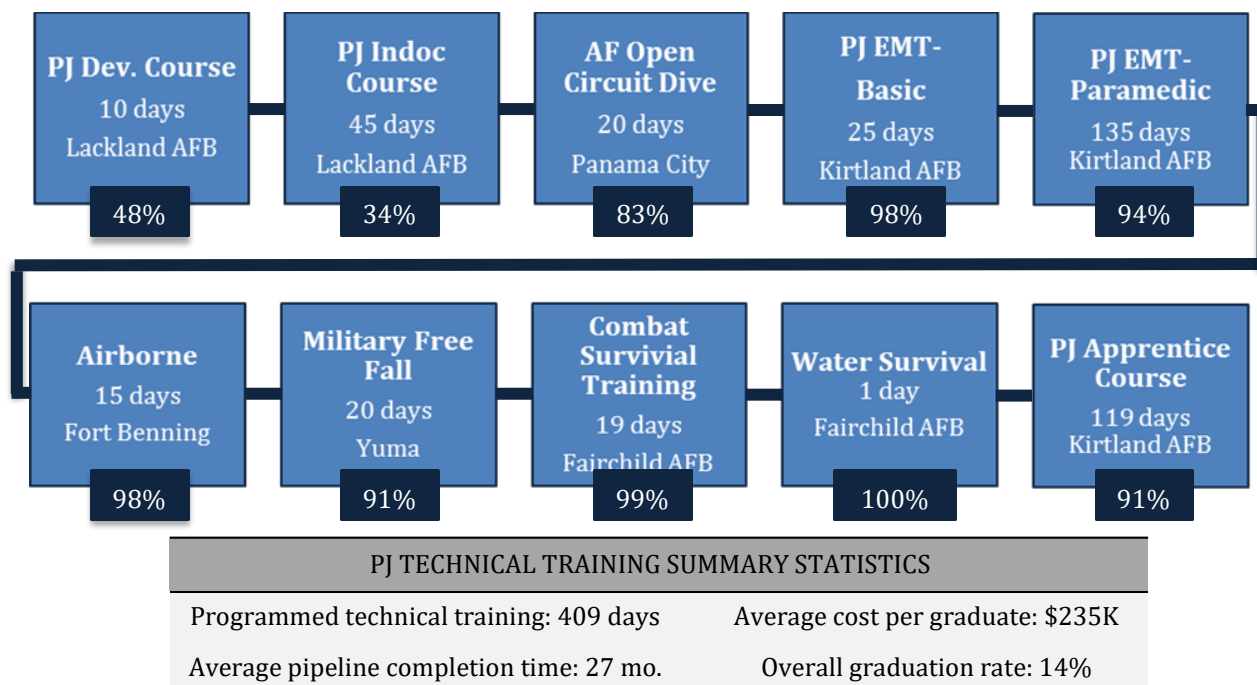
⁷² Information about the course extension in 2016 was based on telephone communication with the EOD preliminary course instructors.

Pararescue (PJ)

Performs, plans, leads, supervises, instructs, and evaluates pararescue activities. Performs as the essential surface, air link in personnel recovery (PR) and materiel recovery by functioning as the rescue and recovery specialist on flying status as mission crew or as surface elements. Provides rapid response capability and operates in the six geographic disciplines: mountain, desert, arctic, urban, jungle and water, day or night, to include friendly, denied, hostile, or sensitive areas. Provides assistance in and performs survival, evasion, resistance, and escape (SERE). Provides emergency trauma and field medical care, and security. Moves recovered personnel and materiel to safety or friendly control when recovery by aircraft is not possible (AFPC, 2016, p. 84).

PJ technical training requires 409 days of instruction. The training pipeline, shown in Figure B.3, includes ten courses at six different locations. The PJ Development Course (conducted at Lackland AFB) is a ten-day preparation course covering basic skills, techniques, career field knowledge. PJs then complete a nine-week Indoctrination Course that requires extensive physical conditioning. PJs spend the rest of training attending a series of short (less than one month) special operations or combat skill courses hosted by the Army or Navy, as well as longer PJ-specific skills courses at Kirtland AFB. On average, it takes 27 months to complete the training pipeline and costs approximately \$235,000 to train a PJ.

Figure B.3. PJ Technical Training Pipeline



SOURCE: Figure adapted from AETC/A3 (2014).

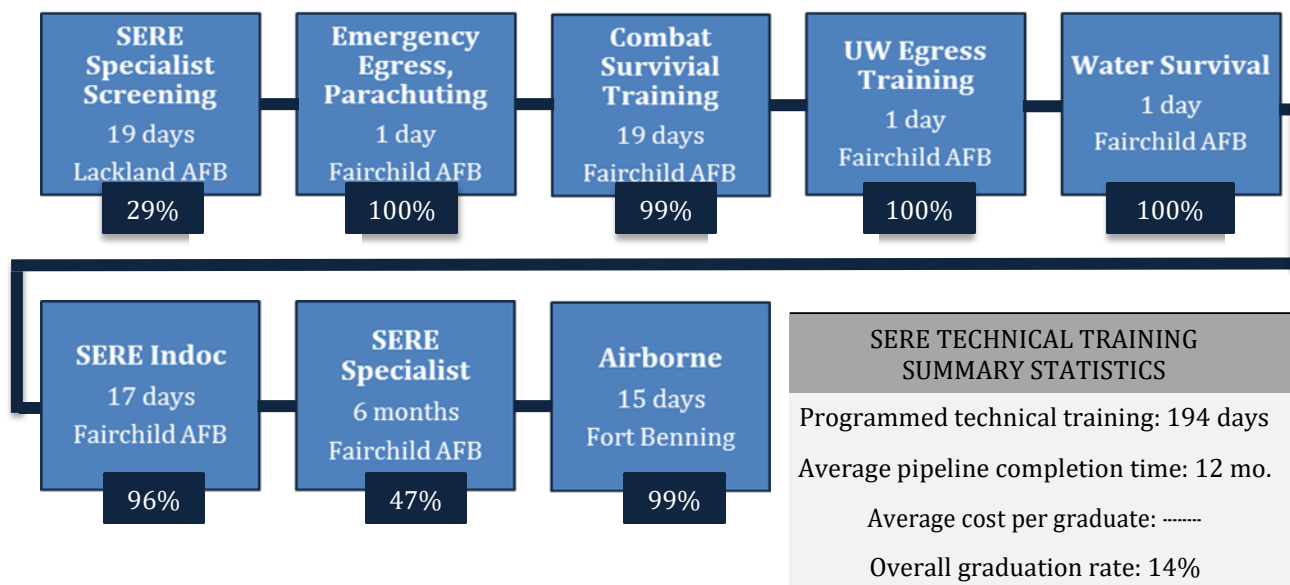
NOTE: Course graduation and pipeline completion estimates are based on RAND's analysis of Air Force TTMS data from January 2011 to December 2015.

Survival, Evasion, Resistance, and Escape (SERE)

Develops, conducts, and manages Air Force Survival, Evasion, Resistance, and Escape (SERE) programs. Develops, conducts, manages, and evaluates Formal SERE training and refresher SERE training. Provides direct support to Combatant Commanders in personnel recovery (PR) preparation, planning, execution, and adaptation. Operates in eight geographic disciplines of Temperate, Arctic, Desert, Tropic, Coastal, Open Sea, Urban and Captivity, day or night, to include friendly, denied, hostile, or sensitive areas in support of operational preparation of the environment (OPE). Conducts foreign internal defense (FID). Conducts developmental and operational testing on and instructs the use of SERE related equipment. Performs and instructs basic, advanced, and emergency military parachuting. Coordinates SERE activities and conducts observer and controller duties during personnel recovery exercises (AFPC, 2016, p. 82).

SERE technical training requires 194 days. The training pipeline consists of eight courses at three locations (see Figure B.4). SERE students begin with a 19-day screening course (also referred to as SERE Specialist Training-Orientation Course). Students then transfer to Fairchild AFB, where they spend the remainder of their training, with the exception of Airborne. The next two months involve a series of prerequisite courses (e.g., water survival) and culminate with SERE specialist training (i.e., the Apprentice Course), which provides necessary SERE qualifications. On average, it takes 12 months to complete the SERE training pipeline.

Figure B.4. SERE Technical Training Pipeline



SOURCE: Figure guided by U.S. Air Force (undated-b).

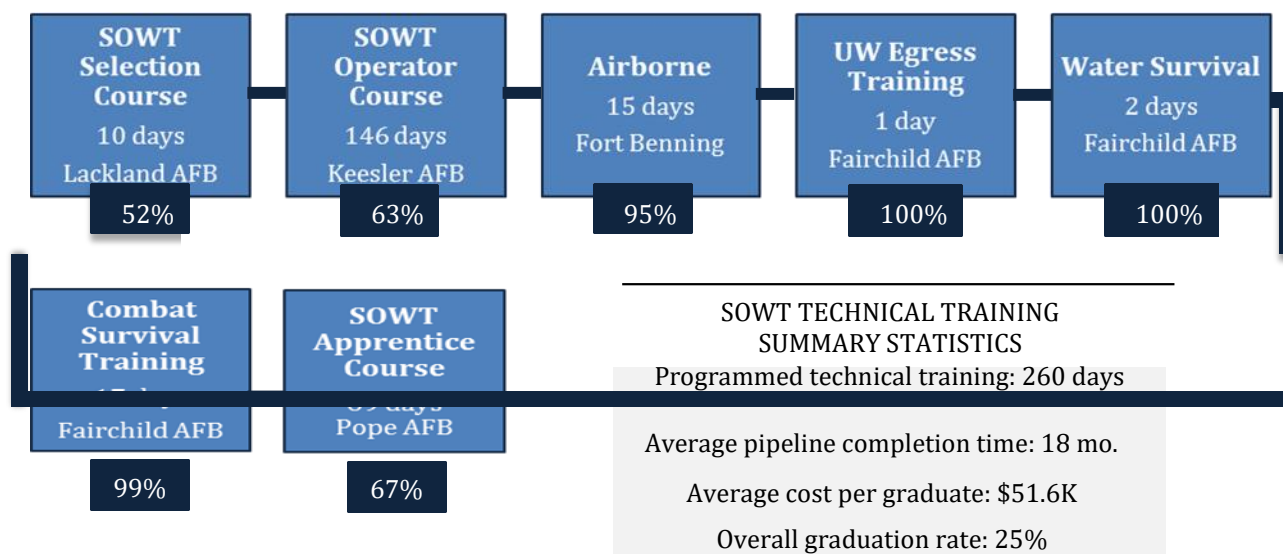
NOTE: Course graduation and pipeline completion estimates are based on RAND's analysis of Air Force TTMS data from January 2011 to December 2015.

Special Operations Weather (SOWT)

Performs, plans, leads, supervises, instructs, and evaluates [SOWTs]. May be employed alone or as part of an Air Force, joint, interagency or coalition force, to support Combatant Commander's objectives and may operate under austere conditions for extended periods. Capable of operating in the six geographic disciplines: mountain, desert, arctic, urban, jungle and water, day or night, to include friendly, denied, hostile, or sensitive areas. Provides tactical-level intelligence, surveillance and reconnaissance to enable decision superiority and application of airpower across the full spectrum of military operations. Performs and manages the collection, analysis, and forecast of meteorological, oceanographic and space environmental conditions. Tailors forecast information for integration into military decisionmaking and intelligence preparation of the battlespace activities (AFPC, 2016, p. 94).

SOWT technical training requires 260 days and includes seven courses at five locations (see Figure B.5). The SOWT Selection Course (conducted at Lackland AFB) is a ten-day orientation course intended to prepare airmen for the rigors of the training pipeline (e.g., proper nutrition and exercise technique, career field history). This is the same course as the CCT Selection Course (i.e., CCT and SOWT students complete this course together). Next, SOWT students travel to Keesler AFB for the SOWT Operator Course, which provides instruction on, among other topics, “basic, intermediate, and advanced meteorology, meteorological reports and computer operations” (U.S. Air Force, 2010) and incorporates intense physical training. After completing various basic training courses, SOWT students attend the SOWT Apprentice Course, which provides final SOWT qualifications. On average, it takes 14 months to complete the training pipeline and costs approximately \$51,600 to train a SOWT.

Figure B.5. SOWT Technical Training Pipeline



SOURCE: Figure adapted from AETC/A3 (2014).

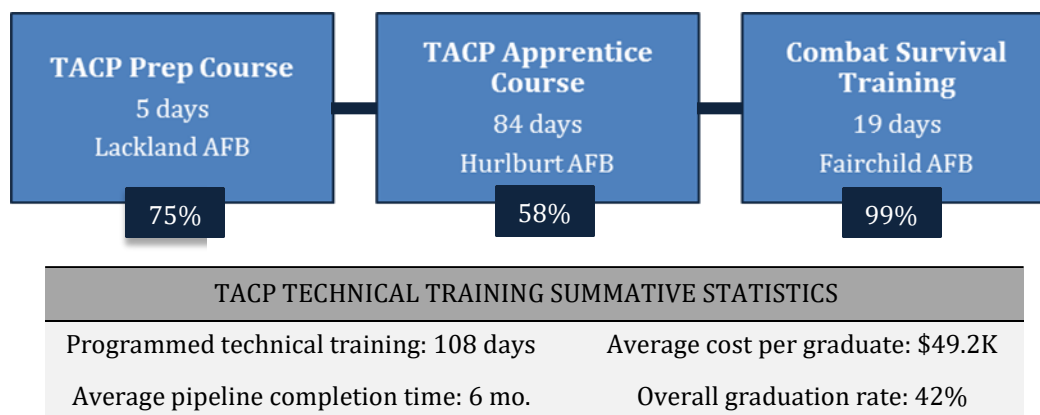
NOTE: Course graduation and pipeline completion estimates are based on RAND's analysis of Air Force TTMS data from January 2011 to December 2015.

Tactical Air Control Party (TACP)

Finds, fixes, tracks, targets, and engages enemy forces in close proximity to friendly forces and assesses strike results. Plans, coordinates and directs manned and unmanned, lethal and non-lethal air power utilizing advanced command, control communications (C3) technologies and weapon systems in direct ground combat. Controls and executes air, space and cyber power across the full spectrum of military operations. Provides airspace deconfliction, artillery, naval gunfire, intelligence, surveillance, and reconnaissance (ISR) and terminal control of close air support to shape the battlefield. Operates in austere combat environments independent of an established airbase or its perimeter defenses. Employed as part of a joint, interagency or coalition force, aligned with conventional or special operations combat maneuver units to support Combatant Commander objectives. Primarily assigned to U.S. Army Installations. (AFPC, 2016, p. 47).

TACP technical training requires 108 days on instruction. The training pipeline, shown in Figure B.6, includes three courses and three locations. The TACP Preparatory Course (conducted at Lackland AFB) is a five-day orientation course intended to prepare airmen for the rigors of the training pipeline (e.g., career field history, career field duties, physical training). TACP students then travel to Hurlburt AFB for the TACP Apprentice Course to learn the requisite qualifications to become a TACP. On average, it takes 14 months to complete the training pipeline and costs approximately \$51,600 to train a TACP.

Figure B.6. TACP Technical Training Pipeline



SOURCE: Figure adapted from AETC/A3 (2014).

NOTE: Course graduation and pipeline completion estimates are based on RAND's analysis of Air Force TTMS data from January 2011 to December 2015.

Appendix C. Pairwise Comparisons Among Predictors and Outcomes

This appendix provides results from our pairwise comparisons of training success predictors and training success outcomes. Specifically, we provide the results from pairwise logistic regressions. Table C.1 lists the strength of the relationship between each characteristic and success in each pipeline for the characteristics that are currently used in screening. The values in Table C.1 are derived from pairwise logistic regressions, except that each continuous variable is standardized and the resulting coefficients are converted into standard deviation units to be more comparable with other research (Chinn, 2000). Relationships expressed in standard deviation units are known as *effect sizes*. Though the size/significance of a relationship is always dependent on the particular context, accepted rules of thumb would consider a value of 0.2 to be “small,” while values of 0.5 and 0.8 would be considered “medium” and “large,” respectively (Cohen, 1969). Positive effect sizes suggest higher levels of the variable are associated with higher success prospects (e.g., PJs who do more pull-ups on the PAST are more likely to succeed), while negative effect sizes indicate lower variable values are associated with success (e.g., lower run times are consistently associated with higher success prospects).

Table C.1. Standardized Effect Sizes Measuring Relationships Between Predictors and Success in Training

	ALL (5,456)	CCT (657)	TACP (1,315)	SERE (888)	PJ (1,133)	SOWT (186)	EOD (1,277)
PAST							
Pull-ups	0.051*	0.237**	0.27***	0.219**	0.342***	0.32	0.117*
Push-ups	0.039+	0.26***	0.244***	0.201*	0.249***	0.228	0.087
Run (1.5 Miles)	-0.111***	-0.326***	-0.289***	-0.24***	-0.418***	-0.306	-0.155***
Sit-ups	0.048*	0.177**	0.228***	0.186**	0.229***	0.119	0.121+
Swim (500 m)	-0.101**	-0.162**			-0.33***	-0.106	
Swim (250 m)				-0.224*			
ASVAB							
Assembling Objects	0.109***	0.174*	0.101+	0.132	0.23*	-0.165	0.17**
Arithmetic Reasoning	0.125***	0.191**	0.14**	0.139	0.159	0.029	0.213***
Auto/Shop Information	0.082***	-0.015	0.041	0.184*	0.158+	-0.042	0.17**
Electronics Information	0.124***	0.182*	0.085	0.246**	0.184*	-0.065	0.19***
General Science	0.089***	0.191*	0.049	0.126	0.164*	-0.058	0.145**
Mechanical Comprehension	0.142***	0.251***	0.117*	0.262**	0.213**	-0.103	0.257***

	ALL (5,456)	CCT (657)	TACP (1,315)	SERE (888)	PJ (1,133)	SOWT (186)	EOD (1,277)
Math Knowledge	0.098***	0.223**	0.107*	0.005	0.172*	−0.007	0.112*
Paragraph Comprehension	0.068**	0.144+	0.092+	0.03	0.085	−0.18	0.129*
Word Knowledge	0.075**	0.26***	0.038	0.148+	0.13+	0.024	0.099+
Composites							
Electronic	0.157***	0.27***	0.097*	0.244**	0.256***	0.076	0.315***
General	0.128***	0.252***	0.114**	0.17*	0.179**	0.016	0.26***
Mechanical Comprehension	0.159***	0.246***	0.112**	0.305***	0.227***	0.024	0.387***
Administrative	0.124***	0.322***	0.09*	0.126+	0.197**	0.009	0.175***
AFQT Score	0.132***	0.299***	0.107**	0.158*	0.193**	0.022	0.236***

NOTE: Overall sample sizes are shown in parentheses (although individual models had varying sample sizes depending on the number of missing observations). ***, **, *, and + represent statistical significance at the 0.001, 0.01, 0.05, and 0.10 levels, respectively, after adjusting for multiple comparisons within each column using the Benjamini and Hochberg (1995) procedure. Effect sizes were calculated from logistic regression coefficients by dividing each coefficient by $\pi/\sqrt{3}$, or the standard deviation of the logistic distribution. All continuous variables are standardized. The full correlation table is available upon request from the authors.

Overall, most of the effects in Table C.1 smaller in magnitude than even the 0.2 threshold are smaller in magnitude than even the 0.2 threshold, which is expected given that applicants with low aptitude and fitness scores would be screened out. Still, the results show that even after screening, most fitness and aptitude measures significantly relate to success. Regarding fitness, a recruit's run time tends to have the strongest relationship, although other aspects of fitness have effects of similar magnitude, depending on the pipeline. Regarding aptitude, the mechanical comprehension subtest and the mechanical composite tend to have the strongest individual influences on success likelihood, but other subtests and composites show similar effects. Based on these relationships, there is likely to be some predictive value in including these characteristics into a statistical model.

Table C.2 shows the strength of the relationships for other characteristics that could potentially be incorporated into a prediction of a HDHA-specialty recruit's prospects for success. The table below uses the same format as before, with standardized continuous variables and logistic regression coefficients converted to standard deviation units.

Table C.2. Standardized Effect Sizes Measuring Relationships Between Alternative Predictors and Success in Training

	ALL^a (5,456)	CCT (657)	TACP (1,315)	SERE (888)	PJ (1,133)	SOWT (186)	EOD (1,277)
TAPAS							
Achievement	0.073**	0.205*	0.029	0.087	0.104	−0.007	0.106*
Adjustment	0.044	0.017	0.025	0.135	0.122	−0.028	0.079
Attention-seeking	0.014	−0.077	0.061	0.088	−0.059	−0.008	0.016
Cooperation	−0.009	−0.078	0.014	−0.065	0.114	0.106	−0.003
Dominance	0.078**	0.105	0.081	−0.018	0.05	−0.062	0.143**
Even-tempered	−0.004	0.07	0.049	−0.16+	−0.092	−0.111	0.067
Intellectual efficiency	0.086**	0.077	0.134**	−0.012	0.061	−0.171	0.13*
Nondelinquency	−0.014	−0.081	−0.021	−0.127	−0.168+	0.011	0.073
Optimism	0.075*	0.204+	0.057	0.101	0.018	−0.05	0.079
Order	−0.008	0.129	−0.041	−0.12	−0.09	0.11	0.02
Physical conditioning	0.064*	0.119	0.075	0.206*	0.135	0.267	0.072
Self-control	0.005	0.028	0.029	−0.012	−0.114	0.058	−0.015
Selflessness	−0.011	0.081	0.129	−0.228	0.114	0.245	−0.065
Sociability	−0.016	−0.142	0.041	−0.004	0.082	−0.051	−0.013
Tolerance	0.005	−0.095	0.156**	−0.123	0.096	0.067	−0.042
Other Characteristics							
HDHA preference	0.065	0.035	0.105	0.191	0.133	−0.027	0.088
High school program	−0.052	−0.094	0.003	−0.009	−0.09	0.083	−0.201+
Married	0.096	−0.045	0.043	0.48**	−0.292	−0.526	0.263+
Minor dependents	0.098	−0.669	0.267	0.545+	−0.446	−0.417	0.216
Age	0.098***	0.085	0.152***	0.286***	0.076	−0.161	0.141***
Race/Eth=Black	−0.212*	−0.425	−0.197	−0.484	−0.868	0.346	−0.442*
Race/Eth=Asian	−0.144	0.08	−0.021	−0.306	−8.057	0.245	−0.355
Admitted drug use	0.065	0.028	0.108	−0.012	0.061	0.242	0.14
Body mass index	0.084***	0.066	0.097*	0.281***	0.083	−0.052	0.026
Some college	0.068	0.001	0.398+	−0.264	−0.128	−0.238	0.204
Associate's degree	0.038	0.001	−0.049	0.342	−0.178	1.032	0.009
Bachelor's or higher	0.247***	0.409*	0.474**	0.553**	0.358*	0.183	0.222
Days, full-time employment	0.022	−0.049	0.053	0.136*	0.053	0.019	0.018
Failed non-swim PAST event	−0.066	−0.185	−0.104	0.071	−0.565+	0.296	0.167
Failed swim event	−0.219	−0.225	—	−0.105	−0.839	0.382	—

	ALL ^a (5,456)	CCT (657)	TACP (1,315)	SERE (888)	PJ (1,133)	SOWT (186)	EOD (1,277)
Census Demographics							
% below poverty line	−0.015	−0.013	−0.002	−0.096	0.016	0.139	−0.081+
Unemployment rate	−0.002	−0.031	0.005	−0.137	0.066	0.068	−0.021
% active-duty military	−0.029	−0.037	−0.065	−0.023	0.031	−0.487	−0.024
% with bachelor's degree	0.018	0.067	−0.014	0.145*	0.105	−0.022	0.004
% veteran	−0.027	−0.067	−0.03	−0.019	−0.053	−0.236	0.013
Median income	0.031	0.028	0.008	0.066	0.104	−0.018	0.062

NOTE: Overall sample sizes are shown in parentheses (though individual models had varying sample sizes depending on the number of missing observations). ***, **, *, and + represent statistical significance at the 0.001, 0.01, 0.05, and 0.10 levels, respectively, after adjusting for multiple comparisons within each column using the Benjamini and Hochberg (1995) procedure. Effect sizes were calculated from logistic regression coefficients by dividing each coefficient by $\pi/\sqrt{3}$, or the standard deviation of the logistic distribution. All continuous variables are standardized.

^a Certain variables, especially the TAPAS facets, are often statistically significant in the “All” model without being significant in a majority of individual models. This occurrence could either be the result of limited statistical power in the individual models (in part, because of missing observations), or the result of a particularly strong relationship in the larger individual samples.

In contrast to the previous table, the values in Table C.2 show fewer characteristics that consistently relate to success in training. Regarding the TAPAS personality facets, relationships indicate there is the potential for achievement, dominance, and intellectual efficiency to be useful in certain pipelines, but many other facets appear unrelated to success. For other characteristics, age, body mass index, and possessing a bachelor's degree tend to be positively associated with success. Waivers show either no relationship or a positive relationship, potentially reflecting a pattern where recruiters selectively pursue waivers for candidates who are more qualified in other areas. Still, success in training appears mostly unrelated to preferences entered early in the process, high school extracurricular program participation (e.g., JROTC), and full-time employment history. Similarly, census demographics from recruits' hometown zip codes are mostly unrelated to success, though there are isolated instances of associations between socioeconomic variables and success in training.

Appendix D. Training Attrition Costs and Offsets

In this appendix, we provide calculations of the cost of attrition in HDHA-specialty courses and indicate the improvement in graduation rates required to offset the costs of a potential attrition-reducing measure—a fitness course preceding battlefield airman course sequences.

AETC/FMAT provided their most recent compilation of battlefield airman course costs—FY 2012 data inflated to FY 2014. In turn, we further inflated these costs to FY 2016 for our calculations. We used multiyear data from TTMS to determine prevailing graduation rates from each course in an AFSC’s sequence.⁷³

To estimate the cost of attrition, we used weighted average course costs incurred for attritions up to the point at which it occurs, assuming that half of the course costs are incurred for the course in which the attrition occurs. For example, for attrition occurring in the third course of a sequence, we included the full costs of the first two courses, military pay costs during the intervening two periods of casual status, and half the cost of the third course. To calculate casual status costs, we used average times between courses reported to us by AETC/AT3B and military standard composite pay by grade provided in Table A19-2 of the Air Force Instruction 65-503 cost factors (Air Force Instruction, 65-503, undated). The military pay cost calculation for casual status was weighted by grade using the grade distribution of entries to the next course in the sequence. Table D.1 provides an example for the PJ course sequence.

⁷³ We had three to five years of usable data, depending on the AFSC.

**Table D.1. Cumulative Attrition Costs at Point of Attrition,
PJ Course Sequence**

Course	Length (Days)	Grad Rate	Cost	Cost of Attrition at This Point
PJ Development	10	53%	\$4,543	\$2,272
Casual status	5		\$792	
PJ Indoctrination	45	44%	\$25,469	\$18,069
Casual status	5		\$851	
Open Circuit Diving	20	98%	\$13,785	\$38,547
Casual status	5		\$841	
Combat Survival	19	100%	\$8,036	\$50,298
Casual status	5		\$843	
Underwater Egress	1	100%	\$1,822	\$56,069
Casual status	5		\$857	
Airborne	19	99%	\$3,255	\$59,465
Casual status	5		\$857	
Freefall Parachute	26	99%	\$4,457	\$64,178
Casual status	15		\$2,570	
EMT-Basic	25	99%	\$10,040	\$73,997
Casual status	15		\$2,578	
EMT-Paramedic	135	98%	\$63,637	\$113,413
Casual status	5		\$867	
PJ Apprentice	119	90%	\$64,017	\$178,107

Total cost of the PJ course sequence is \$210,115. However, because most of the attrition occurs in the first course of the sequence, which is relatively short (ten days), the weighted average cost of attrition is only \$11,393. Table D.2 provides the weighted average cost of attrition we calculated for each of the HDHA-specialty course sequences.

Table D.2. Weighted Average Costs per Attrition

Course Sequence	Weighted Average Cost per Attrition
CCT	\$16,359
TACP	\$10,303
SERE	\$14,863
PJ	\$11,393
SOWT	\$25,282
EOD	\$17,348

Since failure at physical tasks is one of the primary causes of attrition from battlefield airman courses, one proposal to reduce attrition costs involves a fitness course that would precede the battlefield airman course sequences. To be cost-effective, a fitness course must yield reductions in attrition costs that are greater than the cost of the fitness course itself. We examined those tradeoffs for six variants of the fitness course: lengths of two, four, and eight weeks; attendance by 100 percent of those entering battlefield airman training and attendance by the least-fit 50 percent of those entering HDHA-specialty training. Our calculations show the break-even points—the graduation rate that would be required for the reduced attrition cost to exactly equal the cost of the fitness course.

We determined the fitness course costs by calculating the military composite pay cost for the length of the course, then factoring up to account for other course costs. The trainee composite pay component of course costs was calculated using grade weights based on grade distributions of entries to the first courses in each of the sequences. The military pay costs for courses of two, four, and eight weeks were \$1,867, \$4,046, and \$8,403, respectively. After calculating that 38 percent of the costs of the entry-level course in each sequence were attributable to military pay of the trainee, we divided the military pay costs by that factor to get estimates of full fitness course costs. We then added the cost of an additional five days of military pay to account for casual status between the fitness course and the first courses in the battlefield airman sequences. The total costs for the three course lengths we examined were \$5,705, \$11,452, and \$22,947.

Table D.3 shows an extended analysis of the calculations we performed for one of the fitness course variants—a two-week course with 100-percent attendance of those entering battlefield airman training. One set of columns shows historic course flows and costs. Another set shows how the flows would have to be adjusted in order for attrition costs to be reduced by the amount of the fitness course cost.⁷⁴ Note that the number of graduates is held constant in this analysis (the adjusted grads column equals the recent average grads column), with the number of entries reduced until the reduction in attrition yields savings equal to the cost that would be incurred if the reduced number of entries had attended the fitness course. Expected graduation rates from the battlefield airmen course sequences would have to improve to above the levels shown in the adjusted grad rate column for the fitness course to be cost-effective.

⁷⁴ Since we used the average attrition costs shown in Table D.2 for these calculations, our assumption is that reduced attrition attributable to a fitness course would be spread across the course sequences in the same way as the recent historical attrition pattern. This is a strong assumption. It might be the case that the fitness course would reduce early attrition more than it reduces attrition later in a course sequence. If so, our assumed attrition cost savings would be overstated and our break-even graduate rates, shown in Table D.3 and D.4, would be understated.

Table D.3. Break-Even Attrition Reduction to Offset Cost of Two-Week Fitness Course (100-Percent Attendance)

Course Seq.	Recent Averages					Adjusted Flows				Reduced Attrits	Reduced Attrit Cost	Fitness Course Cost
	Entries	Grads	Attrits	Grad Rate	Cost per Attrit	Entries	Grads	Attrits	Grad Rate			
CCT	278	70	208	25.0%	\$16,359	206	70	137	33.8%	72	\$1,175,830	\$1,175,830
TACP	322	118	205	36.5%	\$10,303	207	118	90	56.7%	115	\$1,183,013	\$1,183,013
SERE	211	30	181	14.1%	\$14,863	152	30	123	19.4%	58	\$868,990	\$868,990
PJ	465	45	419	9.7%	\$11,393	310	45	264	14.6%	155	\$1,766,300	\$1,766,300
SOW	59	12	47	20.4%	\$25,282	48	12	36	25.0%	11	\$274,607	\$274,607
EOD	286	90	196	31.5%	\$17,348	215	90	125	41.8%	71	\$1,226,056	\$1,226,056

NOTE: Reduced attrition cost = reduced attritions x cost per attrition;; fitness course cost = adjusted entries x fitness course cost per graduate (\$5,705 for the two-week variant).

Table D.4 shows the changes in graduation rates required for each variant of the fitness course to break even. The closer a break-even graduation rate is to the average graduation rate, the more likely it is that a variant of the fitness course will be cost-effective. The cost of an eight-week fitness course with 50-percent attendance is nearly the same as a four-week course with 100-percent attendance.⁷⁵ Thus, the break-even graduation rate for the eight-week course with 50-percent attendance is very nearly the same as the rate for the four-week course with 100-percent attendance, and similarly with the four-week/50-percent and two-week/100-percent variants.

Table D.4. Break-Even Graduation Rates to Offset Fitness Course Costs

Course Sequence	Average Grad Rate	Break-Even Graduation Rates					
		100% Attendance			50% Attendance		
		2 Weeks	4 Weeks	8 Weeks	2 Weeks	4 Weeks	8 Weeks
CCT	25.0%	33.8%	42.6%	60.2%	29.4%	33.8%	42.6%
TACP	36.5%	56.7%	77.1%	N/A	46.6%	56.8%	77.2%
SERE	14.1%	19.4%	24.9%	35.8%	16.8%	19.5%	24.9%
PJ	9.7%	14.6%	19.5%	29.3%	12.2%	14.6%	19.5%
SOW	20.4%	25.0%	29.7%	38.9%	22.7%	25.0%	29.7%
EOD	31.5%	41.8%	52.3%	73.1%	36.7%	41.9%	52.3%

NOTE: No rate is shown for the eight-week, 100-percent attendance variant for the TACP course sequence because the graduation rate reaches 100 percent before the cost of the fitness course is offset.

⁷⁵ Minor differences arise because a four-week course encompasses three weekends, while an eight-week course encompasses seven weekends. Thus, the cost of an eight-week course is a little more than twice the cost of a four-week course.

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The U.S. Air Force's special operations and combat support specialties in the enlisted force are among the highest in demand by the service yet have persistently high rates of attrition in their initial skills training, which is called "technical training" in the Air Force. These high-demand, high-attrition (HDHA) specialties include Combat Control; Explosive Ordnance Disposal; Pararescue; Survival, Evasion, Resistance, and Escape; Special Operations Weather Team; and Tactical Air Control Party. The Air Force has conducted or sponsored several efforts to address training attrition in these specialties over the past several years, yet training attrition remains high. The reasons for high training attrition are interrelated, with size and quality of the recruiting pool, utility of screening tools, and training environment factors all playing a role.

This report addresses the broader challenges for implementing new approaches to HDHA specialty recruiting, screening, and development of Air Force candidates, and takes a holistic approach to identifying methods and tools to fill gaps in current processes.



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