MILITARY PSYCHOLOGY
2020, VOL. 32, NO. 1, 36–50
https://doi.org/10.1080/08995605.2019.1652487

Routledge
Taylor & Francis Group

Attrition and reenlistment in the Army: Using the Tailored Adaptive Personality Assessment System (TAPAS) to improve retention

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ABSTRACT

Attrition and reenlistment are critical outcomes that continually shape the Army's workforce. However, relatively little is known about factors that reliably predict which Soldiers will ultimately complete their first term of service or reenlist after their first term has concluded. The present study evaluated the efficacy of a noncognitive measure, the Tailored Adaptive Personality Assessment System (TAPAS), as well as a traditional cognitive test, the Armed Forces Qualification Test (AFQT), as predictors of attrition and reenlistment. Specific categories of attrition were examined based on the reasons Soldiers separated from the Army, both during training and while the Soldiers were in their units. Additionally, analyses were conducted to model attrition over time, and reenlistment was examined both Army-wide and for specific MOS. The paper concludes with a discussion of the findings and needs for future research concerning the potential value of cognitive and noncognitive measures for better understanding and predicting Army attrition and reenlistment.

ARTICLE HISTORY
Received 10 July 2019
Accepted 19 July 2019

KEYWORDS
Attrition; reenlistment; army; TAPAS; AFQT

What is the public significance of this article?—An organization's effectiveness is based on the people who comprise it. Thus, selection and placement of personnel directly impact that effectiveness. Historically, cognitive testing has been the dominant tool for these purposes. However, cognitive tests have been shown to be limited in predicting elements of success beyond technical proficiency. They do not predict well those aspects of performance which depend on the individual's motivation to perform well over time, or to remain with the organization over time. For these outcomes, noncognitive attributes such as personality and vocational interests provide critical predictive information. This special issue demonstrates the effectiveness of personality and interest measures in a military context, and how these tools are transforming the military selection and classification process. The effort reported in this issue marks major changes in the selection and classification process, changes that can help both military and civilian organizations be more productive and successful.

Introduction

Reducing attrition and encouraging reenlistment of top performers is important to the Army and the readiness of its force. Attrition not only disrupts the unit and reduces force readiness, but it is costly as well. The cost of training a Soldier in the first year can be up to $70,000 depending on the occupation (U.S. Army Recruiting Command, 2013). When a Soldier leaves the service immediately after training, these investments are lost. Moreover, there are additional costs associated with retaining Soldiers through their first term of enlistment, including housing and subsistence allowances, costs associated with moving service members and their families, and health-care costs (Congressional Budget Office, 2014). However, ensuring qualified Soldiers successfully complete their first term of service is just one of the critical factors that impact the Army's manpower and personnel readiness. For Soldiers who complete their first term of service, retention through reenlistment becomes the focus. Reenlistment capitalizes on investments made during

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This material is based upon work supported by the Army Contracting Command (APG) RTP Division and the Army Research Institute for the Behavioral and Social Sciences under Contract No. W911NF-16-C-0056. Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the Army Research Institute for the Behavioral and Social Sciences or the Army Contracting Command. The views, opinions, and/or findings contained in this report are those of the authors and shall not be construed as an official Department of Army or Government position, policy, or decision, unless so designated by other documents, and no official endorsement should be inferred. The research effort was supported by the U.S. Army Research Institute for the Social and Behavioral Sciences.

training and in unit, and also increases the pool of experienced and talented Soldiers leading to more opportunity for future leaders to emerge. In addition, each reenlistment may save the Army further training costs associated with developing a replacement.

The current study investigates the complete timeline of the enlisted Soldier's first term of service: training, in-unit, and end of contract. In addition to overall attrition, this paper examines attrition categorized broadly by reason for separation, including medical/physical-, misconduct-, and performance-related issues. Furthermore, the frequency of first-term reenlistment Army-wide and for select Military Occupational Specialties (MOS) is examined. Finally, this study examines the potential to predict attrition and reenlistment using a cognitive and a noncognitive measure, specifically the Armed Forces Qualification Test (AFQT) and the Tailored Adaptive Personality Assessment System (TAPAS; Drasgow et al., 2012), respectively. Note that the present paper provides a complementary examination of the TAPAS along with Kirkendall, Bynum, Nesbitt, and Hughes (this issue), which also appears in the current special issue. However, Kirkendall et al. focus on a broader array of Soldiers' in-unit outcomes than examined here.

Predicting attrition

Most turnover decisions are influenced by a myriad of factors, and each turnover decision may be driven by a unique set of drivers both internal and external to the individual. Hom, Mitchell, Lee, and Griffeth (2012) discussed numerous predictors of turnover and how factors can be characterized into different types of motivational forces (Maertz & Campion, 2004; Maertz & Griffeth, 2004). Within the military context, White, Rumsey, Mullins, Nye, and LaPort (2014) found initial job attitudes, level of education, and cognitive ability each contributed to the prediction of attrition within the first 18 months of Soldiers' careers. In as much as personality characteristics assessed by the TAPAS influence Soldiers' ability to manage the unique demands of Army life and job performance, one could expect certain dimensions included in the TAPAS to predict Soldier attrition and retention. In the present study, we focus on turnover (i.e., attrition) within Soldiers' first term of service. We distinguish attrition according to three broad types (i.e., Medical/Physical, Misconduct, and Performance) to examine whether the predictive relationships of the AFQT and TAPAS differ based on the reasons for Soldiers' separation from the Army.

Level of education

Currently, the Army utilizes an educational tier system for Soldier screening for the purpose of mitigating first-term attrition risk for enlisted personnel (Laurence, Ramsberger, & Arabian, 1997). The two tiers are distinguished by the education credential the Soldier earned prior to enlisting. Tier 1 consists of high school diploma graduates, college graduates and those with some college attendance, and other diploma holders (e.g., home school diploma). Tier 2 consists of General Equivalency Diploma (GED) holders and other certificate holders. The Army uses tier status to determine enlistment eligibility. In 2016, about 96% of the Soldiers who enlisted in the Active component with no prior service were in the Tier 1 category (Office of the Under Secretary of Defense, Personnel and Readiness, 2018).

Table 1 shows differences in attrition rates between Tier 1 and 2 at end of training (i.e., 12 months) and first-term (36 months). At both points in time, the rate of attrition is higher among Tier 2 Soldiers. There are still further differences within each tier. For example, high school graduates have a 26% attrition rate at 36 months whereas home school graduates have a 30% attrition rate at 36 months. Despite the reduced attrition associated with its use, the tier system does not address the reasons why Soldiers attrit. Further understanding reasons Soldiers leave is a critical step toward predicting and ultimately reducing attrition.

Armed Forces Qualification Test (AFQT)

In addition to the tier system, the Army has investigated the use of cognitive and noncognitive measures as they relate to Soldier attrition (e.g., White et al., 2014). A measure of cognitive ability used by the Army for Soldier screening, the AFQT is a composite of subtests covering both math and verbal content areas of the Armed Services Vocational Aptitude Battery (ASVAB). Cognitive ability has been linked with performance both within the military (Oppler, McCloy, Peterson, Russell, & Campbell, 2001) and in broader work contexts (Schmidt, 2002), and recent research continues to demonstrate the predictive validity of the AFQT on knowledge-based outcomes (e.g., scores on Army job knowledge tests) at both end-of-training and in-unit (Knapp & Wolters, 2014). Although the Army also has explored the relationship

Table 1. Attrition rate by educational tier.

	Attrition Rate			
	12-Month		36-Month	
Educational Tier	*n*	Rate	*n*	Rate
Tier 1	517,510	13%	399,981	25%
Tier 2	70,653	19%	66,230	38%

Data collected from 2005–2015.

between AFQT scores and attrition, research in this area has produced mixed findings.

A review by Laurence, Naughton, and Harris (1996) concluded that in general, Soldiers with higher AFQT scores are less likely to attrit. McCloy and Putka (2005) found that Soldiers with lower AFQT scores were greater attrition risks. Similarly, White et al. (2014) reported negative correlations between AFQT and attrition, and they found two ASVAB subtests, Mathematical Knowledge (MK) and Assembling Objects (AO), to be significant predictors of attrition. However, other investigations failed to show a significant relationship between AFQT and attrition (Knapp & Heffner, 2010; Putka & Bradley, 2008; White, Young, & Rumsey, 2001).

Tailored Adaptive Personality Assessment System (TAPAS)

Research from both military and civilian contexts suggests that personality may be related to turnover (White et al., 2014; Zimmerman, 2008). Consequently, we were interested in examining the relationship between various personality characteristics and first-term Soldier attrition. The TAPAS is a personality assessment that has received increasing interest in recent research-examining predictors of motivational aspects of job performance (Stark et al., 2014). The TAPAS is administered at the Military Entrance Processing Stations (MEPS) as part of the accession process and currently assesses 13 personality dimensions. The TAPAS was created to predict different aspects of performance (e.g., task performance, contextual performance, and counterproductivity; Drasgow et al., 2012). Research suggests that scores on the TAPAS may add incremental validity beyond the AFQT in predicting attrition (Knapp & Wolters, 2014). Additionally, White et al. (2014) identified five facets assessed by the TAPAS that were important to predicting 18-month attrition: Physical Conditioning, Even-Tempered, Achievement, Selflessness, and Sociability. However, it is unclear how the individual TAPAS dimensions predict categories of attrition and how those relationships may vary over time.

Given the costs associated with Soldier attrition, even small decreases in attrition rates could have sizeable financial impacts. Based on accession and attrition rates from 2005–2012 across education tiers, a decrease by as little as 0.1% could save the Army as much as $4,550,000 per year. With the potential for such a large impact, it is important to examine how the Army can leverage noncognitive measures such as the TAPAS to improve the prediction of attrition and ultimately reenlistment. Although the choice to reenlist is a separate issue from attrition from an administrative perspective, there may be parallels with respect to the predictors of Soldier separation during and after one's term of service. Building on the work of White et al. (2014), the current study explores both attrition and reenlistment in relation to the TAPAS.

Attrition categories

Given the complexity surrounding most turnover outcomes, it is unreasonable to expect a common set of antecedents will adequately predict overall turnover. Hom et al. (2012) recommended further specification of turnover based on motivational types, each of which is likely to be differentially predicted. Thus, several types of leavers and stayers can be differentiated in terms of the forces behind quitting.

The Army assigns reason codes to Soldiers who do not complete their first term of enlistment. Administratively, these codes are used to determine what benefits, if any, Soldiers will receive after they leave the Army. For research purposes, these codes provide insight into the particular factors that may contribute to Soldier attrition. Due to the large number of individual codes, it is not practical to analyze them individually. Consequently, we translated the codes into three broader categories: (a) Medical/Physical, (b) Misconduct, and (c) Performance attrition. Soldiers with an inter-service separation code (ISC) code that did not fall into one of these categories were included in analyses of overall attrition, but an "all other attrition" category was not examined here. Because the cognitive and noncognitive factors influencing attrition may vary across categories, the present study examined potential predictors separately for each category.

Prior research has found that rates of Soldier attrition differ over time depending on the specific reasons for attrition. Using similar attrition categories as those used here, Soldier attrition associated with medical/physical and performance reasons was found to be more common early on at both the start of Soldiers' careers as well as in unit (McCloy & Putka, 2005; Putka, 2005). Conversely, misconduct attrition was found to be more common after a few months into service. Putka (2005) also found differences between attrition categories and their relationships with some administrative variables (e.g., demographics, background factors). However, few differences with respect to personality emerged.

Predicting reenlistment

Just as reducing attrition has many advantages for the Army, increasing reenlistment following Soldiers' terms of service also would entail many benefits. The number of

Soldiers who reenlist is directly related to the pool of experience and expertise available to the Army. Additionally, increases in reenlistment represent reductions in costs associated with recruiting, enlisting, and training new Soldiers. Although research on Soldier reenlistment is sparse, there have been some notable investigations. In their review of the literature on military enlistment, reenlistment, and attrition, Hand, Griffeth, and Mobley (1977) noted that the majority of studies investigating actual reenlistment were focused on predictors associated with demographic or incentive factors. Recent research seems to follow this same trend. Two studies detailing the effect of the Targeted Selective Reenlistment Bonus (Carrell & West, 2007) and the Montgomery GI Bill (Simon, Negrusa, & Warner, 2010) found that incentives are important for determining the likelihood of reenlistment. However, in addition to demographic factors predicting reenlistment, Le (2005) also found effects of attitudinal and perceptual variables on continuance intentions, which in turn predicted Soldier reenlistment.

The Army context provides a unique opportunity to study the motivational forces related to staying. Soldiers who complete their first term of enlistment are given the opportunity to reenlist. Several motivations could be hypothesized for reenlistment involving affective forces in addition to legal and alternative forces. Holt, Rehg, Lin, and Miller (2007) discussed how the term of service contractual forces within the military may differ from the civilian context (e.g., fulfilling a term of service to take advantage of educational benefits instead of reenlisting). However, few studies have directly compared the forces behind both reenlistment and attrition. The present effort seeks to study these outcomes using the same cognitive and noncognitive predictors.

Research questions

Results of our analyses are discussed with respect to the following four research questions:

(1) *How do rates of Soldier attrition change over time for different types of attrition?* Attrition rates over time are examined to determine if certain points during a Soldier's career are associated with higher incidence of specific attrition types. Putka (2005) showed differences in attrition rates across time by reasons for attrition. However, Soldiers included in the sample examined by Putka (2005) undoubtedly experienced salient differences related to their service as well as the broader social and cultural context of the time relative to the Soldiers examined in the research reported herein. Thus, the current study reexamines this issue using more current data.

(2) *Which attributes predict different types of attrition across Soldiers' first-term tenure within the Army?* This study examines the AFQT and TAPAS as cognitive and noncognitive predictors of attrition, respectively. Some dimensions measured by the TAPAS have conceptual overlap with those assessed by the Assessment of Individual Motivation (AIM) that was examined by Strickland (2005). Although the measures are not identical, comparisons between similar constructs measured by each may be informative.

(3) *How do reenlistment rates following Soldiers' first term of service compare across MOS?* All Soldiers share similar experiences by virtue of Army-wide requirements. Nonetheless, the specific duties, experiences, and requisite knowledges, skills, and abilities may be quite varied across MOS. As such, reenlistment outcomes also may vary depending on MOS. This study examines how reenlistment rates differ across MOS and whether similarities in reenlistment are present for certain MOS.

(4) *Which attributes predict reenlistment following Soldiers' first term of service?* Finally, this study examined whether the AFQT or any of the noncognitive attributes measured by the TAPAS are predictive of reenlistment. These relationships were examined both Army-wide and within specific MOS.

Analytic approach

For both the attrition and reenlistment studies, the analysis samples included Regular Army Soldiers with Tier 1 credentials. Data were collected from 2009 through 2017. Soldiers' ISC records were used to determine attrition and reenlistment outcomes. For the reenlistment analyses, Soldiers were included only if their first-term ISC code indicated either (a) immediate reenlistment or (b) completion of required active service. Soldiers who did not reenlist following their first term of service due to other reasons as indicated by their ISC records were not included.

To examine general trends and rates of each outcome, descriptive analyses of both attrition and reenlistment were conducted first. Next, predictive analyses were conducted to examine relationships between the focal predictors (AFQT and TAPAS scores) and each

outcome. Note that the study samples for both the attrition and reenlistment studies differed across the descriptive and predictive analyses due to Soldiers with missing or invalid TAPAS data being excluded from the predictive analyses. Table 2 presents characteristics of the descriptive and predictive samples for both the attrition and reenlistment studies.

We examined attrition at 3-month intervals, starting with 3 months post-accession into the Army through 48 months post-accession. For each time point, attrition was indicated for each Soldier if she or he separated at any time following the previous time point up to and including the specified time point. For example, Soldiers who separated between 1 day and 3 months post-accession all were counted as cases of 3-month attrition, whereas Soldiers who separated between 3 months plus 1 day and 6 months were counted as cases of 6-month attrition.

Cox proportional hazards regression was used to examine the effects of the AFQT and TAPAS scales on attrition. Cox proportional hazards regression is a class of survival models used to examine relationships between a set of predictors and time to event occurrence (e.g., time to attrition; Klein & Moeschberger, 2003). For interpretation purposes, the estimated model coefficients are often transformed to hazard ratios (*HR*s), which quantify the increase or decrease in the likelihood of event occurrence as a function of the model predictors. Estimated *HR*s greater than 1.00 indicate that the likelihood of the event occurring increases as values on the predictor increase. Conversely, estimated *HR*s less than 1.00 indicate that the likelihood of the event occurring decreases as values on the predictor increase. An *HR* estimate of 1.00 indicates no relationship between the predictor and occurrence of the outcome event. When multiple types of mutually exclusive events are possible (i.e., different reasons for attrition), these alternative events correspond to "competing risks" in that the occurrence of one type of event precludes the occurrence of another. In the present context, this arises from the fact that a Soldier who attrits at one point in time for one reason cannot also attrit at a later point in time for another reason. To accommodate this situation, cause-specific (or event-specific) hazard modeling (Singer & Willett, 2003, p. 592) was used to study the predictors of each attrition type. For modeling purposes, Soldiers who separated due to the focal attrition type were coded as separating from the Army, whereas those who either stayed or separated due to alternative reasons were treated as censored (e.g., Prentice et al., 1978). For all proportional hazards regression analyses, Soldiers who separated at a given time point were removed from the risk set (i.e., treated as missing data) at all subsequent points in time. For each model, the AFQT was included as the only predictor in Step 1, and the TAPAS scales were added to the model in Step 2. Only TAPAS scales with significant effects were retained in the Step 2 model.

Logistic regression was used to examine the effects of the AFQT and TAPAS scales on reenlistment. As in the proportional hazards analyses, the AFQT was the only predictor in Step 1. The TAPAS scales were added in Step 2, and only those with significant effects were retained in the model.

Results

Question 1 focused on rates of Soldier attrition over time. Figure 1 shows that the overall rate was highest at

Table 2. Sample characteristics.

	Attrition				Reenlistment			
	Descriptive		Predictive		Descriptive		Predictive	
	n = 168,321		*n* = 156,558		*n* = 56,380		*n* = 34,884	
Characteristic	*n*	%	*n*	%	*n*	%	*n*	%
Gender								
Female	25,074	14.9	23,626	15.1	6,812	12.1	4,286	12.3
Male	136,823	81.3	127,045	81.2	49,544	87.9	30,594	87.7
Missing	6,424	3.8	5,887	3.8	24	0.0	4	0.0
Race								
African American	36,852	21.9	34,177	21.8	11,799	20.9	6,352	18.2
American Indian	1,181	0.7	1,117	0.7	379	0.7	222	0.6
Asian	7,281	4.3	6,727	4.3	2,265	4.0	1,366	3.9
Hawaiian/Pacific Islander	690	0.4	622	0.4	390	0.7	294	0.8
Caucasian	118,785	70.6	110,655	70.7	39,711	70.4	25,115	72.0
Multiple	703	0.4	634	0.4	259	0.5	161	0.5
Missing/Declined to Answer	2,829	1.7	2,626	1.7	1,577	2.8	1,374	3.9
Ethnicity								
Hispanic/Latino	25,711	15.3	23,821	15.2	9,400	16.7	5,538	15.9
Not Hispanic	140,139	83.3	130,454	83.3	45,673	81.0	28,207	80.9
Missing/Declined to Answer	2,471	1.5	2,283	1.5	1,307	2.3	1,139	3.3

Both the Descriptive and Predictive samples were limited to Regular Army Soldiers with Tier 1 educational credentials and valid attrition and inter-service separation code data. The Predictive samples were limited further to include Soldiers with valid TAPAS data.

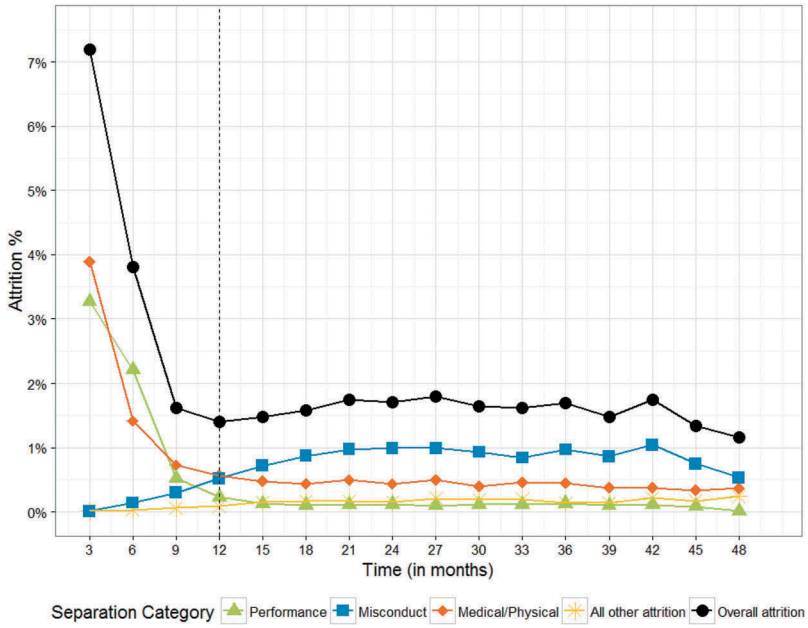

Figure 1. Attrition base rates over time. End of training is represented by the dashed line at 12 months.

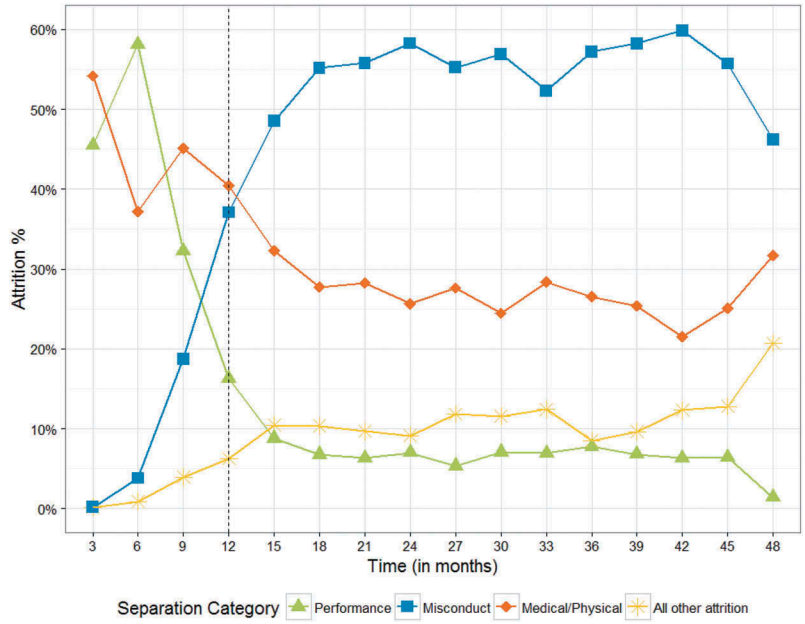

Figure 2. Proportion of attrition by separation category over time. End of training is represented by the dashed line at 12 months.

3 months before sharply declining. Sometime during the second year of Soldiers' terms of service, rates overall as well as for the specific types of attrition remained relatively stable. However, whereas performance and medical/physical attrition peaked during the first 3 months before declining steadily, rates of misconduct attrition were at their lowest within the first 3 months and steadily increased throughout the first 2 years. This pattern suggests that the factors influencing misconduct attrition may be markedly different than those influencing performance and medical/physical attrition.

To examine the relative prevalence of each type of attrition, Figure 2 shows the percentage of total attrition at each time point attributable to each category. For instance, at the 3-month point, performance and medical/physical attrition constitute slightly under 50% and slightly more than 50%, respectively, of all attrition at that point in time. As shown in Figure 2, nearly all

attrition from the Army during training was due to performance or medical/physical attrition. Beyond 12 months, however, misconduct attrition accounted for approximately 50% or more of all attrition. Medical/physical attrition continued to account for roughly one-fourth of attrition after the first year.

Questions 2 and 3 sought to identify factors that predict each type of attrition. Results of the proportional hazards regression analyses are shown in Tables 3 through 6. Table 7 presents the results of the logistic regression analyses. For the proportional hazards regression analyses, Figures 3 through 6 display plots of any significant time-varying effects for predictors in the models. In the present study, time-varying effects were modeled as linear trends and reflect the influence of a given predictor with attrition that changes over time (i.e., the relationship between a predictor and attrition increases or decreases over time). Hazard ratios of 1.00 in Figures 3 through 6 indicate no effect of a predictor on likelihood of attrition at a given time. As indicated previously, hazard ratios greater than 1.00 indicate a positive effect (i.e., that likelihood of attrition increases with scores on the predictor), with the magnitude of the effect positively increasing the further the estimate is above 1.00. Conversely, hazard ratios less than 1.00 indicate a negative effect (i.e., that likelihood of attrition decreases with scores on the predictor), with the magnitude of the effect increasing negatively the further the estimate is below 1.00.

Across both types of analyses, results showed that the influence of the noncognitive TAPAS scale predictors differed depending on the type of attrition. For performance and medical/physical attrition, the Physical Conditioning scale exhibited the strongest effects and had negative relationships with both types of attrition (*HR*s = 0.790 and 0.804, respectively). Thus, Soldiers who place less value on their physical wellbeing appear to experience increased attrition due to

Table 3. Final proportional hazards regression results for overall attrition.

Model Fit				Step 3 Predictor Statistics				
Model	*df*	−2LL	Δ-2LL	Predictor	β	*HR*	*HR* 95% LL	*HR* 95% UL
Step 1	1	365,405.94	—	AFQT	**−0.173**	0.841	0.820	0.862
Step 2	11	364,785.55	**620.39**	Achievement	−0.012	0.988	0.964	1.014
Step 3	17	364,671.91	**113.64**	Adjustment	−0.002	0.998	0.974	1.024
				Dominance	**−0.024**	0.976	0.959	0.993
				Even-tempered	**−0.041**	0.960	0.944	0.976
				Intellectual Efficiency	**0.080**	1.083	1.064	1.103
				Optimism	**−0.031**	0.970	0.953	0.986
				Physical Conditioning	**−0.227**	0.797	0.778	0.817
				Self-Control	**−0.021**	0.979	0.963	0.996
				Selflessness	**0.088**	1.091	1.065	1.118
				Sociability	0.022	1.022	0.997	1.048
				Time x AFQT	**−0.003**	0.997	0.996	0.999
				Time x Achievement	**−0.002**	0.998	0.997	0.999
				Time x Adjustment	**0.002**	1.002	1.001	1.003
				Time x Physical Conditioning	**0.005**	1.005	1.003	1.006
				Time x Selflessness	**−0.002**	0.998	0.997	0.999
				Time x Sociability	**0.002**	1.002	1.001	1.003

n = 72,009. −2LL = − 2 log likelihood. β = standardized parameter. *HR* = Hazard ratio. 95% LL = 95% confidence interval lower limit of the hazard ratio. 95% UL = 95% confidence interval upper limit of the hazard ratio. The Step 1 model includes the AFQT only. The Step 2 model adds the TAPAS scale main effects to the Step 1 model. The Step 3 model adds the interaction terms (i.e., time-varying effects) to the Step 2 model. All models are significant, $p < .05$. The Step 2 and 3 models resulted in significant change in model fit compared to the previous steps based on a Likelihood Ratio χ2 test, $p < .05$. Bolded values indicate significant predictor effects, $p < .05$.

Table 4. Final proportional hazards regression results for performance-related attrition.

Model Fit				Step 3 Predictor Statistics				
Model	*df*	−2LL	Δ-2LL	Predictor	β	*HR*	*HR* 95% LL	*HR* 95% UL
Step 1	1	152,778.28	—	AFQT	**−0.192**	0.825	0.804	0.847
Step 2	8	152,240.07	**538.21**	Achievement	**−0.044**	0.957	0.924	0.992
Step 3	9	152,232.98	**7.09**	Adjustment	**0.031**	1.032	1.005	1.059
				Attention Seeking	**−0.080**	0.924	0.901	0.947
				Intellectual Efficiency	**0.068**	1.070	1.041	1.100
				Optimism	**−0.054**	0.947	0.923	0.972
				Physical Conditioning	**−0.236**	0.790	0.770	0.810
				Selflessness	**0.051**	1.052	1.026	1.079
				Time x Achievement	**−0.005**	0.995	0.992	0.999

n = 104,024. −2LL = − 2 log likelihood. β = standardized parameter. *HR* = Hazard ratio. 95% LL = 95% confidence interval lower limit of the hazard ratio. 95% UL = 95% confidence interval upper limit of the hazard ratio. The Step 1 model includes the AFQT only. The Step 2 model adds the TAPAS scale main effects to the Step 1 model. The Step 3 model adds the interaction terms (i.e., time-varying effects) to the Step 2 model. All models are significant, $p < .05$. The Step 2 and Step 3 models resulted in significant changes in model fit compared to the previous steps based on a Likelihood Ratio χ2 test, $p < .05$. Bolded values indicate significant predictor effects, $p < .05$.

Table 5. Final proportional hazards regression results for misconduct-related attrition.

Model Fit				Step 3 Predictor Statistics				
Model	*df*	−2LL	Δ-2LL	Predictor	β	*HR*	*HR* 95% LL	*HR* 95% UL
Step 1	1	118,698.07	—	AFQT	**−0.263**	0.769	0.717	0.825
Step 2	11	118,119.08	**578.99**	Achievement	**−0.082**	0.921	0.894	0.950
Step 3	13	118,101.62	**17.46**	Adjustment	**0.101**	1.107	1.076	1.139
				Attention Seeking	**0.120**	1.128	1.095	1.162
				Dominance	**0.054**	1.055	1.023	1.088
				Even-tempered	0.034	1.035	0.964	1.111
				Intellectual Efficiency	**0.134**	1.143	1.107	1.180
				Non-Delinquency	**−0.143**	0.867	0.842	0.892
				Physical Conditioning	**0.043**	1.044	1.014	1.074
				Sociability	**0.080**	1.083	1.052	1.116
				Tolerance	**−0.070**	0.932	0.906	0.959
				Time x AFQT	**−0.005**	0.995	0.993	0.998
				Time x Even-tempered	**−0.003**	0.997	0.994	1.000

n = 104,129. −2LL = − 2 log likelihood. β = standardized parameter. *HR* = Hazard ratio. 95% LL = 95% confidence interval lower limit of the hazard ratio. 95% UL = 95% confidence interval upper limit of the hazard ratio. The Step 1 model includes the AFQT only. The Step 2 model adds the TAPAS scale main effects to the Step 1 model. The Step 3 model adds the interaction terms (i.e., time-varying effects) to the Step 2 model. All models are significant, $p < .05$. The Step 2 and 3 models resulted in significant change in model fit compared to the previous steps based on a Likelihood Ratio $\chi 2$ test, $p < .05$. Bolded values indicate significant predictor effects, $p < .05$.

Table 6. Final proportional hazards regression results for medical/physical-related attrition.

Model Fit				Step 3 Predictor Statistics				
Model	*df*	−2LL	Δ-2LL	Predictor	β	*HR*	*HR* 95% LL	*HR* 95% UL
Step 1	1	142,159.82	—	AFQT	**−0.167**	0.846	0.816	0.878
Step 2	11	141,650.35	**509.47**	Attention Seeking	**−0.048**	0.953	0.927	0.979
Step 3	15	141,609.43	**40.92**	Dominance	−0.036	0.965	0.929	1.001
				Even-tempered	**−0.071**	0.932	0.897	0.967
				Intellectual Efficiency	**0.063**	1.065	1.035	1.096
				Non-Delinquency	**0.071**	1.073	1.045	1.102
				Optimism	**−0.053**	0.949	0.924	0.974
				Physical Conditioning	**−0.219**	0.804	0.783	0.825
				Self-Control	**−0.037**	0.964	0.938	0.990
				Selflessness	**0.118**	1.126	1.085	1.167
				Sociability	**0.059**	1.061	1.032	1.090
				Time x AFQT	**0.004**	1.004	1.002	1.006
				Time x Dominance	**−0.004**	0.996	0.994	0.999
				Time x Even-tempered	**0.003**	1.003	1.001	1.006
				Time x Selflessness	**−0.002**	0.998	0.995	1.000

n = 72,009. −2LL = − 2 log likelihood. β = standardized parameter. *HR* = Hazard ratio. 95% LL = 95% confidence interval lower limit of the hazard ratio. 95% UL = 95% confidence interval upper limit of the hazard ratio. The Step 1 model includes the AFQT only. The Step 2 model adds the TAPAS scale main effects to the Step 1 model. The Step 3 model adds the interaction terms (i.e., time-varying effects) to the Step 2 model. All models are significant, $p < .05$. The Step 2 and 3 models resulted in significant change in model fit compared to the previous steps based on a Likelihood Ratio $\chi 2$ test, $p < .05$. Bolded values indicate significant predictor effects, $p < .05$.

difficulty meeting Army performance demands or experiencing medical or physical problems that prevent them from completing their terms of service.

Misconduct attrition over time was negatively and most strongly predicted by Non-delinquency (*HR* = 0.867). However, across all models, the AFQT exhibited even stronger negative relationships with misconduct attrition, suggesting that Soldiers with more cognitive ability are less likely to experience attrition due to misconduct.

Questions 4 and 5 were concerned with reenlistment and its predictors, respectively. Overall, 70.2% of Soldiers who completed their first term reenlisted. Results by MOS showed that the incidence of reenlistment was highest for Human Resources (HR) Specialist Soldiers (42A; 90.3%) and lowest for Infantry/Special Forces Candidates (11B/C/X/18X; 59.5%).[1] Reenlistment overall and by MOS are shown in Table 7. MOS were selected for inclusion in this study based primarily on the availability of data such that larger sample sizes were preferred. Additionally, these MOS represent a diversity of Army job duties and tasks.

Results of the logistic regression analyses showed that the AFQT was negatively related to reenlistment overall. Thus, more cognitively able Soldiers were less likely to reenlist after completing their first term. This finding was observed for seven of the 11 MOS studied here. AFQT scores were unrelated to reenlistment for Cannon Crewmember (13B), Signal Support Systems Specialist (25U), Combat Medic Specialist (68W), and Culinary Specialist (92G) MOS. Overall, few significant TAPAS predictors consistently emerged across models. Nonetheless, three scales with positive relationships for multiple MOS include Achievement,

Table 7. Reenlistment logistic regression results.

	Model Fit				Predictor Statistics			
MOS (*n*)	Model	*df*	−2LL	Δ-2LL	Predictor	*OR*	*OR* 95% LL	*OR* 95% UL
All	Step 1	1	**45,324.45**		AFQT	0.843	0.825	0.861
(34,884)	Step 2	10	**45,088.33**	**236.12**	AFQT	0.835	0.815	0.855
					Achievement	1.068	1.041	1.094
					Adjustment	0.961	0.939	0.984
					Attention Seeking	0.959	0.937	0.982
					Cooperation	0.966	0.944	0.989
					Dominance	1.070	1.044	1.097
					Intellectual Efficiency	1.041	1.014	1.069
					Order	1.037	1.013	1.061
					Physical Conditioning	0.942	0.920	0.964
					Tolerance	1.090	1.065	1.115
11B/C/X/18X	Step 1	1	**10,982.47**		AFQT	0.856	0.819	0.895
(7,971)	Step 2	5	**10,932.47**	**50.00**	AFQT	0.844	0.808	0.882
					Achievement	1.085	1.034	1.140
					Cooperation	0.949	0.906	0.993
					Dominance	1.111	1.060	1.165
					Self-Control	0.952	0.909	0.998
12B	Step 1	1	**1285.05**		AFQT	0.762	0.664	0.874
(979)	Step 2	1	**1285.05**	—[a]	AFQT	0.762	0.664	0.874
13B	Step 1	1	1557.32		AFQT[c]	0.876	0.768	1.000
(1,144)	Step 2	2	**1549.67**	—[a]	Achievement	1.137	1.007	1.284
					Cooperation	0.840	0.742	0.950
19D	Step 1	1	**2413.07**		AFQT	0.790	0.725	0.881
(1,760)	Step 2	2	**2401.40**	**11.67**	AFQT	0.793	0.719	0.875
					Achievement	1.181	1.073	1.300
25U	Step 1	1	614.87		AFQT[c]	0.952	0.766	1.185
(511)	Step 2	2	**604.61**	—[a]	Adjustment	0.763	0.624	0.934
					Dominance	1.247	1.026	1.516
31B	Step 1	1	**516.87**		AFQT	0.713	0.561	0.906
(442)	Step 2	1	**516.87**	—[a]	AFQT	0.713	0.561	0.906
42A	Step 1	1	**299.15**		AFQT	0.557	0.404	0.769
(438)	Step 2	3	**289.71**	**9.43**	AFQT	0.602	0.432	0.840
					Even-Tempered	0.721	0.525	0.990
					Self-Control	1.533	1.112	2.114

	Model Fit				Step 2 Predictor Statistics			
MOS (*n*)	Model	*df*	−2LL	Δ-2LL	Predictor	*OR*	*OR* 95% LL	*OR* 95% UL
68W	Step 1	1	2764.43		AFQT[c]	0.956	0.825	1.107
(2,062)	Step 2	2	**2750.35**	—[a]	Achievement	1.135	1.037	1.241
					Tolerance	1.108	1.013	1.212
88M	Step 1	1	**1224.73**		AFQT	0.834	0.711	0.979
(1,056)	Step 2	2	**1224.73**	—[a]	AFQT	0.834	0.711	0.979
91B	Step 1	1	**2146.87**		AFQT	0.767	0.682	0.863
(1,773)	Step 2	3	**2130.65**	**16.22**	AFQT	0.770	0.684	0.867
					Dominance	1.175	1.055	1.308
					Self-Control	1.149	1.034	1.275
92G	Step 1[b]	1	937.30		AFQT[c]	0.865	0.729	1.027
(769)								

-2LL = − 2 log likelihood (deviance). *OR* = odds ratio. 95% LL = 95% confidence interval lower limit of the odds ratio. 95% UL = 95% confidence interval upper limit of the odds ratio. The Step 1 model includes the AFQT only. The Step 2 model adds the TAPAS scales to the AFQT-only model. All predictors are significant ($p < .05$) unless otherwise noted. For MOS-specific results, Soldiers were only included if they stayed in the same MOS when they reenlisted. Bolded values indicate either significant model fit (−2LL) or significant change in model fit (Δ-2LL) based on a Likelihood Ratio χ2 test, $p < .05$.

[a] The change in model fit was not computed because the Step 1 and Step 2 models are either (a) identical or (b) not nested. Models were not nested when the effect of AFQT was not significant in Step 1 and was therefore removed from the final model.

[b] The Step 2 (i.e., combined AFQT and TAPAS) model contained no significant predictors. Therefore, only the Step 1 (i.e., AFQT-only) model results are presented.

[c] The effect of the predictor was not significant.

Dominance, and Self-control, indicating that Soldiers higher in these characteristics were generally more likely to reenlist for certain MOS. Although these positive relationships for Achievement and Dominance also appeared for Army-wide reenlistment, Self-control was not significant in the Army-wide model. Table 7 presents the results of the logistic models and Figure 7 provides a chart to compare model predictors across each sample.

Discussion

Despite representing very different outcomes within the context of a Soldier's career, both attrition and reenlistment have significant implications for the Army and the readiness of its force. Although attrition serves a beneficial function when individuals depart who are unable or otherwise unwilling to perform the duties required by the job, it would be preferable to reduce attrition through improved selection methods and the

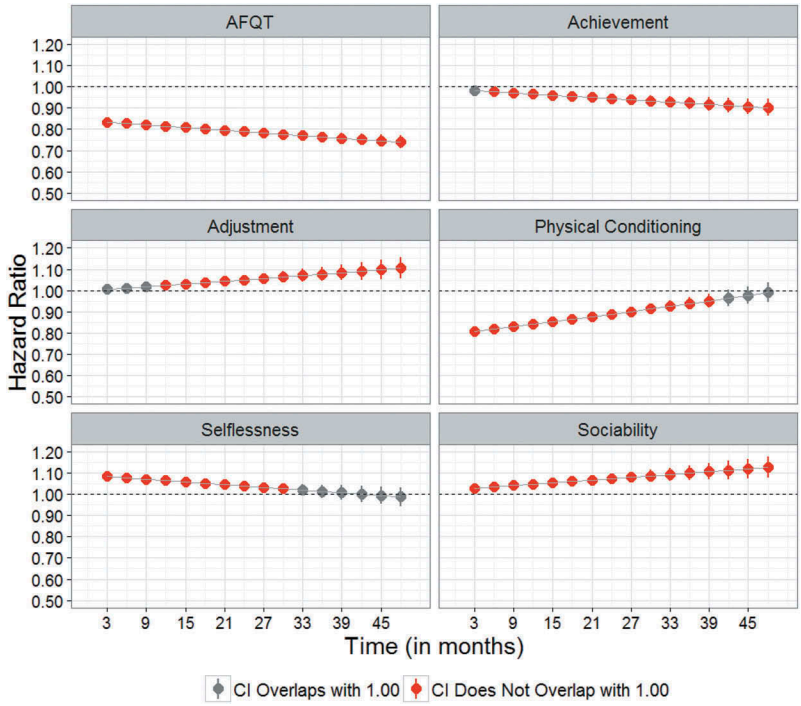

Figure 3. Time-varying effects from the proportional hazards regression model of overall attrition. Red circles represent significant effects; gray circles represent non-significant effects ($p < .05$). Vertical lines extending from circles represent standard errors.

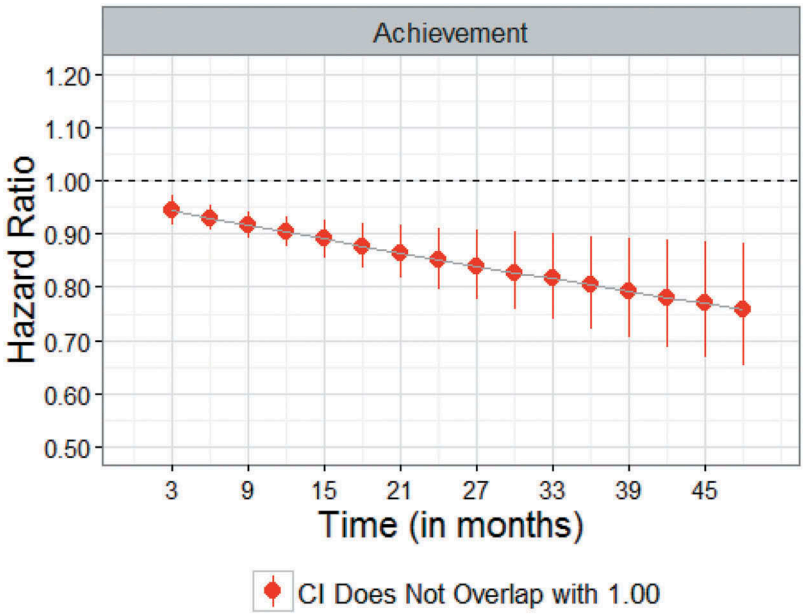

Figure 4. Time-varying effects from the proportional hazards regression model of performance-related attrition. Red circles represent significant effects; gray circles represent non-significant effects ($p < .05$). Vertical lines extending from circles represent standard errors.

enlistment of more capable Soldiers. Similarly, the Army has a vested interest in retaining knowledgeable, experienced, and skilled Soldiers after their first term of service through reenlistment. As such, understanding what factors may predict attrition and reenlistment can help the Army better accomplish its goals related to maintaining a strong force.

Across the attrition analyses, some consistent effects emerged for both the AFQT and TAPAS predictors. Generally, higher ability Soldiers were less likely to

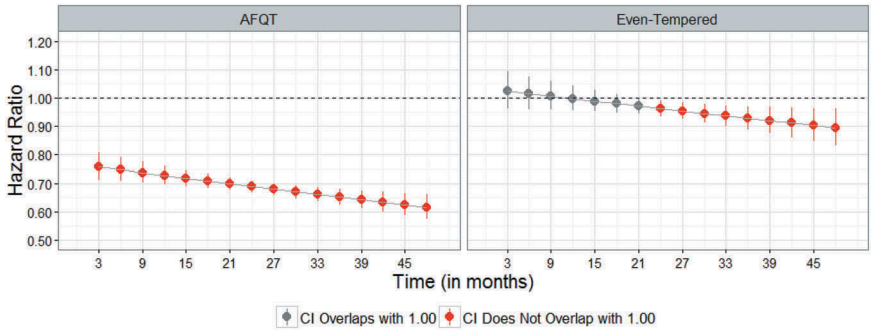

Figure 5. Time-varying effects from the proportional hazards regression model of misconduct-related attrition. Red circles represent significant effects; gray circles represent non-significant effects ($p < .05$). Vertical lines extending from circles represent standard errors.

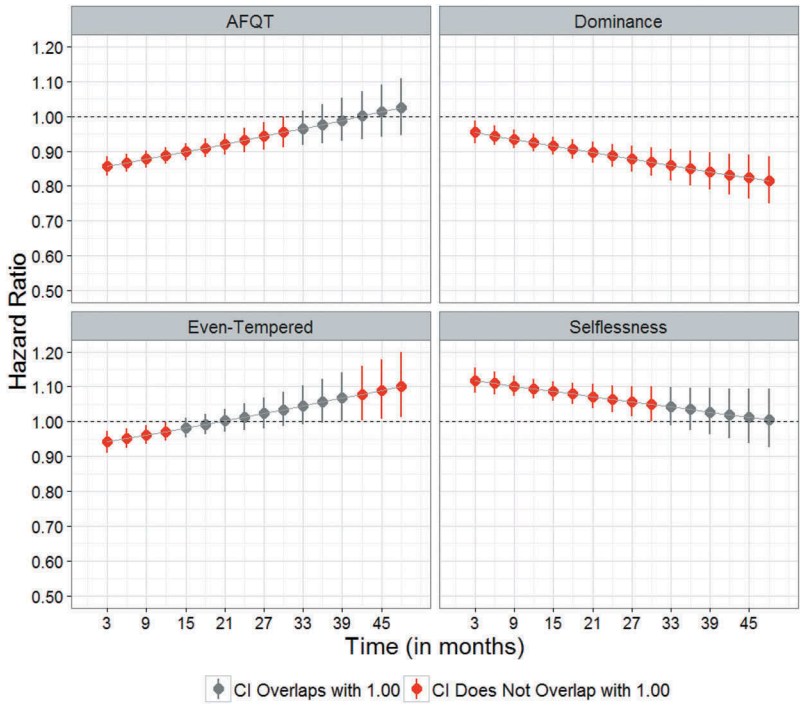

Figure 6. Time-varying effects from the proportional hazards regression model of medical/physical-related attrition. Red circles represent significant effects; gray circles represent non-significant effects ($p < .05$). Vertical lines extending from circles represent standard errors.

attrit throughout training and in unit. Additionally, Soldiers who placed greater emphasis on physical conditioning were less likely to attrit over time. Previous research also has demonstrated a negative relationship between physical fitness and attrition (Putka, 2005; Van Iddekinge, 2005). Moreover, the deleterious effects of poor physical conditioning appear to be most evident at the beginning of a Soldier's career given the increased rates of performance and medical/physical attrition within the first 12 months. However, for Soldiers who completed their first term of service, higher AFQT scores were associated with a lower likelihood of reenlistment in the overall sample as well as for a number of specific MOS. Physical Conditioning also had a negative relationship with reenlistment in the overall sample. Non-delinquency, which was positively related to misconduct attrition, was unrelated to reenlistment outcomes for all samples.

Heightened rates of medical/physical attrition during the first 3 months is not surprising. The physical requirements during training are vastly different from physical activity most Soldiers participate in prior to enlisting, both in type of activity and frequency. Soldiers have little experience with some of the training requirements such as foot marches and obstacle courses. This lack of physical preparation may result in many injuries that ultimately

Predictor	MOS										
	All	Infantry/ Special Forces Candidate (11B/C/X/18X)	Combat Engineer (12B)	Cannon Crewmember (13B)	Cavalry Scout (19D)	Signal Support Systems Specialist (25U)	Military Police (31B)	Human Resources Specialist (42A)	Combat Medic Specialist (68W)	Motor Transport Operator (88M)	Wheeled Vehicle Mechanic (91B)
AFQT	–	–	–		–		–	–		–	–
Achievement	+	+		+	+				+		
Adjustment	–					–					
Attention Seeking	–										
Cooperation	–	–		–							
Dominance	+	+				+					+
Even-tempered								–			
Intellectual Efficiency	+										
Non-Delinquency											
Optimism											
Order	+										
Physical Conditioning	–										
Self-control		–						+			+
Selflessness											
Sociability											
Tolerance	+								+		

Figure 7. Sample sizes (n) are as follows: All = 35,884; 11B/C/X/18X = 7,971; 12B = 979; 13B = 1,144; 19D = 1,760; 25U = 511; 31B = 442; 42A = 438; 68W = 2,062; 88M = 1,056; 91B = 1,773. TAPAS predictors of reenlistment from logistic regression analyses by MOS. Dashes (–) indicate a negative effect. Pluses (+) indicate a positive effect. Empty cells indicate no effect. All effects are significant, $p < .05$. No predictors were significant in the culinary specialist (92G) sample (n = 769).

lead to leaving the Army. Recent research conducted by the Walter Reed Army Institute of Research (WRAIR) found that Soldiers who scored lower on the physical conditioning dimension of TAPAS were more likely to attrit in the first 6 months and more likely to be diagnosed with a mental disorder (Niebuhr et al., 2013).

The ASVAB predicts academic ability and trainability. It is not surprising then that Soldiers who score lower on the AFQT are more likely to attrit. The first months in the Army are associated with a heavy training component (e.g., weapons training, leadership training). A Soldier who is unable to navigate these initial training demands is thus more likely to leave the Army. Our results also suggest that the negative relationship between AFQT scores and attrition strengthens over time. Although not all research has evidenced a negative correlation between cognitive ability and attrition, our findings align with those from recent research (e.g., White et al., 2014). White and colleagues found the negative correlation between AFQT scores and attrition strengthened from 6 to 36 months. In as much as Soldiers are expected to perform increasingly complex tasks and acquire increasingly complex knowledge the longer they are in the Army, the more important general mental ability is likely to be for their success. Thus, Soldiers' cognitive ability may play a more critical role later in their careers as more is demanded of them. Finally, we note that the effect of AFQT scores on medical/physical attrition diminished over time. Although cognitive ability may predict learning and therefore be associated with a lower likelihood of injury (and medical/physical attrition) early in a Soldier's career, we would not expect AFQT scores to predict attrition due to such causes beyond Soldiers' periods of initial training.

Limitations

Like all outcomes in organizational research, there are challenges inherent in the measurement and operationalization of attrition as examined in the present study. One limitation previously noted by others (e.g., White et al., 2014) is that the ISC codes used in the present study to identify types of attrition may not always accurately indicate the specific reason for why the Soldier left. A related limitation of using the ISC codes to identify attrition types is that Soldiers sometimes attrit for multiple reasons. For example, a Soldier may be injured at the same time his or her family is expecting a child. In such situations, only one code will be recorded even though there is more than one reason. Despite these limitations, the codes appear to be useful for reasonable delineation of attrition categories, as

indicated by the differential relationships found between each type of attrition and the predictors examined in this study.

For reenlistment analyses, we attempted to draw predictor comparisons across MOS. However, sample sizes across MOS ranged from fewer than 450 to greater than 2,000. Thus, effects of the AFQT and TAPAS scales may be somewhat less stable in some MOS with smaller samples. Consequently, some nonsignificant predictors examined in the present study may reveal significant relationships with reenlistment given larger samples.

Future directions

The present study examined not just how TAPAS and AFQT scores relate to different types of attrition, but also whether and how those relations may vary over time. In several instances, we found evidence of a predictor-attrition relation increasing or decreasing in magnitude across the time period examined. Often, the change in the relation coincided with expectation based on the construct assessed by the predictor. For instance, one would reasonably hypothesize *a priori* that scores on a scale such as Even-tempered might be negatively related to misconduct attrition. Our results suggest that the relation between scores on Even-tempered and misconduct attrition does indeed increase over time in the direction anticipated (e.g., Figure 5), such that Soldiers who score higher on Even-tempered are increasingly less likely to attrit due to misconduct-related reasons as time progresses. However, there were also several instances where a change in the relation between a predictor and attrition did not conform to expectation. The primary pattern where this was observed pertains to situations where the relation between a predictor and attrition became more strongly positive with time, indicating that Soldiers who score higher on the measure are more likely to attrit. For instance, scores on Sociability were found to be more strongly and positively related to overall attrition with time (e.g., Figure 3). Additional research is needed to evaluate the reproducibility of these results pertaining to time-varying effects, to rule out alternative statistical or methodological explanations (e.g., suppression effects), or to further evaluate potential mechanisms that account for why the pattern of time-varying change occurs.

Understanding attrition is an important foundation for attempts at trying to reduce the number of Soldiers who leave before their contract has ended. One way to reduce attrition is to narrow the focus of selection assessments to the MOS level. Future research should examine ways to address specific types of attrition for specific jobs or job categories. For example, an MOS with abnormally high medical attrition could apply a screen using a combination of cognitive and noncognitive measures aimed specifically at preventing medical attrition. Another MOS or job category may have unusually high misconduct attrition. TAPAS and ASVAB scores could be combined to predict who would be more likely to attrit for misconduct reasons. Moreover, Soldier-occupation fit could be enhanced with the addition of other noncognitive measures, such as an interest inventory, that could further refine the prediction of attrition, and to some degree reenlistment. With this information, the Army could encourage recruits to choose an MOS that would be a better fit. This approach would not limit the number of accessions, but likely increase the likelihood that Soldiers will stay through the duration of their contracts.

The Army would benefit from a more thorough understanding of why Soldiers leave the Army, particularly if there are multiple reasons. Asking Soldiers more in-depth questions about the motivations and reasons for leaving would improve our ability to predict attrition using TAPAS and AFQT and our understanding of Soldier attrition more broadly. A similar method could be used to determine the motivations for Soldiers to reenlist. In addition, collecting data about intentions to leave or thoughts about leaving at different time points (e.g., during training, at their first duty station) would offer insight about events that prompt Soldiers to consider attriting. This information could be useful in better understanding which TAPAS dimensions predict attrition across time.

Retaining Soldiers is vital to the Army's mission of readiness. Losing Soldiers before their contract has finished is costly and time-consuming. Attrition is also difficult to predict using traditional screens such as education credential. By combining tools such as the ASVAB and TAPAS into a selection assessment, the Army can reduce attrition and increase Soldier fit.

Note

1. For all analyses, 11B, 11C, 11X, and 18X Soldiers were combined into a single group (Infantry/Special Forces Candidate). Soldiers entering the Army as 11X are assigned to either 11B or 11C upon graduation of Infantry One Station Unit Training. Soldiers entering the Army as 18X also attend Infantry One Station Unit Training. Upon graduation, 18X Soldiers are given the opportunity to complete additional courses with the potential of qualifying for a Special Forces MOS.

Disclosure statement

No potential conflict of interest was reported by the authors.

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