

## Pilot Testing the Readiness Estimate and Deployability Index Revised for Air Force Nurses

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The Readiness Estimate and Deployability Index Revised for Air Force Nurses (READI-R-AFN) was derived from modifications of Reineck's Readiness Instrument. Reliability and validity of the READI-R-AFN was estimated on completed questionnaires of 181 active duty Air Force nurses. The READI-R-AFN was evaluated based on item analysis, internal consistency ( $\alpha$  coefficient,  $\geq 0.70$ ), confirmatory factor analysis with structural equation modeling, and hypothesis testing. The findings were supported by Flannery's model of stress resistance. There was evidence of reliability and validity of the 83-item READI-R-AFN based on internal consistency ( $\alpha$ , 0.80-0.96), structural equation modeling, and hypothesis testing. The original hypothesized six dimensions were retained.

### Introduction

A state of individual preparedness or personnel readiness for military deployments is a primary concern for the Department of Defense.<sup>1</sup> The Department of Defense medical readiness strategic plan<sup>1</sup> specifically states its personnel must be prepared to respond quickly and move rapidly and decisively anywhere on the globe when called to do so. A heightened importance of readiness was brought to the forefront for the Department of Defense when terrorists destroyed the World Trade Center in New York City on September 11, 2001. This occurrence of aggression on our nation has resulted in a declaration of war on terrorism<sup>2</sup> and has increased short-notice, worldwide deployments known as readiness missions for Air Force nurses.

An instrument for self-assessment of an individual's preparedness to meet the expectations and rigors of military deployments was available for Army nurses.<sup>3,5</sup> However, no such instrument existed for Air Force nurses. Consequently, the purpose of this study was to modify Reineck's instrument developed for Army nurses and test the reliability and validity of the Readiness Estimate and Deployability Index Revised for Air Force nurses (READI-R-AFN) in active duty Air Force nurses. The READI<sup>3,5</sup> was designed as a self-assessment of nurses' perceptions of their preparedness to deploy as required of military nurses. Knowledge of the nurses' perceptions is important because self-perceptions influence an individual's state of stress resistance.<sup>6</sup> This was found to be true in Barger's<sup>7</sup> study of nurses deployed during World War II when stressful events were appraised as a challenge, thus enabling nurses to gain a sense

of confidence and mission accomplishment. A more stress-resistant perspective would enable Air Force nurses to accomplish mastery of skills amid the complex demands of military deployments.<sup>8</sup>

### Background of Instrument Development

Reineck<sup>3</sup> organized focus groups of Army nurses who had extensive experience with deployment missions to develop the READI.<sup>3,5</sup> Focus group members participating in Reineck's<sup>3</sup> concept clarification process were active duty and reserve Army nurses who were representative of a wide array of time in service, military deployment experience, nursing specialties, and geographic assignment. Members clarified their ideas regarding individual readiness and made recommendations specifying how all concepts related to individual readiness fit together.

### Conceptual Support

As a result of ideas generated through focus group techniques, a definition of individual readiness was derived as, "... a dynamic concept with dimensions at the individual, group, and system levels which, together, influence one's ability to prepare to accomplish the mission" (p 23).<sup>6</sup> In addition, recurring themes emerged identifying six inter-related dimensions of individual readiness and their corresponding ideas.<sup>3,5</sup> The six inter-related dimensions identified are: (a) clinical nursing competency, (b) operational competency, (c) soldier/survival skills, (d) personal/psychosocial/physical readiness, (e) leadership and administrative support, and (f) group integration and identification.

The ideas generated regarding individual readiness mirror the domains of mastery, attachment, and meaning addressed in Flannery's<sup>6</sup> model of the stress-resistant person. The domain of "mastery" can be perceived as related to the components of (a) clinical competence, (b) operational competence, and (c) soldier survival skills designed by Reineck et al.<sup>3,5</sup> The domain of "attachment" is reflected in the items that measure (d) personal/psychosocial/physical readiness, (e) group integration and identification, and (f) leadership and administrative support. The domain of "finding meaning" can also be perceived in items measuring (g) leadership and administrative support (believing in the mission and supporting one's country). In applying Flannery's<sup>6</sup> concepts, the stress-resistant Air Force nurse would be more likely to take necessary action to fulfill the course requirements and specifications detailed by the Air Force to prepare for deployment.<sup>9</sup>

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## Development of the READI-R-AFN

The initial form of Reineck et al.'s<sup>15</sup> questionnaire, the READI, was modified based on input from 30 Air Force nurses who had prior deployment experience in addition to the author's personal deployment experience. The revised measure, the READI-R-AFN, was sent to nurses with deployment experience who were asked to comment on items and offer suggestions for improvements. Recommendations were made, and items were reworded so they were consistent with Air Force terminology. A suggestion was also submitted to include an item that would address making arrangements for pets if the Air Force nurse were to be deployed. Three experts who were involved in Air Force medical readiness procedures were then given the instrument to further evaluate the READI-R-AFN for content validity.

### Administration and Scoring of the READI-R-AFN

After initial evaluation of face and content validity, the READI-R-AFN was devised as a paper and pencil test comprising six global areas related to an individual's overall self-perceived state of readiness for deployment. Participants were asked to respond to each item on the READI-R-AFN in a five-point Likert type scale format, ranging from 1 ("not competent" or "totally disagree") to 5 ("totally competent" or "totally agree"). Each item on the READI-R-AFN is measured on a scale ranging from 1 ("not competent" or "totally disagree") to 5 ("totally competent" or "totally agree"). The READI-R-AFN dimensions resulted in six global scores designed to communicate a summary picture of the individual's overall perceived state of readiness for deployment. The clinical nursing competency dimension contained the largest number of items as a result of the greater emphasis in the literature on the need for nurses to be adept clinically to perform in a deployment environment.<sup>16</sup> The personal/psychological/physical readiness dimension also contained a larger number of items due to the need to address content of three conceptual areas. Table III depicts the number of items for each dimension of the modified version of the READI.<sup>1,2</sup> the READI-R-AFN.

## Methods

### Design

A nonprobability, purposive sampling, cross sectional survey design was used for collection of data in this pilot test phase of ongoing instrument development.<sup>11</sup> Psychometric evaluation involved testing the reliability and establishing validity of the instrument in a sample of Air Force nurses considered worldwide qualified for deployment.

### Sample

Nurses were invited to take part through assistance of a nurse researcher on location at a large Air Force Medical Center located in the southwestern region of the United States. A total of 350 active duty Air Force nurses who had experienced mobility-processing exercises as standard readiness deployment procedures were included. The purpose, nature, and procedures of the study were explained to each potential volunteer in addition to the need for informed consent.

## Measures

As part of the validation process, readiness scores were evaluated as a function of indicators of well-being and psychological distress based on assumptions of the Derogatis Affects Balance Scale (DABS)<sup>12,13</sup> and the Brief Symptom Inventory (BSI) as a measure of symptomatic distress.<sup>14</sup>

### Derogatis Affects Balance Scale

The DABS is a multidimensional self-report affects and moods inventory with a theoretical premise "that positive and negative affectivity represent two fundamental axes of human emotional experience, and that the balance between positive and negative affective states represents a highly valid characterization of personal well-being" (p 1).<sup>12</sup> The DABS has been used as a sensitive indicator of well-being and positive psychological integration in numerous medical and community populations.<sup>13</sup> Internal consistency (coefficient  $\alpha$ ) ranges from 0.84 to 0.94 for the subscale and global dimensions of the DABS ( $N = 355$ ). Test-retest reliability for the global measures of the DABS range from 0.80 to 0.87. Several validation studies of the DABS have been conducted establishing the internal structure of the instrument.<sup>13</sup>

### Brief Symptom Inventory

The BSI<sup>14</sup> is an instrument comprised of 53 items for the assessment of psychological distress that yields three general scores and nine specific subscale scores. The nine subscale dimensions include somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Internal consistency (Cronbach's  $\alpha$ ) ranges from 0.75 to 0.85 on the nine dimensions of the BSI. Test-retest reliability of the nine dimensions ranges from 0.68 to 0.91 with a stability coefficient of 0.90 for the global severity index of the BSI.<sup>14</sup> The BSI has been validated in large normative samples and has been shortened to an 18-item version.<sup>15</sup> The 18-item version of the BSI will be used in this study. Recent studies have used the BSI to document levels of psychological distress in military personnel in deployed settings.<sup>16-20</sup> Correlating the READI-R-AFN with the DABS and BSI addressed the convergent validation process.<sup>11</sup>

## Data Analysis

### Reliability Testing

Reliability estimates for the READI-R-AFN short form were based on estimates of internal consistency and the squared multiple correlation coefficients of each item ( $R^2 \geq 0.50$ ).<sup>21</sup> Internal consistency was considered acceptable if coefficient  $\alpha > 0.70$ . A squared multiple correlation coefficient ( $R^2$ )<sup>22</sup> is an alternative estimate of reliability.  $R^2$  estimates the systematic variance in the observed score that can be explained by the model.<sup>22-24</sup> Ideally  $R^2$  for each item should be close to 1. For example, item 16 (recognition of a patient with a pneumothorax) had the highest  $R^2$  at 0.72, indicating that item 16 explained 72% of the variance in the clinical competency dimension.

### Validity Testing

Estimates of validity were based on confirmatory factor analysis (CFA) and hypothesis testing. CFA<sup>25</sup> was performed to as-

ness the underlying domain structure of the READI-R-AFN. This technique was also used to evaluate factorial validity (i.e., the degree to which each item is related to the hypothesized domain with which it is linked) and for confirmation of the dimensional structure of the READI-R-AFN.<sup>27</sup> The sample covariance matrix was used as input and maximum likelihood estimates were sought. The  $\chi^2$  statistic and  $\chi^2$  divided by degrees of freedom, the Normed Fit Index, and Steigers Root Square Error of Approximation (RMSEA) were used to estimate model fit. The larger the probability associated with the  $\chi^2$ , the better the fit of the model to the data.<sup>22,26</sup> The Normed Fit Index tests the hypothesized model against a reasonable baseline model and ideally should be 1.0. The RMSEA is a population-based index and therefore is insensitive to sample size. A RMSEA < 0.10 is a good result and < 0.05 is very good.<sup>27</sup> Item significance was based on the critical ratio, which is the parameter estimate divided by an estimate of standard error. A critical ratio > 2 in absolute value was considered significant.<sup>21</sup> The level of significance used for all analyses was  $p < 0.05$ .

Hypothesis testing was done to evaluate whether individuals with positive emotional bounds on the DABS<sup>12,13</sup> and absence of dysphoric emotional conflict and psychological distress on the BSI-18<sup>14,28</sup> demonstrated higher readiness scores on the READI-R-AFN. This second evaluation of validity was accomplished with hypothesis testing using convergent and divergent validity.

**Item Analyses**

Preliminary item analysis was done to evaluate individual items for a symmetrical distribution of scores. Item frequencies and percent response were evaluated for each item of the READI-R-AFN scales. The distribution of scores was used to identify those items that were more likely to discriminate.

**Results**

A total of 181 nurses responded to the questionnaires, providing a response rate of 52%. Demographic data and descriptive statistics of the sample are shown in Table I. The demographics in the pilot study are representative of demographics on Air Force nurses as noted from correspondence with the Air Force Personnel Center. The mean age was 37.2 ± 8.6 years.

TABLE I

SOCIODEMOGRAPHICS OF PILOT STUDY SAMPLE: PSYCHOMETRIC EVALUATION OF READI-R-AFN

Characteristic	
N	181
Nursing experience (years)	10.44 ± 6.92
Age (years)	37.21 ± 8.61
Sex, frequency (%)	
Male	52 (29%)
Female	127 (71%)
Prior deployment, frequency (%)	
Yes	55 (31%)
No	124 (69%)
On mobility, frequency (%)	
Yes	91 (51%)
No	88 (49%)

Data are presented as means ± SD and frequency and percent.

The majority of participants were female (71%) with a mean of 10.4 ± 6.9 years of nursing experience. Thirty-one percent had prior deployment experience and 51% were currently on mobility status, which means they were ready to deploy if needed.

The item level measures included the estimates of item mean, standard deviation, and correlation coefficients. Means, standard deviations and correlation coefficients were estimated using the Statistical Package for the Social Sciences Version 10.0 software program.<sup>29</sup> Psychometric measures, which are derived from the item level variance-covariance matrices, included reliability and factor structure and were analyzed using AMOS 4.0.<sup>23</sup>

**Reliability**

The estimates of internal consistency reliability for each subscale of the READI-R-AFN are listed in Table II.  $\alpha$  Coefficients ranged from 0.80 to 0.96. The ranges of multiple correlation coefficients ( $R^2$ ) for each dimension of the READI-R-AFN are displayed in Table III. These range from 0.05 to 0.94, indicating that the majority of items explain at least 50% of the variance within each dimension or subscale of the READI-R-AFN.

**Validity**

CFA showed that all factor loadings were significantly related to the appropriate construct or subscale. The range of factor loadings for each dimension or subscale of the READI-R-AFN is displayed in Table III. The Full READI-R-AFN range of mean item scores (possible 1-5) for each subscale is also shown in Table III. The summary of statistics for each measurement model of the READI-R-AFN is displayed in Table IV. The  $\chi^2$  result was significant for each model.

**Hypothesis Testing**

Bivariate correlations of the READI-R-AFN with the DABS<sup>12,13</sup> and the BSI-18<sup>25</sup> were in the expected direction. Significance was found primarily in the negative direction with the BSI-18 subscales and negative aspects of the DABS when correlated with all subscales of the READI-R-AFN. Positive correlations were found to be significant with positive aspects of the DABS on the personal/psychosocial/physical and group integration and identification subscales of the READI-R-AFN. The remaining measures were found to reveal correlations in the expected direction of the hypothesis but did not reach significance. The negative affective measures of the DABS and all subscales of the BSI-18 are much more significant than the positive affective measures when correlated with the READI-R-AFN. This is an

TABLE II

INTERNAL CONSISTENCY RESULTS FOR THE READI-R-AFN

Subscale	Coefficient $\alpha$
Clinical competency	0.96
Operational competency	0.92
Soldier/survival skills	0.95
Personal/psychosocial/physical readiness	0.92
Leadership and administrative support	0.86
Group integration and identification	0.80

N = 181.

\*  $p < 0.05$ .

TABLE III  
NUMBER OF ITEMS, MEAN ITEM  $R^2$ , FACTOR LOADING AND  $p$  LEVEL RANGES FOR EACH SUBSCALE

	No. of Items for Each Subscale	Mean Item Range	SD Range	$R^2$ Range	Factor Loading Range	$p$ Level Range
Clinical competency	28	2.0-4.4	1.17-0.82	0.16-0.72	0.34-0.85	0.03-0.58
Operational competency	9	2.7-4.1	1.35-1.15	0.24-0.75	0.49-0.86	0.07-0.48
Soldier survival skills	10	2.7-3.6	1.21-1.11	0.53-0.76	0.73-0.87	0.05-0.29
Personal/psychosocial/physical readiness	24	3.5-4.8	1.29-0.56	0.11-0.50	0.33-0.69	0.20-0.85
Leadership and administrative support	6	4.5-4.8	0.70-0.48	0.30-0.80	0.50-0.89	0.57-0.87
Group integration and identification	6	3.2-4.7	1.09-0.61	0.05-0.94	0.21-0.97	0.17-0.57
READI-R-AFN total	83	2.0-4.8	0.48-1.35	0.11-0.94	0.21-0.97	0.03-0.87

$N = 181$ .

TABLE IV  
GOODNESS-OF-FIT STATISTICS FOR EACH DIMENSION OF THE READI-R-AFN

	$\chi^2$	$\chi^2/df$	NFI	CFA	RMSEA
Clinical competency	1,963.16	3.04	0.93	0.95	0.11
Operational competency	99.97	3.70	0.98	0.98	0.12
Soldier survival skills	113.10	1.09	0.97	0.98	0.13
Personal/psychosocial/physical readiness	1,791.90	7.11	0.90	0.91	0.18
Leadership and administrative support	109.83	12.20	0.98	0.98	0.25
Group integration and identification	95.91	10.66	0.97	0.98	0.23
READI-R-AFN	198.76	22.08	0.95	0.96	0.31

$N = 181$ . NFI, Normed Fit Index.

indication that absence of negative affectivity is a greater predictor of levels of readiness as indicated by the READI-R-AFN than positive affectivity.

Item  $p$  levels were also included to address validity of each item.<sup>30</sup> The item  $p$  level is calculated as the number of subjects who select the most desired response on each item. Because the READI-R-AFN was designed as a self-assessment of preparation for deployment, it was determined that individuals who classified themselves as totally prepared (a 5 on each scale) would be the most desired response. The number of individuals who gave the desired response was then divided by the total sample to calculate the item  $p$  level.  $p$  levels between 0.30 and 0.70 are desirable for norm-referenced measures.<sup>30</sup> The range of  $p$  levels for each dimension of the READI-R-AFN is displayed in Table III. The items on the personal/psychosocial/physical subscale have a greater overall item mean, indicating respondents are more likely to totally agree with items as specified on the subscale.

## Discussion

The pilot study conducted with the READI-R-AFN provides some evidence for the reliability and validity of the measure. Although there was sufficient evidence for internal consistency ( $\alpha$ , 0.80-0.96), there was limited evidence for the reliability based on  $R^2$  values. For example, item 83 (it is critical to have a good working relationship with members in my deployment unit) had the lowest  $R^2$  at 0.05, indicating that only 5% of the variance of the group integration and identification dimension was explained by item 83. Finally, there was some evidence for the construct validity of the measure based on a statistically

significant relationship between self-perceptions of readiness for deployment, scores of well-being, and scores of psychological distress.

Based on CFA, the factor loading for all 83 items of the READI-R-AFN were statistically significant with estimates  $>0.40$  and having critical ratios  $>2$ . CFA indicated, however, that the fit of the model to the data was poor. The model fit was statistically significant and improved with removal of items that had low multiple correlation coefficient results. Future testing with this measure, with such revisions, is needed to further develop the READI-R-AFN.

Using item analysis techniques, individual items were evaluated for redundancy,  $R^2$  less than 0.50, and factor loadings less than 0.70 as a means to refine the READI-R-AFN and improve the fit of the model. Redundant items were removed because they would not contribute additional variance to the dimension or construct they represent. For example, item 10 in the clinical competency dimension, "Principles involved in deciding which critically injured patient is seen first" and item 21 "Implementing the triage categories" were redundant. It was decided to retain item 21 for the shorter version of the READI-R-AFN, the READI-R-AFN short form.

The majority of the 83 items of the READI-R-AFN were within the limits recommended by Mishel.<sup>31</sup> Each subscale evaluated in the pilot study had internal consistency results of  $\alpha \geq 0.80$ . The high scores provide evidence of redundancy within each subscale and support the elimination of at least one item within each bivariate correlation  $>0.70$ . Because the number of items on each scale also contribute to high correlations, the results of the clinical competency subscale (28 items) and the personal/psychosocial/physical readiness (24 items) may explain  $\alpha$  levels  $>0.92$ . Satisfac-

tion with leadership and administrative support was more likely to achieve similar responses by nurses evaluating preparedness for deployment. The group integration and identification subscale addressed the comfort nurses would have living and working in close proximity with coworkers 24 hours a day. Because some types of individuals may be more comfortable living in groups than others, responses on the group integration and identification subscale would be more likely to fluctuate.

The majority of the 83-item version of the READI-R-AFN had a wide distribution of responses. Several items had skewed distributions and contributed to the low interitem correlations, resulting in elimination of items from the scale. Items in the leadership and administrative support subscale and some of the items in the group integration and identification subscale were worded positively, for example, leadership and administrative item 77 stated, "It is critical that my deployment commander keeps me informed of all pertinent information." Participants were more likely to agree with such positively worded statements; as a result, the majority of responses were rated "highly agree" or "totally agree" in the pilot study and did not discriminate. Items were reworded after consultation with an expert in the preparation of Air Force nurses for deployment. Reworded items will be included in a revised version of the READI-R-AFN.

Based on findings from this pilot work, a total of 41 items were removed from the measure. Items removed from each subscale of the READI-R-AFN to form a more refined version of the instrument for future evaluation were: the clinical competency subscale was reduced from 28 items to 10 items; the operational competency subscale was reduced from 9 items to 7 items; the soldier survival skills subscale was reduced from 10 items to 8 items; the personal/psychosocial/physical readiness subscale was reduced from 24 to 7 items; the leadership and administrative support subscale was reduced from 6 items to 4 items; and the group integration and identification subscale was reduced from 6 items to 4 items. This refined version of the READI-R-AFN will be tested in future work.

Preparing to accomplish deployments involves training personnel to provide top quality health services in a globally uncertain environment, which may require service members to deploy to any international location at a moment's notice.<sup>1</sup> Because deployment of personnel must take place rapidly and effectively during the entire spectrum of military operations, a shorter version of the READI-R-AFN that would maintain the original six dimensions of self-assessment of nurses' preparedness to deploy would be ideal. Future work will focus on developing and testing this revised measure.

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