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Abstract

A 12-item measure of Comprehensive Airman Fitness is proposed and empirically examined, using component measures of mental fitness, physical fitness, social fitness, and spiritual fitness from the Support and Resiliency Inventory. Both a four-component fitness score and a total fitness score are tested using confirmatory factor analysis, and measurement invariance is tested by military pay grade, gender, marital status, and deployment in the last 12 months. Results confirm that the components of comprehensive airman fitness can be conceptualized as pieces of a total fitness construct, and that the measure is invariant across subgroups. Policy and practice implications are discussed.

Keywords: Comprehensive Airman Fitness, total force fitness, U.S. military, U.S. Air Force, Support and Resiliency Inventory

Confirmatory Factor Analysis of a Measure of Comprehensive Airman Fitness

The concept of *Total Force Fitness* was developed by the Department of Defense (DoD) in 2009 to focus efforts on promoting "health, resilience, and optimal performance" in the context of demands and challenges faced by military personnel and their families (Institute for Alternative Futures, 2009, p. 2). Admiral Mike Mullen, Chairman of the Joint Chiefs of Staff (2007-2011), spearheaded the initiative under the title "Total Force Fitness for the 21st Century," which had application to all of the service branches (Jonas, O'Connor, Deuster, Peck, Shake, & Frost, 2010). Integrating components of fitness, health, resilience, and readiness, the concept of total force fitness included eight domains, including four domains of mind (psychological, behavioral, spiritual, and social) and four domains of body (physical, medical, nutritional, and environmental; Jonas et al., 2010; Mullen, 2010).

In response to Admiral Mullen's leadership and parallel to efforts in the U.S. Army (Comprehensive Soldier Fitness, CSF) (Casey, 2011), the U.S. Air Force (AF), which is the focus of this investigation, embraced the concept of Comprehensive Airman Fitness, including the specification of four fitness domains represented in the DoD model: mental, physical, social, and spiritual. Through its contracting relationship with RAND Corporation, the AF has given considerable attention to conducting literature reviews across the domains of Total Force Fitness (see Meadows, Miller, & Robson, 2015, for an overarching summary of this work).

AF efforts were initiated in the Air Combat Command (ACC) in 2010, followed shortly thereafter by efforts in the Air Mobility Command (AMC) (J. Michel, personal communication, May 15, 2015); the AF officially launched its AF-wide Comprehensive Airman Fitness program on March 30, 2011 (Gonzalez, Singh, Schell, & Weinick, 2014). Air Force Instruction (AFI) 90-506, 2 April 2014, established requirements for the program with the "airman" population broadly defined to encompass all AF military members, AF civilian employees, and all AF military and civilian employee family members.

AFI 90-506 defines Comprehensive Airman Fitness as an "integrated framework" rather than a "stand-alone program" or "specified training class" (p. 3). As specified in the instruction, the program "encompasses many cross-functional education and training efforts, activities, programs, and other equities that play a contributory role in sustaining a fit, resilient, and ready force" (p. 3). The Deputy Chief of Staff for Manpower, Personnel and Services (HQ USAF/A1) is the focal point for activities related to implementation of this instruction.

Unlike the U.S. Army, which made assessment a key aspect of the CSF program from the beginning (Peterson, Park, & Castro, 2011), the AF has not established a metric for assessing Airman fitness and its related components, although AFI 90-506 calls for such measures: "CAF metrics/indicators derived from defined measures and self-reported data provided in community-based Air Force surveys will be used to provide commanders a view of the comprehensive fitness of an organization" (p. 11). Even the comprehensive, biennial AF Community Assessment (AFI 90-501, 15 October 2013), which is used at the installation level, in part, to assess member needs and strengths, does not specifically capture and report information on these four fitness domains. Other sources of data, such as the Air Force Climate Survey and the Caring for People Survey, are available but none of these sources focus explicitly on assessing the four fitness components (Meadows et al., 2015).

The Support and Resiliency Inventory (SRI), which is a brief (12-15 minute), anonymous, self-administered, web-based, AF-sponsored assessment tool, offers potential promise for deriving a CAF metric from existing self-report data from AF active duty members

(Bowen & Martin, 2011). Such a measure of total force fitness and its related components has important implications for AF leaders and practitioners charged with understanding, promoting, and supporting CAF through the Community Action Board (CAIB) and Integrative Delivery System (IDS) at each AF installation (AFI 90-501, 15 October 2013), as well as for researchers interested in monitoring and evaluating policy and program interventions to promote fitness. Both evidence-informed policy and practice and intervention research depend on reliable and valid measures of intended outcomes (Fraser & Galinsky, 2010; Mullen, 2004).

Using a sample of active-duty AF members who completed the SRI during a two-week period in January of 2012, we examine the factor structure of the SRI's 12-item fitness measure using confirmatory factor analysis. We hypothesize that the 12 items represent four first-order latent factors (mental fitness, physical fitness, social fitness, and spiritual fitness) and a higher-order latent factor (total fitness). We also examine the results of the confirmatory factor analysis for measurement invariance by important socio-demographic variables—military pay grade, gender, marital status, and deployment in the last 12 months.

The Support and Resiliency Inventory

The Support and Resiliency Inventory (SRI) was originally developed and pilot-tested with sponsorship from the AF Space Command Family Matters Office (2004-2007) in the context of its unit services outreach strategy (Orthner, Bowen, & Mancini, 2003). In its early years of development, the inventory was known as the Unit Assets Inventory, with parallel versions for AF members and the civilian spouses of these members (Personal Assets Inventory) (Huebner, Mancini, Bowen, & Orthner, 2009). The SRI received AF-wide sponsorship in 2008, which continued until 2013, from the Airman and Family Services Division (HQ AF/A1SA) as part of its Community Readiness Consultant Practice Strategy (Bowen, Martin, Liston, &

Nelson, 2009). Sponsorship for the SRI shifted to HQ AF Resilience Division (AF/A1SAY) in 2013/2014 for use by AF installation community support coordinators (CSCs) who are the focal point ("specialist and facilitator") for CAF at the installation level (AFI 90-506, 2 April 2014, p. 7). Currently, the tool is available to installations via individual contracts through a private corporation in Charlotte, NC.

In 2011, the SRI was revised, in part, to better capture the concept of CAF; twelve (12) items are now used to assess the four domains of Airman fitness (3 items per domain). This process has involved a bit of trial and error, including informative work with the United States Marine Corps to develop a similar metric (Bowen & Martin, 2013a). Importantly, the three items on the social fitness domain were recently shifted from a focus on "willingness to seek help from others" to "the ability to depend on support from others," which we believe better reflects the nominal definition of social fitness in AFI 90-506 (see Table 1). This shift did not result in a need to revise the SRI—all items are included on the 2011 revision (Bowen & Martin, 2011), although the individual and group summary reports have not been revised to incorporate this change.

Despite approximately 59,000 AF members and employees completing the SRI from 2011 to 2014, to date, the conceptual integrity of the fitness measure has not received sufficient empirical attention. Exploratory factor analysis of earlier data supported the presence of the four distinct fitness factors (mental, physical, social, and spiritual) and high levels of internal consistency were demonstrated within factors (Bowen & Martin, 2013b). Yet, questions remain as to whether the four fitness measures can be used to represent a useful total score, which is a particularly efficient way to measure fitness in empirical research and a simple way to display results for practitioners. Questions also remain regarding the relative invariance of the measure (component and total) across population subgroups. Measurement invariance across key population subgroups suggests that an instrument reliably captures the same phenomenon for members of each subgroup—a desirable characteristic of any assessment tool used within a diverse target population, such as active-duty AF members. Valid comparisons between population subgroups depend upon invariance in the measure at hand, which is more often assumed than confirmed in studies.

Hypothesized Model

Total fitness is a multi-component factor that includes four domains: mental, physical, social, and spiritual. Table 1 includes nominal definitions of these four fitness domains, as defined in AFI 90-506 (p. 15-16).

Insert Table 1 about here

Figure 1 illustrates the hypothesized model that is tested in this investigation. The model shows a total of 12 observed variables associated with four first-order latent factors (mental, physical, social, and spiritual). In addition, the model shows a second-order factor structure in which the four first-order latent factors load onto a higher-order latent factor, total fitness.

Insert Figure 1 about here

The measurement invariance of the conceptual model is examined in the context of pay grade (E1 – E4, E5 – E6, E7 – E9, O1 – O3, O4-10), gender (female, male), marital status (single, married), and deployment in the past 12 months (no, yes). These variables are frequently used in research to study variation in outcomes for military members and their families. Of these variables, pay grade is most often used in military studies for purposes of making subgroup comparisons on outcomes of interest (e.g., Bowen, Jensen, Martin, & Mancini, 2016; Bowen, Mancini, Martin, Ware, & Nelson, 2003). Special attention is often directed to junior enlisted members (E1 – E4). Compared to their more senior counterparts (both mid and senior enlisted and officers), junior enlisted members (E1 through E4) have less influence over the nature of their day-to-day assignments and job responsibilities and less supervisory/ leadership responsibilities for/authority over others (Hamaoka et al., 2014). Many junior enlisted members also struggle with the demands associated with new marriages and young children in the context of military policies that actively encourage members to pursue marriage and parenthood at a young age (Lundquist & Xu, 2014).

Methods

Source of Data

In January 2012 the AF Chief of Staff, General Norton A. Schwartz (2008-2012), and the Chief Master Sergeant of the Air Force, James A. Roy (2009-2013), directed a one-day stand down for all Air Force units worldwide to focus on member, unit, and community resiliency. The one-day stand down was in direct response to the uptick in the USAF suicide rate in the first two weeks of 2012.

Associated with this mandatory event, individuals and units (including military members and AF civilian employees) were offered the opportunity to complete the web-based *Support and Resiliency Inventory* (SRI) as a means of facilitating stand-down discussions (Department of the Air Force, Office of the Chief of Staff, 12 January 2012). During a two-week timeframe (12 January 2012 to 26 January 2012), 11,885 AF members and civilian employees voluntarily completed the SRI in support of this command directive. All SRI responses were anonymous.

Although information from the SRI was intended to inform the design, delivery, and evaluation of program and services to promote the fitness and resilience of total force AF members and civilian employees at the unit, base or Major Command level, this administration had a specific purpose—to allow total force AF members to examine their own fitness and resilience profile as part of the stand-down conversation. The SRI was well suited for this purpose, as respondents were able to download a graphical summary of their responses at the end of the survey, including their fitness profile. A web-based worksheet provided respondents with an opportunity to develop an individual plan of action for increasing their success in adapting to life challenges and meeting military life and duty responsibilities.

Sample Profile

The present analysis focuses on the 8,730 respondents from the larger sample who reported that they were currently serving on active duty (regular component). Civilian employees and members of the AF Reserve and Air National Guard were not included in the present analysis—these employees and members face a rather unique set of occupational circumstances and challenges (Redmond et al., 2015). Also, active duty members who were currently deployed were deleted from the sample (N = 209). Respondents represented all of the major commands in the AF with the exception of the AF Global Strike Command, the AF Special Operations Commands, and the AF Reserve Command, although it was not possible to determine the major command of respondents who used the “portal-based” self-administration rather than the “unit-based” administration of the SRI.

Table 2 includes a profile description of the full sample. Overall, respondents approximated the profile of the AF active duty population (Department of Defense, Office of the Deputy Assistant Secretary of Defense, Military Community and Family Policy, 2012). The modal respondent was male (79%), married (59%), a parent or stepparent (51%), had not been deployed in the past 12 months (77%), and in either the junior-enlisted (31%) or mid-enlisted

(33%) pay grade profile group. Approximately two in five respondents were under the age of 26 (43%).

Insert Table 2 about here

Measures

Substantive Variables. Twelve items were used to assess the four first-order constructs in the empirical model: mental fitness (3 items: MF1, MF2, MF3), physical fitness (3 items: PF1 PF2, PF3), social fitness (3 items: SCF1, SCF2, SCF3), and spiritual fitness (3 items: SPF1, SPF2, SPF3). Table 3 presents the items that corresponded to each construct. Modeled after Cantril's (1965) self-anchoring ladder scale, each item was assessed on the same 11-point "slider" scale from 0 (*not at all*) to 10 (*completely*). Although the design of the rating scale was driven more by the design of the online survey and the ease of using a slider scale on a handheld device, Lozano, Garcia-Cueto, and Muniz (2008) reported that, in general, the reliability and validity of a measure increase as the number of response options increase. When comparing 5-point versus 11-point scales, Dawes (2002) found modest mean differences between the two scale formats when the 5-point scale was re-scaled for comparison; however, the 11-point scale had a greater amount of variance (coefficient of variation) than the 5-point scale. As concluded by Dawes, scales that produce greater variance have benefit in examining relationships among variables.

Table 2 presents descriptive statistics (means, standard deviations) for these measures, and Table 4 presents the associated correlation matrix. The alpha coefficients for the summary measures ranged from a low of .79 for social fitness to a high of .94 for spiritual fitness.

Grouping Variables. Four grouping variables were used for the conduct of measurement invariance tests. Participants were partitioned into five pay grade groups, representing each the following levels: (a) E1 to E4, (b) E5 to E6, (c) E7 to E9, (d) O1 to O3, and (e) O4 and above. Gender was a binary measure, representing either male or female participants. Marital status was a binary measure such that those who indicated being married were grouped together, and those who indicated being single and never married, legally separated, divorced, or widowed were grouped together. Deployment in the past 12 months was a binary measure that partitioned participants based on whether or not they had been deployed in the past 12 months.

Insert Tables 3 & 4 about here

Data Analysis

We began with an examination of the distributional properties of each of the 12 observed indicators in the hypothesized model. Tests of multivariate normality were conducted and indicated significant non-normality; however, these tests are highly sensitive to sample size (Kline, 2011). Consequently, we examined the skew index and kurtosis index values associated with each observed indicator (see Table 1; Kline, 2011). All skew index values were less than 2 (average = -1.22), and all kurtosis index values were less than 8 (average = 4.47). This indicated that the distributions of our measures were not necessarily problematic (Curran, West & Finch, 1996; Kline, 2011). A correlation matrix was also estimated for all observed indicators to assess inter-item associations. All univariate and bivariate analyses were conducted in Stata 13.0 (StataCorp, 2013).

Following a descriptive and bivariate examination of our observed indicators, our analysis consisted of two key components: (a) confirmatory factor analysis and tests of alternative factor structures, and (b) measurement invariances tests with respect to pay grade (five groups), gender (two groups), marital status (two groups), and deployment in the past 12 months (two groups). We used structural equation modeling (SEM) in Mplus 7.11 (Muthén &

Muthén, 2012) to conduct these analyses. Prior to analysis, we randomly partitioned the full sample (*N* = 8,730) into a development sample (*N* = 4,365) and a validation sample (*N* = 4,365). The development sample was used for initial model-building, tests of alternative factor structures, and measurement invariance tests. The validation sample was then used to re-analyze the data and confirm results. Supplemental analyses indicated that the development and validation samples did not significantly differ across sociodemographic and substantive variables in the analysis.

We used the following model fit criteria to evaluate the acceptability of all analyzed models: root mean square error of approximation (RMSEA) and its upper-bound 90% confidence interval ≤ .08 (Browne & Cudeck, 1993), Tucker-Lewis Index (TLI) ≥ .95, and Comparative Fit Index (CFI) ≥ .95 (Hu & Bentler, 1999). Because our samples were large, and chi-square difference tests are highly sensitive to sample size, we followed the admonition of Cheung & Rensvold (2002) and determined that model changes/constraints were statistically negligible if the change in CFI was smaller than or equal to -0.01 (i.e., ΔCFI ≤ -0.01). Although our data were ordinal, items with more than 10 response options cannot be specified as ordinal in Mplus. Thus, we used a Maximum Likelihood (ML) estimator. As a robustness check, we re-analyzed our final model with Maximum Likelihood estimation with robust standard errors (MLR) and assessed any notable differences. Missing data (less than 4.2% across all indicators) were handled with full-information maximum likelihood estimation (FIML).

In terms of factor structure, we analyzed a first-order factor model in which four fitness constructs were specified for mental fitness, physical fitness, social fitness, and spiritual fitness. We used a jigsaw piecewise technique, whereby model fit and measurement parameters were assessed one construct at a time (Bollen, 2000). Because we expected the presence of an overall fitness construct, we then tested a second-order factor model in which the four first-order factors loaded onto a higher-order construct. Because model difference tests indicated that both factor structures were statistically indistinguishable, we selected the second-order factor model and subjected it to the measurement invariance tests.

We adapted guidelines outlined by Chen, Sousa, and West (2005) to inform the measurement invariance testing process with our second-order factor model. Specifically, we assessed configural invariance (equivalent factor structure), first-order metric invariance (equivalent first-order factor loadings), second-order metric invariance (equivalent second-order factor loadings), and first-order scalar invariance (equivalent observed indicator intercepts) across all groups within a particular grouping (i.e., pay grade, gender, marital status, deployment). To obtain model identification and metric calibration, first- and second-order factor means and variances were fixed to 0 and 1, respectively. Preliminary calculations indicated that all analytical models were over-identified and sufficiently powered (N. Bowen & Guo, 2012; MacCallum, Browne, & Sugawara, 1996). No adjustments to the model were made that were not specified in the hypothesized model (e.g., no error covariances were specified).

Results

Factor Structure

Table 5 displays the model fit indices associated with the first-order and second-order factor models. Results indicated that the second-order factor structure was statistically indistinguishable from the first-order factor structure (i.e., ΔCFI = -.001), confirming our hypothesis that first-order fitness constructs can be conceptualized as part of a larger construct representing total or overall fitness. Model fit indices for the second-order factor model were

$\chi^2(50) = 533.552$, $p < .001$, RMSEA = .047 [upper-bound 90% CI: .051], TLI = .982, and CFI = .986, indicating acceptable model fit based on our pre-specified cutoff criteria.

Insert Table 5 about here

Measurement Invariance Tests

Table 5 also displays the model fit indices and ΔCFI associated with all measurement invariances tests. Beginning with invariance tests by pay grade, results indicated that configural (ΔCFI = -.003), first-order metric (ΔCFI = -.007), second-order metric (ΔCFI = -.001), and first-order scalar invariance (ΔCFI = -.008) could be specified without significantly worsening model fit. Model fit indices for the fully constrained measurement model by pay grade were $\chi^2(362) = 1539.655$, $p < .001$, RMSEA = .061 [upper-bound 90% CI: .065], TLI = .970, and CFI = .967, indicating acceptable model fit based on our pre-specified cutoff criteria.

Results from invariance tests by gender indicated that configural (ΔCFI = .000), first-order metric (ΔCFI = -.003), second-order metric (ΔCFI = .002), and first-order scalar invariance (ΔCFI = -.002) could also be specified without significantly worsening model fit. Model fit indices for the fully constrained measurement model by gender were $\chi^2(128) = 735.096$, $p < .001$, RMSEA = .047 [upper-bound 90% CI: .050], TLI = .982, and CFI = .983, indicating acceptable model fit based on our pre-specified cutoff criteria.

In terms of marital status, results from invariance tests indicated that configural (ΔCFI = -.001), first-order metric (ΔCFI = -.001), second-order metric (ΔCFI =- .001), and first-order scalar invariance (ΔCFI = -.004) could be specified without significantly worsening model fit. Model fit indices for the fully constrained measurement model by marital status were $\chi^2(128) = 865.840$, $p < .001$, RMSEA = .052 [upper-bound 90% CI: .055], TLI = .979, and CFI = .979, indicating acceptable model fit based on our pre-specified cutoff criteria.

Finally, results from invariance tests by deployment experience indicated that configural (ΔCFI = .000), first-order metric (ΔCFI = .000), second-order metric (ΔCFI = .000), and first-order scalar invariance (ΔCFI = .000) could be specified without significantly worsening model fit. Model fit indices for the fully constrained measurement model by deployment experience were $\chi^2(128) = 629.870$, $p < .001$, RMSEA = .043 [upper-bound 90% CI: .046], TLI = .985, and CFI = .986, indicating acceptable model fit based on our pre-specified cutoff criteria. All measurement invariance test results were confirmed from analyses conducted with the validation sample (results not shown in tables). Validation sample results are available upon request.

Final Model

Figure 2 displays the final second-order factor model with the full sample. All estimated measurement parameters were significant at the $p < .001$ level. Standardized first-order factor loadings ranged from .640 to .957. Standardized second-order factor loadings ranged from .581 to .861. As mentioned previously, the final model was re-analyzed with MLR as a robustness check. The results were identical to those estimated with ML. Refer to Figure 2 for more details regarding the final model.

Insert Figure 2 about here

Discussion and Implications

Our results indicate that the four components of airman fitness (mental, physical, social, and spiritual) can be conceptualized as pieces of a total or comprehensive fitness construct. Our results also indicate that this comprehensive measure of airman fitness reliably captures the same phenomena for a) members of all pay grades, b) males and females, c) those who are married and those who are not, and d) those who have been deployed in the past 12 months and those who have not. Thus, our results suggest that the instrument is particularly robust for active-duty members, and shows significant promise as a CAF metric derived from an existing community-based AF sponsored survey.

These results have important implications for monitoring and evaluating the implementation of the CAF. In discussing the intersections across the domains of total force fitness (e.g., “physical fitness is enhanced by psychological factors”), Jonas et al. (2010) noted the need to move beyond a “siloed approach to components of fitness” (p. 12). Although the authors did not go so far as to suggest a total fitness score, they did suggest the need for “a comprehensive set of measures of success and [their use] in an integrated fashion for continual process improvements” (p. 12).

As the CAF “specialist” and “facilitator” at the installation level, as well as the CAIB Executive Director, IDS Chair, and Caring for People Coordinator (AFI 90-506, 2 April 2014, p. 7) the community support coordinator could consult with unit commanders to administer either the SRI in full or a shortened version of the assessment tool, which includes the 12-item measure of fitness, to profile the fitness of their respective units. It would be especially appealing to develop a one-page summary report that displays a total fitness score, as well as the four component fitness scores. These scores could be further displayed for demographic subgroups, such as by pay grade, gender, marital status, and deployment during the past 12 months. As suggested by Jonas et al. (2010), a highly informative graphic could be developed for visualizing “strengths and gaps in fitness,” as well as “areas for improvement” (p. 12). In time, data from a representative sample of AF active duty members could be used to develop comparison norms, including norms for multiple subgroups like pay grade, gender, and job functions.

Assuming a web-based delivery system for administrating the measure, whether the full or an abbreviated version of the current SRI, respondents could be offered the opportunity to view a copy of their fitness profile, including the ability to print or email themselves a copy of their results. The SRI's online delivery system already has these features, including the ability to be administered on a handheld device. AF members interested in examining their own fitness and developing strategies for promoting it could also use the 12-item fitness measure as a short, self-assessment tool. Evidence-based tips and strategies for promoting fitness could be added to the online delivery system for informing the development of a personal fitness plan. Heyman et al.'s (2015) development of evidence-based action sheets for active duty AF members, which are focused on dealing with a variety of relationship issues with spouses or significant romantic partners, is an excellent model to follow. In time and after further validations of the measure, which are discussed below, it would be possible to develop a cell phone or other hand-held digital application of the measure, which would promote the ability of airmen to monitor their own fitness.

Limitations and Implications for Future Research

In the present investigation, we used a non-probability sample. Non-probability samples are limited in their ability to produce fully generalizable findings. To the extent possible, future investigations should incorporate representative samples of AF members to increase the external validity of estimated parameters. The current sample was also restricted to only active duty AF members serving in the regular component and excluded those serving in the Air National Guard and the Air Force Reserve Component, or as AF civilian employees. Although recently published research indicates that the CAF measure is invariant for active duty AF members, members of the Air National Guard/AF Reserve, and AF civilian employees (Bowen, Jensen, & Martin, 2016), further research should examine the psychometric performance of the CAF instrument among members of other population subgroups, such as the family members of AF members, who are included in the broad definition of "airman" as specified in the AFI 90-506.

Further research is also needed to acquire additional evidence of the criterion-related and construct validity of the CAF instrument (DeVellis, 2012). First, future studies should examine temporally neutral correlations that are expected to exist between the CAF instrument and other related variables (i.e., criterion-related validity). Such variables may include health-related outcomes (e.g., good sleep quality and social participation in unit and community-based events and activities) and other instruments that purport to measure one or more features of individual fitness.

Second, studies should examine temporally neutral correlations that are not expected to exist between the CAF instrument and other related variables (i.e., discriminant validity). Although examples of discriminant validity are more difficult to identify in the context of the broad and integrative nature of the fitness concept, such examples may include relatively stable personality traits (e.g., extraversion vs. introversion, conscientiousness vs. spontaneous).

Third, researchers should analyze directional associations between the CAF instrument and theoretically relevant constructs (i.e., construct validity). For example, Land (2010), in discussing DoD's flexibility in the way in which the various service components implement CAF, notes that the AF established its model on a human performance framework. Consequently, we would expect the total fitness measure to predict successful role performance in meeting duty and personal responsibilities. Bowen et al. (2016), in the same analysis referenced above, found support for this expectation in reporting a strong and positive association between the current CAF measure and a measure of resiliency, which included three items related to the level of success in meeting the challenges of military life, performing assigned duties, and meeting overall responsibilities associated with personal and family roles among active duty personnel, members of the Air National Guard/AF Reserve, and AF civilian employees,. However, the cross-sectional nature of the study design restricts the ability to rule out competing explanations for this relationship (e.g., common methods variance). Longitudinal designs are needed to determine the temporal order between the current measure and hypothesized outcomes—a necessary condition to bolster causal inference.

Finally, future studies should explore the extent to which the CAF instrument successfully distinguishes between members of groups for which differences in scores are expected (i.e., known-groups validity). For example, known-groups validation could be explored by examining how the CAF instrument scores individuals differentially (significant mean differences) based on factors like rank and duty position that affect the degree to which a service member has control over their work day, or the inherent demands in marriages among young service members, especially in the context of early family formation and the demands of childcare. Beyond job control and family demands, problem behavior status warrants examination (e.g., cited for driving under the influence, established perpetrator of family maltreatment, early return from a deployment for violations of military policy or for problem behavior) as well as the degree to which service members and their families have experienced trauma associated with military duty and service life. Taken together, these tests would help reveal the extent to which the CAF instrument measures what it purports to measure (DeVellis, 2012).

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Table 1. USAF Definitions of Four Fitness Domains

Fitness Domain	Definition
Mental Fitness	The ability to effectively cope with unique mental stressors and challenges.
Physical Fitness	The ability to adopt and sustain healthy behaviors needed to enhance health and well-being
Social Fitness	The ability to engage in healthy social networks that promote overall well-being and optimal performance.
Spiritual Fitness	The ability to adhere to beliefs, principles, or values needed to persevere and prevail in accomplishing missions.

Source: AFI90-506, 2 April 2014, Comprehensive Airman Fitness, pp. 15-16.

Table 2. Variable and Sample Description for the Full Sample (*N* = 8,730)

Variable	N	mean	SD	Skewness	Kurtosis	Min	Max	Missing Values
Fitness Variables								
Mental Fitness								
MF1	8,556	7.11	2.63	-0.83	2.95	0	10	1.99%
MF2	8,582	8.15	2.08	-1.36	4.77	0	10	1.70%
MF3	8,582	7.77	2.26	-1.19	4.07	0	10	1.70%
Physical Fitness								
PF1	8,596	7.24	1.90	-0.65	3.60	0	10	1.53%
PF2	8,591	7.85	2.16	-1.07	3.84	0	10	1.59%
PF3	8,595	7.58	1.88	-0.77	3.62	0	10	1.55%
Social Fitness								
SCF1	8,479	8.11	2.59	-1.44	4.24	0	10	2.88%
SCF2	8,488	7.67	2.57	-1.08	3.43	0	10	2.77%
SCF3	8,510	7.02	2.82	-0.75	2.61	0	10	2.52%
Spiritual Fitness								
SPF1	8,461	8.70	1.86	-1.97	7.56	0	10	3.08%
SPF2	8,451	8.60	1.87	-1.88	7.28	0	10	3.20%
SPF3	8,369	8.27	2.24	-1.66	5.69	0	10	4.14%
Grouping Variables								
Deployed during past 12 months (1 = yes)	8,664	0.23				0	1	0.76%
Gender (1 = male)	8,664	0.79				0	1	0.76%
Marital status (1 = married)	8,730	0.59				0	1	0.00%
Pay Grade	8,650							0.92%
E1-E4		0.31						
E5-E6		0.33						
E7-E9		0.14						
O1-O3		0.10						
O4 and higher		0.11						
Other Characteristics								
Age	8,658							0.82%
Under 26		0.43						
26-35 years		0.30						
36 and older		0.26						
Parent or Stepparent (1 = yes)	8,730	0.51						

Table 3. Observed Indicators for Each First-Order Latent Construct

Construct/Item Label	Description
Mental Fitness (α = .90)	
MF1	I look forward to beginning each day.
MF2	I keep a positive outlook on life.
MF3	I enjoy most days.
Physical Fitness (α = .86)	
PF1	I maintain a healthy diet.
PF2	I exercise on a regular basis.
PF3	I maintain a healthy lifestyle.
Social Fitness (α = .79)	
SCF1	I can depend on support from one or more extended family members, if I need it.
SCF2	I can depend on support from one or more friends, if I need it.
SCF3	I can depend on support from one or more members of my unit (or place of work), if I need it.
Spiritual Fitness (α = .94)	
SPF1	I have a guiding set of principles or beliefs.
SPF2	I attempt to live in accordance with a guiding set of principles or beliefs.
SPF3	I draw strength from a set of guiding principles or beliefs.

Note: All dimensions range from 0 (Not At All) to 10 (Completely).

Table 4. Correlation Matrix for Observed Indicators

		1	2	3	4	5	6	7	8	9	10	11
Mental Fitness												
1	MF1											
2	MF2	0.71*										
3	MF3	0.79*	0.79*									
Physical Fitness												
4	PF1	0.40*	0.39*	0.37*								
5	PF2	0.35*	0.33*	0.33*	0.57*							
6	PF3	0.43*	0.45*	0.43*	0.78*	0.69*						
Social Fitness												
7	SCF1	0.33*	0.36*	0.35*	0.23*	0.18*	0.25*					
8	SCF2	0.38*	0.42*	0.42*	0.28*	0.26*	0.31*	0.56*				
9	SCF3	0.42*	0.42*	0.45*	0.27*	0.25*	0.29*	0.46*	0.66*			
Spiritual Fitness												
10	SPF1	0.38*	0.42*	0.38*	0.30*	0.24*	0.34*	0.24*	0.28*	0.27*		
11	SPF2	0.39*	0.44*	0.39*	0.31*	0.24*	0.34*	0.24*	0.28*	0.28*	0.89*	
12	SFP3	0.42*	0.45*	0.41*	0.30*	0.24*	0.34*	0.25*	0.29*	0.28*	0.81*	0.83*

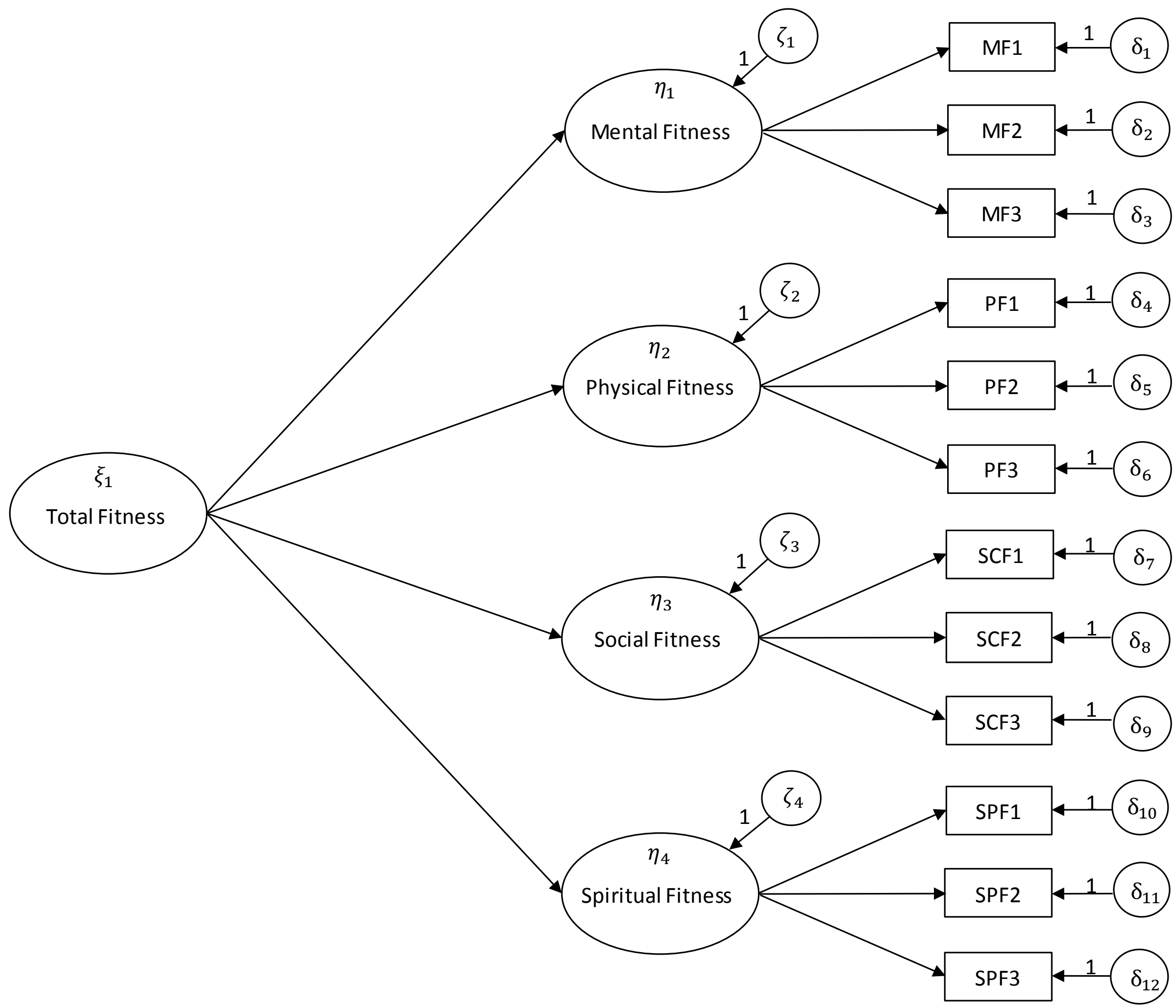
Note: *$p < .05$. Analysis included non-missing data (N = 8,204 to 8,596). All variance inflation factor scores across items were below 6 in the context of a supplemental analysis, indicating no issue with multicollinearity.

Table 5. Model-Building and Measurement Invariance Tests with Development Sample (*N* = 4,365)

Model	N	Parameters	Chi-square	df	p-value	RMSEA	Upper-bound	TLI	CFI	ΔCFI	Comparison
Factor Structure[a]											
Model A: First-order factor structure	4,344	42	506.890	48	< .001	0.047	0.051	0.982	0.987		
Model B: Second-order factor structure	4,344	40	533.552	50	< .001	0.047	0.051	0.982	0.986	-0.001	Model A
Measurement Invariance Tests											
Pay Grade (5 Groups)[b]											
Model 1A: Configural invariance	4,301	200	844.569	250	< .001	0.053	0.057	0.978	0.983	-0.003	Model B
Model 2A: Invariance of first-order factor loadings	4,301	152	1132.682	298	< .001	0.057	0.061	0.974	0.976	-0.007	Model 1A
Model 3A: Invariance of second-order factor loadings	4,301	136	1196.294	314	< .001	0.057	0.061	0.974	0.975	-0.001	Model 2A
Model 4A: Invariance of observed indicator intercepts	4,301	88	1539.655	362	< .001	0.061	0.065	0.970	0.967	-0.008	Model 3A
Gender (2 Groups)[c]											
Model 1B: Configural invariance	4,323	80	607.181	100	< .001	0.048	0.052	0.981	0.986	0.000	Model B
Model 2B: Invariance of first-order factor loadings	4,323	68	630.456	112	< .001	0.046	0.050	0.985	0.983	-0.003	Model 1B
Model 3B: Invariance of second-order factor loadings	4,323	64	645.385	116	< .001	0.046	0.049	0.983	0.985	0.002	Model 2B
Model 4B: Invariance of observed indicator intercepts	4,323	52	735.096	128	< .001	0.047	0.050	0.982	0.983	-0.002	Model 3B
Marital Status (2 Groups)[d]											
Model 1C: Configural invariance	4,344	80	633.525	100	< .001	0.050	0.053	0.980	0.985	-0.001	Model B
Model 2C: Invariance of first-order factor loadings	4,344	68	683.503	112	< .001	0.048	0.052	0.981	0.984	-0.001	Model 1C
Model 3C: Invariance of second-order factor loadings	4,344	64	701.190	116	< .001	0.048	0.052	0.981	0.983	-0.001	Model 2C
Model 4C: Invariance of observed indicator intercepts	4,344	52	865.840	128	< .001	0.052	0.055	0.979	0.979	-0.004	Model 3C
Deployment (2 Groups)[e]											
Model 1D: Configural invariance	4,320	80	586.849	100	< .001	0.047	0.051	0.982	0.986	0.000	Model B
Model 2D: Invariance of first-order factor loadings	4,320	68	612.332	112	< .001	0.045	0.049	0.983	0.986	0.000	Model 1D
Model 3D: Invariance of second-order factor loadings	4,320	64	621.225	116	< .001	0.045	0.048	0.984	0.986	0.000	Model 2D
Model 4D: Invariance of observed indicator intercepts	4,320	52	629.870	128	< .001	0.043	0.046	0.985	0.986	0.000	Model 3D

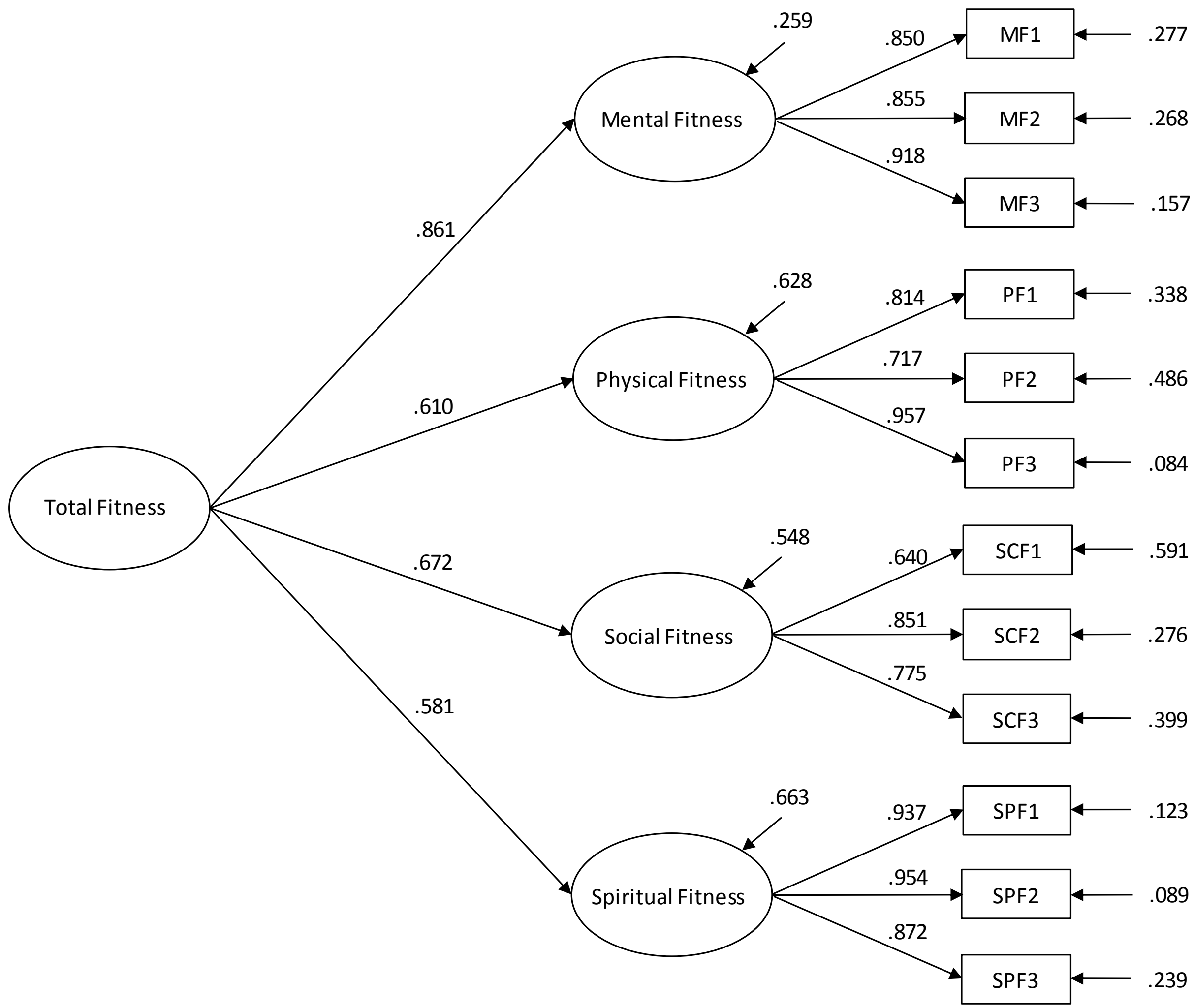
Note: [a]21 cases are omitted due to missing values on all variables. [b]Pay grade subgroups: E1-E4 (N = 1,354), E5-E6 (N = 1,427), E7-E9 (N = 589), O1-O3 (N = 476) , 04+ (N = 455). [c]Gender subgroups: Female (N = 916), Male (N = 3407). [d]Marital status subgroups: Married (N = 2,563), Not Married (N = 1,781). [e]Deployment subgroups: Not Deployed in Past 12 Months (N = 3,343), Deployed in Past 12 Months (N = 977). Invariance tests were conducted as outlined in Chen, Sousa, and West (2005). For the purposes of model identification and metric calibration, first-and second order factor intercepts were fixed to 0 across all groups and first- and second-order variances were fixed to 1 across all groups from the onset of measurement invariance tests. The number of cases in each set of invariances tests varies due to missing values associated with the grouping variable.

Figure 1. Hypothesized Second-Order Factor Model



Note: For metric calibration, the variances/error variances of first- and second-order factors are fixed to 1.

Figure 2. Final Second-Order Factor Model with the Full Sample (N = 8,680)



Note: Final model fit indices: $\chi^2(50)$ = 860.605, p < .001, RMSEA = .043 [90% CI: .041 - .046], TLI = .985, CFI = .989. Maximum Likelihood estimator was used for the analysis. All estimated parameters are standardized and significant at the p < .001 level. Fifty cases were omitted from the analyis because they were missing values on all observed indicators.