Examining the Reliability, Validity and Factor Structure of the DRS-15 with College Athletes

Leilani Madrigal

Nebraska Athletic Performance Laboratory, University of Nebraska-Lincoln, USA

Diane L. Gill

Department of Kinesiology, University of North Carolina at Greensboro, USA

Kent M. Eskridge

Department of Statistics, University of Nebraska-Lincoln, USA

Abstract

Hardiness, comprising feelings of commitment, control and challenge, is most frequently measured with the Dispositional Resiliency Scale (DRS), but little work has been done with the brief 15-item version.

To examine the factor structure, reliability, validity, and item functioning for gender invariance of the 15-item DRS with 525 collegiate athletes from a wide range of sports. Convergent and divergent validity were examined through relationships with mental toughness, grit and competitive anxiety. Participants completed measures of mental toughness, optimism, grit, competitive anxiety, and the DRS-15.

Confirmatory Factor Analysis revealed a poor fit for the three-factor hardiness model, and subsequent exploratory factor analysis yielded a four-factor model with better fit than the three-factor structure. Additionally, several items appear to be biased towards males or females. The fourth factor may be unique to the collegiate athlete population, and related to perceived lack of control in future life directions. Convergent and divergent validity were supported through correlations of DRS scores with related measures.

The four-factor model should be tested with different samples to determine if these changes should be adapted when using the DRS-15 in collegiate athletics or other settings.

Keywords: athletics, collegiate, validation, gender, hardiness

✉ Leilani Madrigal, University of Nebraska Athletics, One Memorial Stadium, Lincoln, NE 68588, USA. E-mail: *madrigal.leilani@gmail.com*

Introduction

Bouncing back from a negative sporting experience is a desired outcome for many athletes and coaches. Hardiness has been identified as a personality characteristic that can facilitate this process through appraising such situations as less stressful and promoting more adaptive coping efforts to overcome the stress (Kobasa, 1979). Hardiness has three components: commitment, control and challenge (Kobasa 1979). Commitment refers to becoming involved in whatever one experiences rather than becoming alienated or avoiding the experience. Control is the feeling of being influential in the face of contingencies in life rather than feeling helpless. Challenge involves believing that change is normal and will provide growth rather than viewing change as a threat. Thus, individuals high in hardiness feel committed to the activities in their lives because they believe they have a sense of control and view challenges as opportunities for growth and development.

Hardy individuals are thought to appraise situations differently, perceive stress as less threatening, and remain optimistic about their ability to cope with demands (Weibe & Williams, 1992). Hardiness has been linked to coping with stress by problem solving, rather than denying and avoiding; interacting with others by giving and getting assistance and encouragement, rather than competition or overprotection; and engaging in effective self-care, rather than excessive or insufficient nutrition, exercise, and relaxation (Maddi, 2002).

The health benefits of hardiness may stem from the coping strategies employed by hardy individuals. The relationship between hardiness and adaptive coping is a robust finding across populations (Eschleman, Bowling, & Alarcon, 2010). Cash and Gardner (2011) found that higher levels of hardiness were associated with more positive appraisals and more effective coping responses in an organizational setting. Conversely, researchers have found those low in hardiness tend to rely on negative, avoidance coping strategies such as alcohol consumption and drug use (Bartone, Hystad, Eid, & Brevik, 2012).

Hardiness has been examined in various settings such as military and in the work place (Bartone, Ursano, Write, & Ingraham, 1989). Research involving male executives, city bus drivers, disaster family assistance workers, and military populations have found those high in hardiness do not experience or succumb to the effects of stress as those low in hardiness (Bartone et al., 1989; Waysman, Schwarzwald, & Solomon, 2001). Application of hardiness in military and work place settings has been instrumental in understanding the nature of overcoming challenges and not succumbing to the detriments of stress. The literature on hardiness has begun to bridge into the sport domain. Maddi and Hess (1992) showed that hardiness, measured before the basketball season began, predicted six out of seven indexes of performance excellence throughout the ensuing season among male, varsity, high-school players. Lancer (2000) measured hardiness in female synchronized swimmers, and found those with the highest levels subsequently made

the US Olympic team in 2000, and then performed the best in competition.

Hardiness has also been found to differentiate elite and non-elite athletes. Thomas, Reevees, and Agombar (2013) examined hardiness of motorcycle racers competing in the World Endurance Championship and found that the top 10% of elite motorcycle racers had higher hardiness scores than the bottom 10%. Elite athletes high in hardiness have been found to have lower worry intensity levels and more facilitative perception of somatic anxiety and worry than non-elite athletes (Hanton, Evans, & Neil, 2003). Goss (1994) investigated the relationship between hardiness, mood states, and age of swimmers during a period of overtraining. Swimmers scoring high on hardiness experienced less mood disturbances (i.e., lower feelings of tension, depression, anger, fatigued, and confusion; Goss, 1994).

Findings on gender differences within the hardiness literature are mixed. Goss (1994) found no difference between male and female competitive swimmers on hardiness over the course of a training period. Similarly, outside of sport, Priyadarshini (2009) found that male and female business employees did not differ in hardiness factors of commitment, control and challenge. However it seems that hardiness may be expressed differently in women and men, given that there is general support for the notion that they appraise life events differently (Baum & Grunberg, 1991). In a sample of university employees, hardiness buffered against stress for men but not women (Benishek & Lopez, 1997). The authors suggest that cognitive appraisal and coping strategies may explain gender differences. Men are more likely to cope with life stress by using cognitive or problem-focused strategies whereas women are more likely to use emotion-focused coping strategies (Ptacek, Smith, & Zanas, 1992). Findings on gender differences in hardiness within sport are mixed. One goal of this study is to determine if gender influences responses to the hardiness measure.

Hardiness findings are consistent both inside and outside of sport; however, a number of conceptual and measurement issues have been raised (Funk, 1992). One debate is over using a composite score or the separate components of hardiness (Carver, 1989; Funk & Houston, 1987). Kobasa (1979) originally described hardiness as a unitary construct encompassing the "3c's" of commitment, control, and challenge. However, some researchers argue that the specific components of hardiness should be measured independently, as well as using the composite score (Klag & Bradley, 2004). Carver (1989) stipulated that information would be lost when the composite measure is preferred to the measurement of separate components. Bartone et al. (1989) found total hardiness to be a more powerful discriminator of health than its three components. Additionally, Florian, Mikulincer, and Taubman (1995) found commitment and control, but not challenge, significantly predicted changes in mental health.

Measurement issues have also been raised, especially with the most frequently used hardiness measures, the *Dispositional Resiliency Scale* (DRS; Bartone et al., 1989). The DRS has advantages over other hardiness measures due to more

positively-worded items and an equal number of items to measure commitment, control, and challenge (Funk, 1992). The original 45-item version was developed in 1989 using a sample of military personnel. Sinclair and Tetrick (2002) confirmed a three-factor structure of commitment, control, and challenge on the 45-item version of the DRS. The 30-item version was developed in 1991, and the 15-item version was developed in 1995. All versions of the DRS give scores on commitment, control, and challenge, as well as an overall hardiness score. Factor analyses have been done primarily on the 45-item version (Bartone, 1989; Bartone et al., 1989). While the 45-item and 30-item version have been used extensively in research, the 15-item brief scale offers an alternative to reduce survey length and time. The 15-item version was derived from the 30-item DRS and has shown good internal consistency (α=.82), 3-week test-retest reliability (α=.78) and criterion-related validity (Bartone, 2007).

Purpose

The DRS is considered the soundest hardiness measure available, both conceptually and psychometrically (Funk, 1992). However, no factorial structure analyses have been done on the 15-item version of the DRS in a sport-setting. The purpose of this study was to examine the factor structure, validity, and reliability of the 15-item DRS in an athletic population. We expected to confirm the 3-factor DRS structure, and hypothesized positive relationships of DRS scores with related constructs of mental toughness and grit, and no relationship with competitive anxiety. We also examined gender equivalence on the factor structure and item functioning and expected that the items would be gender equivalent. In other words, it was expected that item functioning would not differ between men and women.

Method

Participants

A total of 570 current collegiate athletes (202 men; 322 women) were recruited from a wide range of sports (i.e., soccer, baseball, softball, basketball, wrestling, track and field, tennis, volleyball, field hockey, lacrosse, swimming and diving, and rifle) and several universities and colleges using convenience sampling. Athletes ranged in ages 18-24 (*M*=19.5, *SD*=1.16). The sample consisted of freshman (34%), sophomores (24%), juniors (23%), and seniors (19%); their ethnic composition was predominately Caucasian (63%) and African-American (23%). Due to missing data (i.e., participants did not respond to more than one full measure) 45 cases were removed, leaving a total sample of 525 for analyses. Inclusion criteria included being a current college athlete over the age of 18.

Measures

The Dispositional Resiliency Scale-15 (DRS-15) is used to measure hardiness and its three subcomponents: commitment, control, and challenge (Bartone et al., 1989). The shortened DRS consists of 15 statements about life in general (5 items per subcomponent). Six items are reverse-coded. Participants are asked to indicate the truthfulness of each statement for them on a 4-point Likert scale anchored at 0 (*not at all true*) and 3 (*completely true*). Scores for each subcomponent range from 0 to 15. The composite hardiness score ranges from 0 to 45. In a critical review of hardiness research, Funk (1992) recommended the DRS as the best available instrument to measure hardiness. The DRS-15 is a widely-used scale in health and sport psychology literature and has internal reliability of .80 and 3-week test-retest reliability of .78 (Bartone, 2007).

The Mental Toughness Scale (MTS, Madrigal, Hamill, & Gill, 2013) is an 11-item scale used to measure mental toughness. Participants rate their agreement with each statement on a 5-point Likert-scale. Items are summed and higher scores indicate a greater degree of mental toughness. The MTS has demonstrated good reliability and validity, converging with related measures and maintaining internal reliability (Cronbach's alpha=.86) and 1-week test-retest reliability (r=.90). Similar to hardiness, mental toughness has also been associated with greater use of problem-focused or approach coping strategies (e.g., mental imagery, thought control) and less use of avoidance coping strategies (e.g., distancing, mental distraction; Nicholls, Polman, Levy, & Blackhouse, 2008). Mental toughness was included to assess convergent validity with the DRS-15.

The Short Grit Scale (GRIT-S, Duckworth & Quinn, 2009) is an eight-item measure to assess the personality trait of grit. Grit, which is defined as perseverance and passion for long-term goals, is characterized by strenuously working toward challenges, and maintaining effort despite failure, adversity, and plateaus (Duckworth & Quinn, 2009). Similar to mental toughness and resilience, a gritty individual stays focused on the task despite roadblocks that may emerge. The GRIT-S has demonstrated construct and predictive validity, as well as internal reliability of .82 (Duckworth & Quinn, 2009). Participants respond using a 5-point scale to rate the degree of their agreement with statements reflecting consistency of passions (e.g., "I have been obsessed with a certain idea or project for a short time but later lost interest"; 4 items) and consistency of effort (e.g., "Setbacks don't discourage me"; 4 items). Grit was included to assess convergent validity.

The Sport Competitive Anxiety Test (SCAT, Martens, Vealey, & Burton, 1990) is a 15-item scale that measures the tendency to perceive competitive situations as threatening and to respond to these situations with elevated state anxiety. Participants respond on a 3-point ordinal scale (hardly ever, sometimes, or often). Ten of the items assess individual differences in competitive trait anxiety proneness (e.g., "Before I

compete I worry about not performing well"); five unrelated filler items are also included to reduce possible response bias. Total scores on the SCAT range from 10 (low competitive trait anxiety) to 30 (high competitive trait anxiety). The SCAT has demonstrated good test-retest reliability across four time intervals: 1 hour, 1 day, 1 week, and 1 month (mean $r=.77$) (Martens et al., 1990). Competitive anxiety was used to assess divergent validity.

Procedures

Following Institutional Review Board approval, recruitment began by contacting athletic directors and coaches to request approval to contact the targeted teams. At the time arranged with the coach, the PI met with the athletes to explain the study and informed consent. Those who agreed to participate either completed a survey in group settings or were sent an electronic survey. Group settings were in a team locker room, study hall, or classroom. No names were collected and responses were placed in envelopes or submitted online. Those who participated were entered in a drawing to win one of five $20 gift cards. The survey included measures of hardiness, mental toughness, grit, competitive anxiety, and demographic information, and took about 30 minutes to complete.

Data Analysis

To test the factor structure of the DRS-15, the three-factor model was tested by confirmatory factor analyses using AMOS 22.0. Generally, comparative fit index (CFI), Tucker-Lewis Index $\geq$ .90m and root mean square error of approximation (RMSEA) $\leq$ .08 indicate good model fit (Hu & Bentler, 1999; Kline, 1998). While χ^2 has been known to be biased relative to sample size, Kline (1998) suggests χ^2/df (CMIN/DF) can also be calculated and values less than 3 are considered favorable. To establish overall model fit, Hu and Bentler's (1999) suggestion for continuous data were used – Root Mean Square Error of Estimation (RMSEA)<.06, Tucker Lewis Index (TLI)>.95, Comparative Fit Index (CFI)>.95, *p* of Close Fit (PCLOSE) >.05. Exploratory factor analysis was used to aid with model modification and to identify a better fitting factor structure which was then reassessed using confirmatory factor analysis (Schmitt, 2011).

Pearson's product-moment correlations were used to determine whether total hardiness scores, as well as the subscales Control, Commitment, and Challenge scores, were related to measures of mental toughness and grit (convergent validity) and competitive anxiety (divergent validity).

Following the suggestions of Widamen and Reise (1997), a series of models were estimated to assess the degree of measurement invariance across gender in the DRS-15. Using the three-factor structure, configural, metric, and scalar invariance respectively were tested. To establish overall model fit, Hu and Bentler's (1998) suggestion for continuous data were used – RMSEA<.06, TLI>.95, CFI>.95.

Results

Reliability and Factor Structure of the DRS-15

The DRS-15 is composed of three factors (control, challenge, commitment) yielding factor scores as well as having a total score. Participants reported high levels of hardiness (M=43.69, SD=4.05). Checks of internal consistency indicated problems with reliability of all DRS scales (control, α=.67; challenge, α=.67; commitment, α=.58; total, α=.69). Item-total correlations ranged from .19-.39.

Confirmatory Factor Analysis

The three-factor hardiness model was tested using CFA, and this model produced a poor fit, DF=87; χ^2=584.81; CMIN/DF=6.72; CFI=.68, RMSEA=.10 (.10-.11), PCLOSE=.000; TLI=.62, SRMR=.11 (see Figure 1). One item from the Challenge subscale (item 9) did not have a significant factor loading, while three items (items 1, 7, 10) from the Commitment subscale and one time (item 8) from the Control subscale had weak factor loadings (<.30) below the suggested cut-off of .60 (Tabachnick & Fidell, 2007). Additionally, based on modification indices, these problematic items (1, 7, 8, 9, 10) cross-loaded onto other factors.

Figure 1. *Three-Factor Structure for DRS-15*
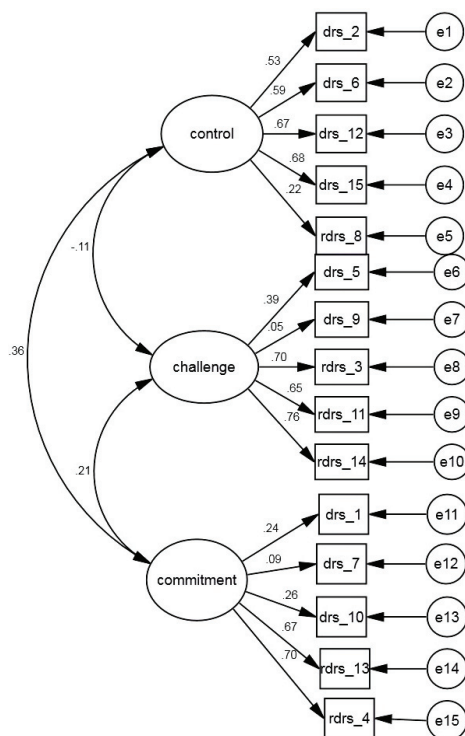
Exploratory Analyses

An exploratory factor analysis (EFA) was done to further examine the model fit. For the EFA, the 15 items of the DRS were factor analyzed using maximum likelihood extraction (allowing extractions of factors with Eigenvalues greater than 1) with a varimax rotation using IBM SPSS 22.0. A four-factor model emerged, which explained 41.26% of variance. Specifically, five items did not fit with the hypothesized three-factor structure of the DRS-15. One Challenge subscale item (item 9) loaded onto the Commitment subscale. Two Commitment items (item 4; "I feel that my life is somewhat empty of meaning", item 13; "Life in general is boring for me"), and one Control item (item 8; "I don't think there is much I can do to influence my own future") loaded onto a new fourth factor, labelled "purpose". Table 1 shows the factor loadings (maximum likelihood estimates) for the four-factor structure. To check the model fit, a confirmatory factor analysis was done with the new four-factor model. This model produced a good fit, DF=84; χ^2=230.01; CMIN/DF=2.74; CFI=.88, RMSEA=.06 (.05-.07), PCLOSE=.008; TLI=.85, SRMR=.06 (see Figure 2).

Table 1. *Exploratory Factor Analysis: Maximum Likelihood Estimates for items in 4-Factor Hardiness Model SPSS*

Item	Challenge	Control	Commitment	Purpose
3	.67	-.06	-.04	.11
5	.51	.08	.33	-.19
11	.62	-.09	-.15	.16
14	.78	-.06	-.04	.12
2	-.08	.48	.09	.25
6	.02	.61	.15	-.02
12	-.03	.66	.15	.05
15	-.06	.65	.09	.17
1	-.15	.16	.43	.11
7	.04	.17	.45	-.04
9	.10	.04	.54	-.10
10	-.04	.23	.51	.09
4	.02	.11	.10	.66
8	.10	.15	-.21	.66
13	.17	.01	.08	.73
M (*SD*)	10.13 (2.58)	14.14 (1.79)	12.04 (1.98)	10.99 (1.64)
% Variance Explained	11.86%	10.56%	8.92%	9.91%

Figure 2. *Four-Factor Structure for DRS-15*
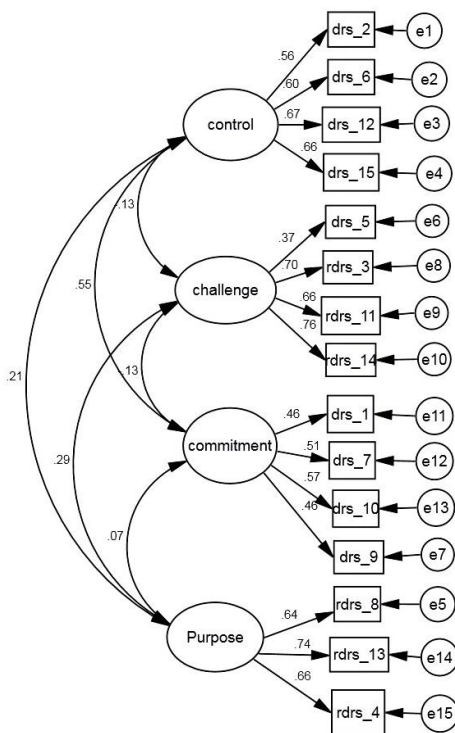
Gender Invariance Testing

A multi-group test of equivalence was performed on the four-factor model. In testing for configural invariance in which no equality constraints were imposed, the model produced a good fit, DF=168; χ^2=370.24; CMIN/DF=2.20; CFI=.88, RMSEA=.05 (.04-.05), PCLOSE=.75; TLI=.85, SRMR=.07. In testing for metric invariance each parameter was assigned a label and held equal across groups. Thus, the factor loadings were constrained and a model was re-run using unit variance identification. This model produced a good fit, DF=183; χ^2=402.53; CMIN/DF= 2.20; CFI=.87, RMSEA=.05 (.04-.05), PCLOSE=.78; TLI=.85, SRMR=.08. Evidence of invariance is based on the chi-square difference test, and in this case, the χ^2 difference, χ^2_D (15)=32.29, exceeded the 19.68 (*p*=0.05; *df*=1) cut-off score, meaning that accounting for gender significantly improved the fit. Maximum likelihood estimates for the four-factor model by gender are found in Table 2.

Table 2. *Maximum Likelihood Estimates for Four-Factor Model by Gender*

			Standardized Path Coefficients	
			Men	Women
DRS 5	←	challenge	.391*	.425*
DRS 14	←	challenge	.767*	.786*
DRS 11	←	challenge	.623*	.665*
DRS 3	←	challenge	.674*	.721*
DRS 2	←	control	.591*	.548*
DRS 6	←	control	.612*	.581*
DRS 12	←	control	.688*	.657*
DRS 15	←	control	.700*	.597*
DRS 1	←	commitment	.479*	.490*
DRS 7	←	commitment	.527*	.447*
DRS 9	←	commitment	.502*	.471*
DRS 10	←	commitment	.691*	.623*
DRS 8	←	purpose	.553*	.530*
DRS 13	←	purpose	.740*	.746*
DRS 4	←	purpose	.711*	.653*

*p<.05.

To determine which items specifically differentiated men and women, each item was constrained in the four-factor model. Table 3 shows model comparison of each item constrained in the DRS-15 across gender. Three items functioned differently between genders. Within the challenge subscale, item 5 ("Changes in routine are interesting to me") and in the newly constructed Purpose subscale, item 8 ("I don't think there is much I can do to influence my own future") and item 4 ("I feel that my life is somewhat empty of meaning") also differed between genders.

Table 3. *Model Comparison of Each Item Constrained in the Four-Factor Model Across Gender*

		df	χ^2	CMIN/DF	CFI	TLI	$\Delta\chi^2$
	Unconstrained	168	370.24	2.20	.88	.85	
Control							
	DRS 2	169	373.83	2.21	.88	.84	3.59
	DRS 6	169	370.45	2.19	.88	.84	0.21
	DRS 12	169	370.36	2.19	.88	.84	0.12
	DRS 15	169	372.97	2.21	.88	.84	2.73
Challenge							
	DRS 5	169	378.73	2.24	.87	.84	8.49**
	DRS 3	169	372.14	2.20	.88	.84	1.90
	DRS 11	169	370.25	2.19	.88	.84	0.01
	DRS 14	169	370.59	2.19	.88	.85	0.35

Table 3. - *Conntinued*

		df	χ^2	CMIN/DF	CFI	TLI	$\Delta\chi^2$
	Unconstrained	168	370.24	2.20	.88	.85	
	DRS 1	169	370.31	2.19	.88	.85	0.07
	DRS 7	169	373.70	2.21	.88	.84	3.46
	DRS 10	169	370.48	2.19	.88	.85	0.24
	DRS 9	169	370.55	2.19	.88	.84	0.31
Purpose							
	DRS 8	169	380.18	2.25	.87	.84	9.94**
	DRS 13	169	370.35	2.19	.88	.84	0.11
	DRS 4	169	375.19	2.22	.87	.84	4.92*

*p<.05; **p<.01.

In addition, an independent *t*-test was used to explore whether genders differed on the overall DRS-15 scale. Male athletes (*M*=43.65, *SD*=4.46) did not significantly differ from female athletes (*M*=43.75, *SD*=3.77) on average DRS-15 scores, $t(522)$= -2.75, *p*=.78.

Convergent and Divergent Validity of the DRS-15

We first examined convergent and divergent validity of the DRS-15 using the original three-factor model. As predicted, Commitment, Control, and total hardiness scores were positively related to mental toughness and GRIT, supporting convergent validity. Challenge was positively related to GRIT, but not mental toughness. The Control and Challenge subscales had no significant relationship to competition anxiety, while total hardiness scores and the Commitment subscale had low, negative, and significant relationships with competition anxiety.

The four-factor DRS model showed similar relationships. Commitment, Control, and Purpose (new fourth factor) had positive relationships with mental toughness and GRIT, and Challenge was positively related to GRIT. Commitment, Challenge, Control and Purpose all had significant but low, negative relationships to competition anxiety. See Table 4 for all relationships for both the original three-factor and four-factor DRS scores.

Table 4. *Convergent and Divergent Validity of Original Three-Factor*
Hardiness Model and Four-Factor Model

Original Three-Factor Hardiness Model

	Convergent Validity			
	DRS-CM	DRS-CO	DRS-CH	DRS-Total
MTS	.40[**]	.26[**]	.10[*]	.16[**]
Grit	.39[**]	.13[*]	.11[*]	.13[*]
	Divergent Validity			
SCAT	-.18[**]	-.07	-.14[*]	-.11[*]

Four-Factor Model

	Convergent Validity			
	DRS-CM	DRS-CO	DRS-CH	DRS- Purpose+
MTS	.38[**]	.31[**]	.04	.22[**]
Grit	.32[**]	.19[**]	.06	.31[**]
	Divergent Validity			
SCAT	-.11[**]	-.09[*]	-.13[*]	-.16[**]

[*]$p<.05$; [**]$p<.01$.

Discussion

The focus of this study was to examine the factor structure, validity, reliability, and gender invariance of the 15-item DRS in an athletic population. In testing the original 3-factor hardiness model, the CFA produced a poor fit. Subsequent exploratory factor analysis identified four factors consistent with hardiness theory (Kobasa, 1979). Specifically, most items loaded on the proposed factors of challenge, commitment, and control; however three items loaded onto a fourth factor, which focused on a perceived lack of control on future life directions. This four-factor model produced better fit statistics than the original three-factor model. However, several items of the DRS-15 appeared to differ between male and female athletes, despite no gender differences in the average results of the DRS-15 scale. These results should be interpreted with caution until the four-factor model can be tested with different populations.

Hu and Bentler's (1998) suggestion for continuous data were used – RMSEA <.06, TLI>.95, CFI>.95 to establish model fit. Neither the CFA nor exploratory approach met these requirements, but the four-factor model approached these criteria. With the four-factor model Commitment, Control, and Challenge emerged with slight variations from the proposed DRS structure, and a fourth factor emerged (i.e., Purpose) consisting of negative statements reflecting a life filled with boredom, empty meaning, and little control over one's own future. When these items are reverse-coded for interpretation, this new factor reflects a purpose in life and control in the direction of its outcome, which is consistent with the hardiness theory (Kobasa, 1979).

The emergence of a fourth factor reflecting purpose in one's life may be unique to the population of collegiate athletes. The original DRS was developed using survivor assistance officers in the military (Bartone et al., 1989). Military personnel may differ from the collegiate athletic population through (a) decision making processes regarding career choice and identity, and (b) control imposed by the setting.

Those that choose a military career do so because they are fulfilling a part of their identity that meets the career role (Hall, 1971). Tziner (1983) suggests that army personnel remain in the army due to factors like mobility, opportunities to promote through rankings, and the social status of being a part of a military service that is associated with idealistic motivations (Tziner, 1983). The motivations, identity, and values of military personnel may differ from the typical college student. Today's youth have been perceived by teachers as more entitled than previous generations (Stout, 2000). Furthermore, Generation Y, as compared to other generations of the same age, is perceived as more egotistical, overconfident, and entitled (Twenge, 2006). Purpose in one's life may be less apparent in today's college students who have progressed through academics without truly being challenged.

Another factor related to defining purpose for a college athletic population is the feeling of control. The military has a hierarchical decision-making structure in place, in which the chain of command is very apparent and clearly delineated by rank (Tziner, 1983). Although college students have autonomy in many of their academic choices, the same clear level of control may not be evident in student-athletes. In terms of career development, athletes are more likely than non-athletes to face problems related to career maturity, clarity of educational plans, and adjustment to college (Watson & Kissinger, 2007). Student-athletes are a subculture of college students and their control is limited due to the restraints imposed by NCAA regulations, coaches, and university policies. Students who believe they have more control over the outcomes in their life have been found to have high levels of career decision-making self-efficacy (Taylor & Pompa, 1990). The fourth factor termed Purpose may have emerged in this population of collegiate athletes due to limited control in their future and career development.

To our knowledge this is the first study to examine gender invariance of the DRS-15 in an athletic population. Kardum, Hudek-Knezevic, & Krapic (2012) examined gender invariance of the DRS-15 in businessmen and women and found the measurement structure within their modified 12-item version was invariant across gender. In the current study, multiple items appeared to differ between genders. In the better fitting model (four-factor model), item 5 from the challenge component and two items from the newly constructed Purpose subscale differed between genders. One of the biggest distinctions between Kardum et al. (2012) and the current study is the sample. Kardum et al.'s (2012) population had a mean age of 40 and consistent of those working in administration, management and technical jobs. The current study, which had a mean age of 19.5 consisted of current collegiate athletes.

The emergence of a fourth factor in this population which had two items that differed between men and women suggests work done using collegiate athletes may need to characterize hardiness differently than older adults or military personnel. Specifically, perceiving little control over future life directions may be an area that differs between men and women at the collegiate level that has been unaccounted for in previous hardiness literature.

Convergent validity was demonstrated for the DRS-15 by positive relationships with mental toughness and grit, while divergent validity was partially supported through low negative relationships with competitive trait anxiety. Although no relationship was expected, low, negative relationships are logical and in line with some existing research. Elite athletes high in hardiness, commitment and control demonstrated lower worry and a more facilitative perception of somatic anxiety and worry than athletes low in hardiness (Hanton et al., 2003).

Limitations

The current study did have limitations that should be noted. First, the four-factor model emerged through exploratory analyses and was confirmed using the same dataset. The four-factor model should be tested using a different sample of college athletes. Second, the majority of the data were collected via survey in team settings. The setting and the influence of the coach may have impacted the way in which athletes responded to items. In anticipation of these effects, coaches were reminded that they would not receive their team's score, and players were reminded of the anonymity of their responses. Third, to handle missing data, a listwise approach was used, which resulted in a deletion of 45 cases. The majority of these cases did not complete at least two full scales, leading to a loss of information.

Conclusion

Research on hardiness has extended into the sport domain, and the short DRS-15 is often preferred over the original 45-item or 30-item versions. Although research on hardiness in sport mirrors findings in other settings; specifically, protecting against stress while promoting adaptive coping efforts, the psychometric properties of the DRS-15 have been relatively unexamined beyond reporting reliability. Our results partially supported the theorized DRS hardiness model and its validity, but confirmatory and exploratory factor analyses yielded a better fitting four-factor model. The new fourth factor, Purpose, which is related to identifying purpose in life and future directions, may be unique to the student-athlete sample. Furthermore, items within the DRS-15 appear to differ between genders, which warrants further refinement and work on implementing the DRS-15 in a collegiate athletic population. Future research should explore this four-factor model by confirming it separately for male and female student-athletes to determine if gender invariance exists for the revised model. More work is needed to test this four-factor model to determine if the

measurement of hardiness truly is different for collegiate athletes as opposed to other populations such as military. Hardiness is a desired characteristic in sport, and its relationship to stress and performance outcomes is a major research topic in sport and exercise psychology. Relevant, reliable and valid measures of hardiness are needed to address these issue in that research.

References

Bartone, P.T. (2007). Test-retest reliability of the Dispositional Resilience Scale-15, a brief hardiness scale. *Psychological Reports, 101*, 943-944. doi: 10.2466/PR0.101.7.943-944

Bartone, P.T. (1989). Predictors of stress-related illness in city bus drivers. *Journal of Occupational Medicine, 31,* 657-663.

Bartone, P.T., Hystad, S.W., Eid, J., & Brevik, J.I. (2012). Psychological hardiness and coping style as risk/resilience factors to alcohol abuse. *Military Medicine, 177,* 517-524. doi: 10.7205/MILMED-D-11-00200

Bartone, P.T., Ursano, R.J., Write, K.M., & Ingraham, L.H. (1989). The impact of a military air disaster on the health of assistance workers: A prospective study. *Journal of Nervous and Medical Disease, 177,* 317-328. doi: 10.1097/00005053-198906000-00001

Baum, A., & Grunberg, N.E. (1991). Gender, stress, and health. *Health Psychology, 10,* 80-85.

Benishek, L.A., & Lopez, F.G. (1997). Critical evaluation of hardiness theory: Gender differences, perception of life events, and neuroticism. *Work and Stress: An International Journal of Work, Health, & Organizations, 11,* 33-45. doi: 10.1080/ 02678379708256820

Carver, C.S. (1989). How should multifaceted personality constructs be tested? Issues illustrated by self-monitoring, attribution, style, and hardiness. *Journal of Personality and Social Psychology, 56,* 577-585.

Cash, M.L., & Gardner, D. (2011). Cognitive hardiness, appraisal and coping: Comparing two transactional models. *Journal of Managerial Psychology, 26*, 646-664. doi: 10.1108/02683941111181752

Duckworth, A.L., & Quinn, P.D. (2009). Development and validation of the Short Grit Scale (Grit-S). *Journal of Personality Assessment, 91,* 166-174. doi: 10.1080/ 00223890802634290

Eschleman, K.J., Bowling, N.A., & Alarcon, G.M. (2010). A meta-analytic examination of hardiness. *International Journal of Stress Management, 17,* 277-307. doi: 10.1037/ a0020476

Florian, V., Mikulincer, M., & Taubman, O. (1995). Do hardiness contribute to mental health during a stressful real-life situation: The roles of appraisal and coping. *Journal of Personality and Social Psychology, 68,* 687-695.

Funk, S.C. (1992). Hardiness: A review of theory and research. *Health Psychology, 11,* 335-345. doi: 10.1037//0278-6133.11.5.335

Funk, S.C., & Houston, B.K. (1987). A critical analysis of the Hardiness Scale's validity and utility. *Journal of Personality and Social Psychology, 53*, 572-578.

Goss, J.D. (1994). Hardiness and mood disturbances in swimmers while overtraining. *Journal of Sport & Exercise Psychology, 16,* 135-149.

Hall, D.T. (1971). A theoretical model of career subidentity development in organizational settings. *Organizational Behavior and Human Performance, 6,* 50-76.

Hanton, S., Evans, L., & Neil, R. (2003). Hardiness and the competitive trait anxiety response. *Anxiety, Stress, and Coping, 16,* 167-184. doi: http://dx.doi.org/10.1080/10651580021000069416

Hu, L., & Bentler, P. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods, 3,* 424-453. doi: 0.1037//1082-989X.3.4.424

Kardum, I., Hudek-Knezevic, J., & Krapic, N. (2012). The structure of hardiness, its measurement invariance across gender and relationships with personality traits and mental health outcomes. *Psychological Topics, 21*(3)*,* 487-507.

Klag, S., & Bradley, G. (2004). The role of hardiness in stress and illness: An exploration of the effect of negative affectively and gender. *British Journal of Health Psychology*, *9*, 137-161. doi: 10.1348/135910704773891014

Kline, R.B. (1998). *Principles and practices of structural equation modeling.* New York, NY: Guilford.

Kobasa, S.C. (1979). Stressful life events, personality, and health: An inquiry into hardiness. *Journal of Personality and Social Psychology, 37,* 1-11.

Lancer, K. (2000). *Hardiness and Olympic women's synchronized swim team.* Paper presentation at University of Nevada, Las Vegas.

Maddi, S.R. (2002). The story of hardiness: Twenty years of theorizing, research, and practice. *Consulting Psychology Journal, 54,* 173-185. doi: 10.1037/1061-4087. 54.3.173

Maddi, S.R., & Hess, M. (1992). Hardiness and success in basketball. *International Journal of Sports Psychology, 23,* 360-368.

Madrigal, L., Hamill, S., & Gill, D.L. (2013). Mind over matter: The development of The Mental Toughness Scale (MTS). *The Sport Psychologist, 27,* 62-77.

Martens, R., Burton, D., Vealey, R.S., Bump, L.A., & Smith, D.E. (1990). Development and validation of the Competitive State Anxiety Inventory-2. In R. Martens, R.S. Vealey, & D. Burton (Eds.), *Competitive anxiety in sport* (pp. 117-190). Champaign, IL: Human Kinetics.

Martens, R., Vealey, R.S., & Burton, D. (1990). *Competitive anxiety in sport.* Champaign, IL: Human Kinetics.

Nicholls, A.R., Polman, R.C., Levy, A.R., & Backhouse, S.H. (2008). Mental toughness,

optimism, pessimism, and coping among athletes. *Personality and Individual Differences, 644,* 1182-1192. doi: 10.1016/j.paid.2007.11.011

Priyadarshini, S.K. (2009). A study on occupational stress and hardiness among BPO employees. *Social Science International, 25,* 34-45.

Ptacek, J.T., Smith, R.E., & Zanas, J. (1992). Gender, appraisal, and coping: A longitudinal analysis. *Journal of Personality, 60,* 747-770. doi: 10.1111/j.1467-6494.1992. tb00272.x

Schmitt, T.A. (2011). Current methodological considerations in exploratory and confirmatory factor analysis. *Journal of Psychoeducational Assessment*, *29*(4), 304-321.

Sinclair, R.R., & Tetrick, L.E. (2000). Implications of item wording for hardiness structure, relation with neuroticism, and stress buffering. *Journal of Research in Personality, 34,* 1-25. doi: 10.1006/jrpe.1999.2265

Stout, M. (2000). *The feel-good curriculum: The dumbing down of America's kids in the name of self-esteem.* Cambridge, MA: Perseus Publishing.

Tabachnick, B., & Fidell, L. (2007). *Using multivariate statistics 5th edition.* Boston, MA: Pearson Education Inc.

Taylor, K.M., & Pompa, J. (1990). An examination of the relationships among career decision-making self-efficacy, career salience, locus of control, and vocational indecision. *Journal of Vocational Behavior, 37,* 17-31.

Thomas, S., Reeves, C., & Agombar, J. (2013). Personality hardiness at different levels of competitive motorcycling. *Perceptual & Motor Skills: Exercise & Sport, 116,* 315-321. doi: 10.1080/1612197X.2010.9671940

Twenge, J.M. (2006). *Generation me: Why today's young Americans are more confident, assertive, entitled—and more miserable than ever before.* New York: Free Press.

Tziner, A. (1983). Choice and commitment to a military career. *Social Behavior and Personality, 11,* 119-128.

Watson, J.C., & Kissinger, D.B. (2007). Athletic participation and wellness: Implications for counseling college student-athletes, Some possible answers. *Personnel and Guidance Journal, 60,* 52-55.

Waysman, M., Schwarzwald, J., & Solomon, Z. (2001). Hardiness: An examination of its relationship with positive and negative long term changes following trauma. *Journal of Trauma Stress, 14,* 531-548. doi: 10.1023/B:JOTS.0000014671.27856.7e

Widamen, K.F., & Reise, S.P. (1997). Exploring the measurement invariance of psychological instruments: Applications in the substance abuse domain. In K.J. Bryant (Ed.), *Alcohol and substance abuse research* (pp. 281-324). Washington, DC: American Psychological Association.

Weibe, D.J., & Williams, P.G. (1992). Hardiness and health: A social psychophysiological perspective on stress and adaptation. *Journal of Social and Clinical Psychology, 11,* 238-262.

Provjera pouzdanosti, valjanosti i faktorske strukture skale DRS-15 na uzorku studenata sportaša

Sažetak

Iako je čvrstoća konstrukt koji objedinjuje osjećaje predanosti, kontrole i izazova, i najčešće je mjerena Upitnikom dispozicijske otpornosti (DRS), ne postoji puno istraživanja koja provjeravaju karakteristike skraćene verzije ove skale.

Cilj je ovoga istraživanja ispitati faktorsku strukturu, pouzdanost, valjanost i spolnu invarijantnost u funkcioniranju čestica skraćene skale DRS-15 na uzorku 525 studenata sportaša iz različitih sportova. Konvergentna i divergentna valjanost skale provjerena je u odnosu na mentalnu izdržljivost, ustrajnost i anksioznost u kompetitivnim situacijama. Ispitanici su ispunili upitnike koji mjere mentalnu izdržljivost, optimizam, ustrajnost, anksioznost u kompetitivnim situacijama i skalu DRS-15.

Konfirmatornom faktorskom analizom trofaktorske strukture nisu dobiveni zadovoljavajući indeksi slaganja. Naknadnom su eksploratornom faktorskom analizom dobivena četiri faktora, koja u konfirmatornoj analizi imaju bolje indekse slaganja u odnosu na trofaktorsku strukturu. Također, nekoliko čestica ne pokazuje invarijantnost s obzirom na spol. Četverofaktorska bi struktura mogla biti specifična za populaciju studenata sportaša i povezana s percepcijom nedostatka kontrole budućeg smjera života. Konvergentna i divergentna valjanost skale potvrđena je korelacijama skale DRS-15 i ostalih relevantnih mjernih instrumenata.

Potrebno je provjeriti četverofaktorsku strukturu skale na drugim uzorcima sportaša i nesportaša kako bi se utvrdila primjerenost korištenja ovih četiriju faktora na specifičnim uzorcima.

Ključne riječi: sportaši, studenti, validacija, spol, čvrstoća

Pruebas de fiabilidad, validez y estructura factorial de la escala DRS-15 en la muestra de estudiantes deportistas

Resumen

Aunque la resistencia es un constructo que consta de sentimientos de compromiso, control y desafío, y normalmente se mide por la Escala de resistencia disposicional (DRS), no hay muchas investigaciones que verifican características de versiones abreviadas de esta escala.

El objetivo de esta investigación es examinar la estructura factorial, fiabilidad, validez e invariancia de género en el funcionamiento de las partículas de la escala DRS-15 abreviada en la muestra de 525 estudiantes deportistas de deportes diferentes. La validez convergente y divergente de la escala se comprobó en relación con la resistencia mental, perseverancia y ansiedad en situaciones competitivas. Los encuestados rellenaron encuestas que medían la resistencia mental, optimismo, perseverancia, ansiedad en situaciones competitivas y escala DRS-15.

Con el análisis factorial confirmatorio de la estructura trifactorial no se han conseguido índices satisfactorios de concordancia. Gracias al análisis factorial exploratorio posterior se han obtenido cuatro factores que en el análisis confirmatorio tienen mejores índices de concordancia en comparación con la estructura trifactorial. Además, algunas partículas no muestran invariancia de género. La estructura de cuatro factores podría ser específica para la población de estudiantes deportistas y relacionada con la percepción de la falta del control de la futura dirección de la vida. Validez convergente y divergente de la escala se ha confirmado por las correlaciones de la escala DRS-15 y otros instrumentos de medida relevantes.

Es necesario averiguar la estructura de cuatro factores de la escala en otras muestras de deportistas y no deportistas para confirmar la conveniencia de utilizar estos cuatro factores en las muestras específicas.

Palabras claves: deportistas, estudiantes, convalidación, género, resistencia