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# Validity and reliability of the Connor-Davidson Resilience Scale (CD-RISC) in competitive sport

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ABSTRACT

*Objective:* This study replicates and extends the work of Gucciardi, Jackson, Coulter, and Mallett (2011) in relation to the validity of the Connor-Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003) in sport. Three primary aims were explored: 1) Examine the factor structure and fit of three versions of the CD-RISC: the original 25-item CD-RISC, both as a 25-item five factor scale and as a 25-item unidimensional scale, and the 10-item CD-RISC-10; 2) examine gender invariance of the best fitting version of the CD-RISC; and 3) examine the validity of the best fitting CD-RISC by relating it to affect and performance anxiety in a sample of competitive American distance runners (N = 409).
*Design:* Cross-sectional.
*Methods:* Multiple self-report questionnaires were delivered through an online medium.
*Results:* Using confirmatory factor and item level analyses, the CD-RISC-10-item scale was psychometrically superior to the unidimensional 25-item and the five factor 25-item CD-RISC versions. The CD-RISC-10-item exhibited measurement invariance for gender, with significant configural, strong, and weak analyses. Using structure equation modeling, the CD-RISC-10-item scale moderately and positively correlated with positive affect and was inversely related to negative affect and performance anxiety, establishing convergent and divergent validity.
*Conclusion:* The findings offer some initial psychometric evidence for the use of the CD-RISC-10 in sport performers.

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Psychological resilience, or the ability to experience adversity and adapt positively (Luthar & Cicchetti, 2000), has been identified as a desirable characteristic for athletes and coaches in sport (Fletcher & Sarkar, 2012; Galli & Vealey, 2008; Gucciardi, Jackson, Coulter, & Mallett, 2011; Hosseini & Besharat, 2010). Unfortunately, research involving resilience in the sport context is limited (Gucciardi et al., 2011; Sarkar & Fletcher, 2013). Despite these limitations, one scale that has recently gained attention in sporting contexts is the Connor Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003), which assesses resilient qualities of an individual. Sport psychology researchers have reported favorable psychometrics of a 10-item version of the CD-RISC (Gucciardi et al., 2011). Recognizing the need for a measure of resilience in sport, as well as the continued examination of the CD-RISC in sporting contexts, we aimed to further examine the validity, reliability and measurement invariance of both the 10 and 25-item the Connor Davidson Resilience Scale for sport use (Campbell-Sills & Stein, 2007; Connor & Davidson, 2003; Gucciardi et al., 2011).

## 1. Resilience in sport

Resilience is a highly desirable characteristic for athletes to have in sport given the stressors and challenges that they encounter (Fletcher & Sarkar, 2012; Galli & Gonzalez, 2015). Based on their findings, Fletcher and Sarkar recently defined psychological resilience as "the role of mental processes and behavior in promoting personal assets and protecting an individual from the potential negative effect of stressors" (2012, p. 675, 2013, p. 16) and conceptualized resilience as "the interactive influence of psychological characteristics within the context of the stress process"

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(2012, p. 675, 2013, p. 16). Resilience is thus conceptualized as a dynamic process rather than a rigid personality trait (Block & Block, 1980; Rutter, 1987) as previously thought. Although the process conceptualization of resilience is currently more accepted, Fletcher and Sarkar (2012) found support for both process and trait conceptualizations of resilience in the sport context. Both classic and contemporary conceptualizations of resilience support the idea and existence of pre-existing individual and socio-cultural resources (or protective factors) that help an individual combat or be protected from stressors (Galli & Gonzalez, 2015; Galli & Vealey, 2008; Sarkar & Fletcher, 2014a). For example, positive personality, motivation, confidence, and focus are individual factors and perceived social support is a socio-cultural protective factor that Olympic champions possess to help combat stress and adversity (Fletcher & Sarkar, 2012; Sarkar & Fletcher, 2014a). With the presence of protective factors and resources, individual have sources to draw mental strength from to overcome adversity.

## 2. Measuring resilience: The Connor Davidson Resilience Scale (CD-RISC)

The CD-RISC was developed using constructs shown previously to be related to resilience, such as hardiness (Kobasa, 1979), which is a dispositional form of resilience and characteristics derived from the presence of protective factors found in research on resilient individuals (Lyons, 1991; Rutter, 1985). Examples of such characteristics include self-efficacy, the strengthening effect of stress, close relationships to others, and an action oriented approach to situations (see Connor & Davidson, 2003 for detailed list). Items from the CD-RISC were tested in general and clinical populations, specifically individuals from a typical American community, primary care outpatients, general psychiatric outpatients, individuals with generalized anxiety disorders, and individuals with post-traumatic stress disorder (PTSD). Researchers examining the efficacy of resilience training have utilized the CD-RISC to trace resilience changes over time, supporting the validity of the instrument in an applied context (Davidson et al., 2005).

The 10-item version of the CD-RISC emerged from analyses conducted by Campbell-Sills and Stein (2007) while examining the psychometric structure of the original CD-RISC in multiple samples totaling over 1700 college students (74% female). Exploratory factor analyses (EFA) of the 25-item CD-RISC in two subsamples did not support the five factors originally proposed by Connor and Davidson. Several issues emerged, namely, inconsistent item loading across the EFAs, an item failed to load on a factor, a factor being defined by too few items, and factors being difficult to interpret because the items focused on more than one theme. This led the authors to examine shorter versions of the CD-RISC. What emerged was a unidimensional 10-item CD-RISC. A CFA analysis confirmed the construct validity of the 10-item CD-RISC, $\chi^2$ (35) = 176.10, $p < .001$, RMSEA = .050, 90% CI = .043–.057, CFit = .50, SRMR = .028, CFI = .97, and determinacy = .93 (p. 1025; Campbell-Sills & Stein, 2007). The 10-item CD-RISC exhibited adequate internal reliability ($\alpha = .85$). Concurrent validity was supported by the finding that resilience (measured with the 10-item CD-RISC) moderated the relationship between self-reported trauma and the expression of psychiatric symptoms. Participants rating themselves as higher in resilient qualities reported less symptomology. Campbell-Sills and Stein concluded, "… the 10-item CD-RISC measures a characteristic that differentiates individuals who are functioning well after adversity from those who are not" (p. 1026).

Further support for a shortened unidimensional version of the CD-RISC was found by Burns and Anstey (2010). The structural validity of the original 25-item five factor CD-RISC was examined by conducting a CFA in a population-based sample of 1775 young adults in Australia. Findings revealed a number of large modification indices, items that did not suitably differentiate the factors, a problematic GFI (.858) and a substantial amount of overlap between four of the five factors. The authors conducted further statistical analyses on a unidimensional CD-RISC by using an EFA with an oblique Direct Oblimin rotation with Parallel Analysis to allow any emerging factors to correlate with one another. The results of the EFA revealed that most items loaded on a single dimension, supporting the findings Campbell-Sills and Stein (2007); however, using Parallel Analysis to extract factors and noticing a lower than desired General Fit Index (GFI), Burns and Anstey settled on a slightly longer 22-item CD-RISC. Overall, the authors concluded that the two unidimensional versions of the CD-RISC were comparable and that the brevity of the 10-item version (Campbell-Sills & Stein, 2007) may be appealing to researchers.

## 3. Measuring resilience in sport with the CD-RISC

To date, there is not a specific measure of resilience developed for the sport context, nor does a measure exist that assesses resilience as a process of positive adaptation following adversity. Although several resilience measures exist in general psychology, only the CD-RISC has received attention in sport. The CD-RISC measures "personal resources or qualities deemed appropriate for positive adaption to adversity" (p. 424; Gucciardi et al., 2011). Thus, the CD-RISC assesses personal protective resources (i.e., trait-like characteristics or qualities) and not necessarily the process of resilience.

Hosseini and Besharat (2010) were the first to use the original 25-item CD-RISC in a sport context. In a sample of 139 ($n = 96$ male and $n = 43$ female) Iranian athletes, the CD-RISC was used to differentiate athletes on psychological well-being and performance. Athletes with more self-reported resilient qualities had better psychological well-being and performances than athletes with less resilience. The authors did not explore the psychometrics of the scale outside of calculating Cronbach's alpha, which was reported to be sufficient (no numerical value was provided). Hosseini and Besharat's work should be interpreted with caution, given the lack of statistical reporting on the CD-RISC.

In the only psychometric study of the CD-RISC in sport to date, Gucciardi et al. (2011) examined the original 25-item CD-RISC (both as a five dimensional scale and a unidimensional 25-item scale), the 22-item scale recommended by Burns and Anstey (2010), and Campbell-Sills and Stein's 10-item CD-RISC in a sample of adult ($n = 321$) and youth ($n = 199$) male and female Australian cricket athletes. Using CFAs, age variance testing, and convergent and divergent validity assessments, the 10-item version of the CD-RISC (Campbell-Sills & Stein, 2007) was deemed the best instrument for use with athletes. Specifically, the 10-item CD-RISC had better item level statistics and factor structure than all other CD-RISC versions for both adult, $\chi^2$ (35) = 80.10, $p = .001$, RMSEA = .063, 90% CI = .045–.082, CFI = .947, TLI = .932, IFI = .947, and adolescents, $\chi^2$ (35) = 61.34, $p = .001$, RMSEA = .062, 90% CI = .035–.087, CFI = .948, TLI = .934, IFI = .949 (p. 6). The original 25-item, five factor and the unidimensional 22-item CD-RISCs had poor model fit and exhibited poor item level analyses across adults and adolescents. These findings echo previous concerns about CD-RISC, namely poor clarity and labeling of the five factors and the use of an orthogonal rotation in the original EFA (Ahern, Kiehl, Sole, & Byers, 2006). In summary, the 10-item unidimensional CD-RISC was the only version of the CD-RISC that emerged as a reliable and valid measure of resilient qualities in a sport population.

Gucciardi et al.'s (2011) study offered some initial psychometric evidence for the use of the measure in sport performers. However, more research is needed to further support the use of the CD-RISC

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