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The Challenge of the Umpire’s Chair: Challenge and threat, self-efficacy, and psychological
resilience in Australian tennis officials.

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Abstract

1
2 Sports officials are often under stress and pressure when they are officiating. In this novel
3 study of Australian tennis officials, the aim was to investigate challenge and threat appraisals,
4 self-efficacy, sources of self-efficacy and psychological resilience in a cross-section of 140
5 Australian tennis officials. There were 95 males and 45 females with a mean age of 49.9
6 years (SD = 16.15) involved in the study. Participants completed the Connor-Davidson
7 Resilience Scale-10 (CD-RISC10); the Challenge Appraisal Scale (CAS); a modified version
8 of the Referee Self-Efficacy Scale (REFS); and the Sports Officials Self-Rating Scale. Two
9 hierarchical regression analyses were used to examine the extent to which self-efficacy and
10 challenge and threat appraisals were related to psychological resilience, and to examine
11 which sources of self-efficacy predicted self-efficacy. Age, gender, years officiating,
12 officiating role and number of tournaments officiated within the previous 12 months, were
13 controlled for in both analyses. The results revealed that a challenge appraisal and higher
14 self-efficacy significantly predicted psychological resilience. While higher self-efficacy was
15 significantly predicted by number of tournaments officiated and greater perceptions of
16 physical and mental preparation. To develop official's self-efficacy, challenge appraisals and
17 psychological resilience, practical strategies and skills (e.g., reappraisal, imagery, quiet eye
18 training) could be taught to officials when they undertake their initial training or any
19 subsequent courses or workshops.

20 *Keywords:* Sports officials, challenge and threat appraisals, officiating performance, referee
21 self-confidence, resilience training,

1 Sport officials play an important role in providing structured sport opportunities for athletes
2 from grassroots to elite levels (Livingston & Forbes, 2017). They are required to maintain
3 order and adjudicate sports contests (Tingle et al., 2014) in varied environments (Livingston
4 & Forbes, 2016), and at an elite level are under intense scrutiny as officials (Hill et al., 2016).
5 Sport psychology research concerning psychological resilience has centred mainly on athletes
6 (e.g., Fletcher & Sarkar, 2013) and to a lesser extent coaches (e.g., Hodgson et al., 2017).
7 Psychological resilience can be defined as “the role of mental processes and behaviour in
8 promoting personal assets and protecting an individual from the potential negative effect of
9 stressors” (Fletcher & Sarkar, 2012, p. 675). It could be argued that sports officials are
10 performers, similar to coaches and athletes, as they are expected to execute skills under
11 pressure, often in front of an audience (Hill et al., 2016), make accurate decisions (Pizzera &
12 Raab, 2012), communicate assertively (MacMahon & Plessner, 2008), deal with criticism
13 (Anderson & Pierce, 2009) from coaches, athletes, spectators, and commentators
14 (VanYperen, 1998), and keep order and solve disputes (Tuero et al., 2002). In addition,
15 officials are expected to perform at a higher standard than an athlete (Lirgg et al., 2016). Yet
16 there has been very little research directed at sports officials (Livingston & Forbes, 2017),
17 and to the authors’ knowledge, no known study has examined the antecedents of
18 psychological resilience in officials.

19 Furthermore, there is a global shortage of sports officials (Warne et al., 2013).
20 Brackenridge et al. (2011) found that 17% of football referees had stopped officiating
21 between the 2007/08 and 2008/09 seasons. One reason for the decline could be the stress
22 associated with officiating (Webb et al., 2018, 2020). Officials report threats of harm and
23 verbal abuse from coaches, players, and spectators (Webb, 2020), and officials report being
24 afraid to make mistakes (Goldsmith & Williams, 1992), which has been linked to stress (e.g.,
25 Voight, 2009) and burnout (e.g., Taylor et al., 1990). There is a need to examine the factors

1 that determine psychological resilience in officials, in order to recommend ways in which
2 officials can deal with the myriad stressors that punctuate officiating. The study of
3 psychological resilience seeks to understand why some individuals can withstand and even
4 thrive on the pressure they experience in their lives (Sarkar & Fletcher, 2014). Further,
5 people with higher resilience adapt more successfully to stressful events than do those with
6 lower resilience (Luthar, 2006). Two studies have been conducted with sporting officials and
7 resilience. Specifically, Livingston and Forbes (2016) investigated what motivated 1073
8 Canadian officials to enter and remain active in officiating, their resilience, and the perceived
9 support from their sporting organisation. While Livingston and Forbes (2017) examined
10 resilience in 62 females and 12 males who officiated in aesthetic sports. In both studies, the
11 researchers found that the officials scored highly in resilience. While these two studies
12 measured resilience, they did not examine the factors that may be involved in facilitating
13 resilience in sporting officials, and in both studies' Canadian officials from a range of sports
14 were recruited, rather than from a specific sport as is the case in the current study.

15 There are a number of definitions of resilience. For example, Solomon and Becker
16 (2004) suggest that resilient athletes (could also potentially relate to sports officials) are able
17 to overcome setbacks, remain confident, and stay focused on the present. Others define
18 resilience as “the ability to bounce back from the variety of challenges that can arise in life”
19 (Scali et al., 2012), or the ability to use personal qualities to withstand pressure (Fletcher &
20 Sarkar, 2016). As part of the concept of resilience, there is a notion that a “challenge
21 mindset” (Fletcher & Sarkar, 2016) or “challenge appraisal” (Fletcher & Sarkar, 2012) is
22 important for greater resilience. What is clear across the variety of definitions and
23 conceptualisations of resilience, is that various factors feed into resilience, most prominently
24 self-confidence (or self-efficacy), control and attention (and self) regulation, and a challenge
25 appraisal. Indeed, in Fletcher and Sarkar’s (2012) grounded theory of resilience, the

1 processes that determine resilience are similar to that which determine a challenge state in
2 Jones et al.'s (2009) theory of challenge and threat states in athletes (TCTSA). Both include
3 motivation, confidence, personality, self-regulation, adaptive responses (including facilitative
4 interpretation of emotions), and optimal performance. Fletcher and Sarkar (2012) include
5 perceived social support, whilst Jones et al. (2009) do not, but the reconceptualised TCTSA
6 (the TCTSA-R; Meijen et al., 2020) includes social support. As Fletcher and Sarkar (2016)
7 state, "the ability to evoke and maintain a challenge mindset is of crucial importance in
8 developing resilience" (p. 144).

9 Therefore, challenge as conceptualised in the TCTSA (and TCTSA-R), and resilience
10 as conceptualised in the grounded theory of resilience, share more similarities than
11 differences, specifically they both include confidence, personality, adaptive responses, and
12 optimal performance. This alignment is captured somewhat in Turner and Barker's (2013)
13 view of resilience, who state, "greater resilience is evidenced by the exhibition of a challenge
14 state, and potentially positive (or less negative) outcomes (e.g., intended skill or tactical
15 execution), during performance situations" (p. 624). The idea that challenge appraisal
16 (synonymous with a challenge state and a challenge mindset) is important for resilience
17 emanates in part from the work of Seery (2011) who suggested that through stressful
18 experiences, athletes (and potentially sports officials) can adapt to future stressors, thus
19 demonstrating resilience. Seery (2011) goes onto outline that resilience should be greater in
20 those who have some history of pressure or stress compared to those with "a history of no
21 lifetime adversity or a high level of adversity" (Seery, 2011, p. 1608). This is reinforced by
22 Moore et al. (2018) who found that athletes who had encountered a moderate (3-13) number
23 of adverse life events performed better in a pressured task than those who had encountered a
24 lower (<3) or higher (>13) number of adverse life events.

1 So, one important marker of resilience might be the propensity to exhibit a challenge
2 state (e.g., Turner & Barker, 2013), an adaptive psychophysiological response to a stressor
3 (Seery, 2011; Turner et al., 2014). A challenge state is characterised as an “evaluation that
4 one’s personal coping resources match or exceed situational demands” (Hase et al., 2019, p.
5 124), and occurs when “an individual feels confident about mastering situational demands”
6 (Turner & Jones, 2014, p. 89). In contrast, a threat state is considered maladaptive and occurs
7 when an individual perceives the demands as exceeding their resources (Lazarus & Folkman,
8 1984), and therefore perceives being in danger (Blascovich & Mendes, 2000).

9 The aforementioned TCTSA-R (Meijen et al., 2020) has as its foundation the notion
10 of cognitive appraisal, which arises as a consequence of perceiving that one’s personal
11 resources are sufficient to meet perceived situational demands. In the TCTSA-R, resources
12 comprise three interrelated constructs of achievement goals, perceptions of control, and self-
13 efficacy. Achievement goals are closely linked to the individual’s motivation to participate in
14 sport (Meijen et al., 2020), while control is linked to self-efficacy and includes acceptance of
15 factors within and outside an individual’s personal control (Jones et al., 2009). Research
16 concerning challenge and threat appraisals and performance has been undertaken in domains
17 such as academia (Seery et al., 2010), sport (Dixon et al., 2020), and simulated surgery (Vine
18 et al., 2013). Research supports the notion that a challenge state is adaptive for athletic
19 performance whilst threat is harmful for performance (Behnke & Kaczmarek, 2018).

20 Self-efficacy is considered to be the chief resource that contributes to a challenge state
21 and indeed it appears in all major theories of challenge and threat appraisals (Jones et al.,
22 2009), and has been demonstrated to predict superior athletic performance under pressure
23 despite physiological threat reactivity (Turner et al., 2013). Self-efficacy is the belief that one
24 has the means and ability to perform a specific task (Bandura, 1997). Both experimental
25 (Turner et al., 2014) and intervention (Williams et al., 2010) research, alongside theoretical

1 postulations (Turner & Barker, 2013) indicates a close connection between self-efficacy and
2 challenge. In contrast, self-efficacy has also been found to be negatively associated with
3 threat (Meijen et al., 2014). Further, Turner et al. (2013) found that cricketers even in a threat
4 state, had better performance when they had high self-efficacy, which indicates some
5 disjunction between self-efficacy and challenge and threat appraisals. The mixed evidence
6 linking self-efficacy and challenge and threat warrants further research.

7 Self-efficacy is not just relevant to challenge and threat appraisals, and resilience,
8 there is rich and deep literature attesting to the adaptive effects of high self-efficacy in sport.
9 Regarding sporting officials, referee self-efficacy is defined as the extent to which referees
10 believe they have the adequate capacity to perform successfully (Guillén & Feltz, 2011).
11 TCTSA predictions would suggest that an official who believes that they are able to cope
12 with the demands of the situation and have the skills to perform successful will experience a
13 challenge state (cf. Jones et al., 2009). Not only is self-efficacy considered to be crucial for a
14 challenge state, but is also important in the development of psychological resilience, with,
15 higher levels of self-efficacy closely related to an increase in an individual's resilience (Lee et
16 al., 2013). The benefits of referee's having high self-efficacy include increased commitment
17 to their job (Tojjari et al., 2013) and a positive impact on decision making performance
18 (Hepler & Feltz, 2012). It has been argued that those with high self-efficacy can focus on
19 tasks at hand and produce more effort in comparison to people with low self-efficacy, who
20 may be anxious and divert attention from possible solutions (Spence, 2015). Further, high
21 self-efficacy not only yields better performance, but efficacious individuals are less afraid to
22 set challenging goals and persevere through failure (Feltz et al., 2008). They are also more
23 likely to cope better in adverse situations (Park & Folkman, 1997), and can boost referees'
24 confidence in performing their tasks (Nazarudin et al., 2014). In comparison, lack of efficacy
25 can lead to lapses in attention, errors in judgment, delayed reactions, stress and burnout

1 (Guillén & Feltz, 2011). In regard to sport specific research, self-efficacy has been examined
2 in athletes (Kingston et al., 2010), and coaches (Hilland et al., 2012), but few studies have
3 been conducted concerning sporting officials' self-efficacy, and therefore it is unclear as to
4 what factors determined official's self-efficacy. Myers et al. (2012) developed the Referee
5 Self-Efficacy Scale (REFS) to measure the self-efficacy of officials. Further, the Sports
6 Officials Self-Rating Scale (SOSRS) was developed by Guillén and Feltz (2011) revealing
7 six sources of self-efficacy; social support, physical or mental preparation, environmental
8 comfort, situational favourableness, past accomplishments, and vicarious experience. The
9 REFS and SOSRS indicate that the self-efficacy of officials may be determined by role-
10 specific factors, but broadly, aligns with dominant theory.

11 Owing to the apparent conceptual convergence of challenge and threat appraisals, and
12 resilience, seemingly underpinned in part by self-efficacy, the current study investigates these
13 important psychological constructs in a cohort of officials, for the first time in literature.
14 Indeed, the factors that determine challenge and resilience are equally applicable to officials
15 as they are to athletes. However, resilience in officials is an important and underexplored
16 research area with a dearth of literature to draw upon. Understanding what factors predict
17 psychological resilience in sporting officials may provide some valuable recommendations
18 for retention, wellbeing, and performance, of this population. The current study aimed to
19 examine the antecedents of psychological resilience in Australian tennis officials. Examining
20 challenge and threat appraisals, and self-efficacy as potential antecedents to official
21 psychological resilience represents a step forward in the study of resilience in officials. Based
22 on theory and past research, it is hypothesized that greater challenge appraisals and self-
23 efficacy will predict greater psychological resilience, whilst greater threat will predict lower
24 psychological resilience. As a secondary aim, we investigated the sources of self-efficacy to
25 enable a greater understanding of the factors that determine self-efficacy in tennis officials.

1 **Methods**

2 **Participants**

3 The analysis was based off multiple linear regression, with a medium effect size (f^2)
4 of .15, an alpha of .05, a standard power level of .80, and a total of six predictors. The results
5 of the power analysis showed that a minimum of 98 participants would be needed for an
6 appropriate power level.

7 The average age of the officials participating was 49.9 years and had a mean
8 officiating experience of 10.49 years. There were 95 (67.9%) males and 45 (32.1%) females
9 involved. 42 of the participants coached tennis for an average of 10.17 years, and 126 of the
10 participants had played tennis for an average of 32.21 years. Of the officials who completed
11 the questionnaire, 78 (55.71%) viewed being a lines person as their primary tennis officiating
12 role, 10 (7.14%) viewed chair umpiring as their primary tennis officiating role, 23 (16.43%)
13 viewed their primary role as being a referee, and 29 (20.71%) viewed their primary role as a
14 court supervisor. The officials had officiated at 11.07 tournaments in the previous 12 months.
15 Before conducting this study, ethics approval was obtained from both Staffordshire
16 University and Tennis Australia. Participants were recruited via email which was sent from
17 Tennis Australia to their database of officials. The email provided a link to the questionnaire
18 and the link was open for two weeks (27th August 2018 to 9th September 2018) for officials to
19 complete. 600 tennis officials received the email, with 140 completing the questionnaire
20 indicating a return rate of 23.33%.

21 **Measures**

22 Quantitative data was collected using a multifaceted survey tool built on the
23 SurveyMonkey (TM) web-based platform. The data was exported to excel and then SPSS 25.
24 In addition to completing a demographic questionnaire, and a series of open-ended questions

1 about their officiating experiences, participants responded to four instruments with known
2 reliability and validity characteristics.

3 **Psychological resilience.** The Connor-Davidson Resilience Scale-10 (CD-RISC10:
4 Campbell-Sills & Stein, 2007) is an abbreviated version of the Connor-Davidson Resilience
5 Scale. It is a self-rated measure of resilience and adaptability, where resilience is defined as
6 "a measure of stress coping ability" (Connor & Davidson, 2003, p. 76). The instrument
7 requires responses to ten statements (i.e., "I am able to adapt to change") using a five point
8 Likert-scale ranging from 1 (*Not true at all*) to 5 (*True nearly all the time*) which are used to
9 calculate a single overall score through totaling the score on each item. The CD-RISC10 has
10 been shown to be valid and to have high internal reliability (Gonzalez et al., 2016), and has
11 been deemed to be the best instrument for use with athletes (Gonzalez et al., 2016). In the
12 current research, considering the entire sample, the total mean score was 31.82 ($SD = 4.86$),
13 which is comparable to American post-collegiate distance runners who had a mean of 31.1
14 (Gonzalez et al., 2016), and an Australian population of experienced paramedics (Gayton &
15 Lovell, 2012) who had a mean score of 30.1. The CD-RISC10 in the current study achieved a
16 Cronbach's alpha reliability of .85.

17 **Challenge and threat.** Challenge and threat appraisals were measured using the
18 Cognitive Appraisal Scale (CAS; Skinner & Brewer, 2002). The CAS is an 18-item Likert-
19 type scale in which item responses range from 1 (*strongly disagree*) to 6 (*strongly agree*) and
20 participants were asked to indicate the extent to which they agreed with each statement. Eight
21 items make up the Challenge subscale (e.g., "I tend to focus on the positive aspects of any
22 situation"). Ten items make up the Threat subscale (e.g., "I am concerned that others will find
23 fault with me"). The Challenge appraisal subscale had a Cronbach's alpha coefficient of .74,
24 whereas, the Threat appraisal subscale had an alpha coefficient of .92.

1 **Self-efficacy.** Referee Self-Efficacy Scale (REFS) measures the extent to which a
2 referee believes that they have the ability to successfully officiate a competition (Myers et al.,
3 2012). The REFS consists of 13 items, and the stem for all items is “in the context of
4 performing your tennis officiating role, how confident are you in your ability to...”. Each
5 items relates to one or more factors of referee self-efficacy: game knowledge (5 items:
6 confidence in knowledge of their sport, including rules, officiating mechanics, and basic
7 game strategy), decision making (5 items: confidence that referees have in their ability to
8 quickly and firmly make decisions during competition), pressure (5 items: confidence that
9 referees have in their ability to be uninfluenced by pressure from players, spectators, and
10 coaches), and communication (7 items: confidence that referees have in their ability to
11 communicate effectively with other referees, coaches, players, and auxiliary personnel). The
12 Total REFS was calculated by summing all 13 items. Previous research (e.g., Cunningham &
13 Sullivan, 2020; Karacum & Adiguzel, 2019) has found the REFS to be valid and reliable, for
14 example, Karacum and Adiguzel (2019) in a study on basketball referees, as a result of CFA
15 analysis, $\chi^2/sd = 1.96$, RMSEA = .06, CFI = .94, GFI = .95, RMR = .01. Myers et al. (2012)
16 showed support for the sources of referee self-efficacy as significant predictors of the four
17 dimensions of REFS. While the REFS has been used predominantly with football (soccer)
18 referees, to adapt the REFS for tennis officials, six items were modified slightly to reflect
19 officiating in tennis. For example, question 4 was modified from “communicate effectively
20 with partner” to “communicate effectively with other on-court officials”. Items have been
21 modified in previous research to suit the sport (e.g. Spencer, 2015). High scores that are
22 obtained for each factor of the scale indicate high self-efficacy in the factor. Many of the
23 items relate to more than one of the factors, for example, “make critical decisions during
24 competition” related to communication, pressure, and decision-making. Reliability
25 (Cronbach’s Alpha) for the Total REFS was .88. Reliability for game knowledge was .85; .70

1 for pressure, .86 for decision-making, and .89 for communication. Note, participants in the
2 study completed the original 39-item REFS, however, on consultation with an author of the
3 original scale, they suggested to use only the 13-item REFS which can be collected from the
4 original 39-item REFS.

5 **Sources of self-efficacy.** The Sports Officials Self-Rating Scale (Guillén & Feltz,
6 2011), modified from the Sources of Sport Confidence Scale (Vealey et al., 1998), was used
7 to evaluate sources of self-efficacy in the participating officials. Officials are asked to
8 indicate how important various events are in giving them confidence in officiating their sport.
9 The measure has 25 items on a 7-point scale. The stem for all items is “I gain confidence in
10 officiating when I...” The 7-point scale ranges from 1 (*Not at all important*) to 7 (*Of highest*
11 *importance*). Each item relates to one of six sources of self-efficacy: social support, physical
12 or mental preparation, environmental comfort, situational favourableness, past
13 accomplishments, and vicarious experience. Eleven questions were modified to be suitable
14 for tennis officials. Specifically, ‘tennis’ was added before ‘officials’ in four questions, for
15 example, “I know I have support from other officials in my sport” to “I know I have support
16 from other tennis officials in my sport”. The reliability (Cronbach’s Alpha) for the Sports
17 Officials Self-Rating Scale was .93. Reliability for the subscales were: .88 for social support,
18 .91 for environmental comfort, .68 for situational favourableness, .92 for vicarious
19 experiences, .83 for physical and mental preparation, and .80 for past accomplishments. With
20 an acceptable level of .70 (Bland & Altman, 1997).

21 **Data Analysis**

22 The analysis of the data was conducted using SPSS 25. To test the assumption of
23 normality, skewness and kurtosis values for each variable were assessed; all of the factors
24 were within acceptable levels. Therefore, reasonable assumptions about normality could be
25 established.

1 Main analyses were conducted in two stages. First, a hierarchical linear multiple
2 regression analysis was used to examine the extent to which challenge and threat appraisals,
3 and self-efficacy, predicted psychological resilience, after controlling for age, gender,
4 officiating role, number of tournaments officiated within the previous 12 months and years
5 officiating. Specifically, age, gender, years officiating, officiating role and number of
6 tournaments officiated within the previous 12 months were entered in the first step of the
7 analyses, whereas in the second step of the analyses, challenge and threat appraisals were
8 entered. Finally, in the third step, self-efficacy (REFS) was entered. Second, a hierarchical
9 linear multiple regression analysis was used to examine the extent to which the six sources of
10 self-efficacy (e.g., social support, environmental comfort etc.) predicted self-efficacy, after
11 controlling for age, gender, years officiating, officiating role and number of tournaments
12 officiated within the previous 12 months. Specifically, age, gender, years officiating,
13 officiating role and number of tournaments officiated within the previous 12 months were
14 entered at step one, in step 2, the six sources of the REFS were entered. Preliminary analyses
15 were conducted to ensure no violation of the assumptions of normality, linearity,
16 multicollinearity, and homoscedasticity. The alpha level used for both regression analyses
17 was set at .05.

18 **Results**

19 Correlations and descriptive statistics are displayed in Table 1. Positive correlations
20 were shown for resilience and self-efficacy, challenge appraisals, age, and physical and
21 mental preparation. Negative correlation occurred between resilience and threat appraisal. For
22 self-efficacy, positive correlations occurred with challenge appraisal, physical and mental
23 preparation, age, and years officiating, with a negative correlation with threat appraisal.

24 **Predicting psychological resilience**

1 Hierarchical regression analysis (Table 2) revealed that age in Model 1 significantly
2 predicted psychological resilience ($\Delta R^2 = .07$). In Model 2, challenge appraisal and threat
3 appraisal were significant predictors of psychological resilience ($\Delta R^2 = .3$). In Model 3, with
4 the addition of self-efficacy (Total REFS), challenge appraisal, threat appraisal and self-
5 efficacy were significant predictors of psychological resilience ($\Delta R^2 = .03$). That is, greater
6 challenge and self-efficacy, and lower threat, were related to greater psychological resilience.

7 **Predicting self-efficacy**

8 Hierarchical regression analysis (Table 3) revealed that age in Model 1 significantly
9 predicted self-efficacy in officials ($\Delta R^2 = .10$). In Model 2, age, number of tournaments
10 officiated at in the past 12 months, and physical and mental preparation significantly
11 predicted self-efficacy ($\Delta R^2 = .12$). That is, greater physical and mental preparation and more
12 tournaments officiated were related to greater self-efficacy.

13 **Discussion**

14 If resilience does indeed reflect the ability to use personal qualities to withstand
15 pressure (e.g., Sarkar & Fletcher, 2014), then antecedents to resilience should be greater
16 challenge and lesser threat (Turner & Barker, 2013), and greater self-efficacy (Lee et al.,
17 2013); constructs that have been shown in research (e.g., Behnke & Kaczmarek, 2018) to
18 underpin superior performance under pressure. Thus, in the current paper we sought to
19 examine the extent to which challenge and threat, and self-efficacy offer antecedents to
20 resilience in Australian tennis officials. In line with resilience conceptualising (Fletcher &
21 Sarkar, 2012) and challenge and threat theorising (TCTSA-R; Meijen et al., 2020; Turner &
22 Barker, 2013), it was hypothesized that greater challenge appraisals and self-efficacy, and
23 lower threat appraisals, would predict greater psychological resilience. In addition, given the
24 novel nature of a study examining self-efficacy in officials, we investigated the sources of
25 self-efficacy in officials. Wolfson and Neave (2007) portrayed soccer officials as confident

1 and resilient, but they did not explicitly measure self-efficacy or psychological resilience. The
2 current study is unique, in that it investigates challenge and threat, and psychological
3 resilience, in officials for the first time in research. As well as making advancement in the
4 study of officials, the explicit examination of challenge and threat states in relation to
5 psychological resilience reflects a test of recent theoretical conceptualisations in both
6 resilience (Fletcher & Sarkar, 2016) and challenge and threat (Seery, 2011; Turner & Barker,
7 2013).

8 Hierarchical linear regression analyses revealed that psychological resilience was
9 most powerfully predicted in sporting officials through challenge appraisals (positively),
10 threat appraisals (negatively), and self-efficacy (positively). Specifically, greater challenge,
11 and lesser threat, was related to greater psychological resilience. In addition, greater self-
12 efficacy was associated with greater psychological resilience. These findings support the
13 postulations of the TCTSA-R whereby challenge appraisals, including self-efficacy, are
14 considered to be more adaptive than threat appraisals (Meijen et al., 2020), and supports the
15 notion that challenge states are important for resilience (Fletcher & Sarkar, 2012; Seery,
16 2011; Turner & Barker, 2013).

17 Specifically, as proposed in prominent resilience and challenge and threat literature
18 pertaining to sport, self-efficacy appears to be particularly salient for resilience and challenge.
19 Given that self-efficacy is an individual's belief in their capacity to achieve a specific
20 performance (Bandura, 1997), and believing that one may be successful is likely to increase
21 the chances of exhibiting a challenge state (Jones et al., 2009; Turner & Barker, 2013),
22 through opportunities for mastery, success, learning and personal growth (Skinner & Brewer,
23 2004), it is important to develop self-efficacy in officials to assist them in appraising stressful
24 situations as a challenge. This proclivity to appraise stressors as a challenge is either part of
25 the resilience process (e.g., Fletcher & Sarkar, 2012), or is akin to resilience itself (e.g.,

1 Turner & Barker, 2013; Turner & Jones, 2014), but either way, self-efficacy is paramount
2 (Turner et al., 2013). Thus, those who work with and develop sports officials could encourage
3 officials to reflect on their previous successful performances, engage in efficacy enhancing
4 imaginal experiences, and adopt physical and mental preparation with a view to enhancing
5 challenge appraisals (e.g., Williams et al., 2010).

6 In addition, based on Seery's (2011) notion of resilience, multiple experiences of
7 coping successfully under pressure could abet self-efficacy for similar situations in the future,
8 thus promoting a challenge appraisal, with subsequent increases in resilience expected. This
9 highlights the importance of carefully exposing officials to systemic stressors in order that
10 "they acclimatise to the experience of stress and develop or learn personal and often implicit
11 resources for performing under pressured conditions" (Turner & Barker, 2013, p. 626). This
12 is reinforced by Fletcher and Sarkar (2016) who report the importance of a facilitative
13 environment to develop resilience. Although the results of the present study are in line with
14 some past research, it is important to state that most past research recruited athletes or
15 undergraduate students as participants, rather than officials.

16 As hypothesised, self-efficacy was positively associated with psychological resilience
17 in the sample of tennis officials. According to Aydogdu et al. (2017) "self-efficacy can
18 prompt considerable change in the power of an individual's qualities and thus the ability to
19 change his or her resilience mechanism" (p. 39). This is reinforced by previous non-sport
20 specific research. For example, Schwarzer and Hallum (2008) found that German teachers
21 high in self-efficacy were less likely to report symptoms of job burnout. In regard to sport
22 specific research, confidence was deemed to be a particularly important factor underpinning
23 the resilience-stress-performance relationship in Olympic champions (Fletcher & Sarkar,
24 2012). The secondary aim of the present study was to investigate the sources of self-efficacy
25 in officials. The self-efficacy findings in the present study supports past research and theory,

1 but we also investigated the antecedents to this self-efficacy in the tennis officials. It was
2 revealed that physical and mental preparation, along with age and number of tournaments
3 officiated within the last 12 months, significantly predicted self-efficacy. Specifically, greater
4 perceptions of physical and mental preparation, a higher age, and number of tournaments
5 officiated within the previous 12 months, were all significantly related to greater self-
6 efficacy.

7 Based on these results, it is important for tennis officials to consider themselves both
8 physically and mentally prepared. This includes having goals for the game, regulating
9 arousal, using imagery to see self-performing well, using self-talk, and having self-belief that
10 the official is ready to give maximum effort (Guillén, & Feltz, 2011). According to Spencer
11 (2015), the best way to practice is to simply referee more matches, that is, have mastery
12 experiences, whereby an individual is deriving confidence from mastering or improving
13 skills. This is reinforced by Pizzera and Raab (2012) who suggested that experience playing
14 or watching the game may be helpful. The notion that experience is important for officiating
15 self-efficacy is corroborated in the current study. In predicting self-efficacy, age in years and
16 number of tournaments officiated within the previous 12 months was significantly and
17 positively related to self-efficacy. This suggests that older tennis officials had stronger levels
18 of self-efficacy, reinforcing previous research (Karaçam & Pular, 2017). The importance of
19 past experience has been noted in previous challenge and threat research, and recently Turner
20 et al. (2020) found that the strongest predictor of netball trials performance was the number
21 of past trials the netball athletes had previously attended.

22 According to Anshel and Weinberg (1999), a primary role of psychologists is to assist
23 all sports participants to manage their stress and improve their coping skills. The same can be
24 said for working with sporting officials. Previous research has provided recommendations to
25 enhance sporting official's confidence and strategies to deal with stress on the sporting field.

1 For example, Wolfson and Neave (2007) recommended a number of strategies to reduce
2 stress, such as having support systems to allow officials to talk, and train with each other.
3 Further, education on psychological strategies and skills could be taught to tennis officials
4 when they undertake their initial training or any subsequent courses or workshops, this is
5 highlighted by Voight (2009) who stated “official’s associations should be more proactive in
6 teaching more than the laws of the game and the mechanics of officiating in their training
7 courses” (p. 100). For example, officials could learn about psychological skills, including
8 developing self-efficacy and psychological resilience, relaxation, concentration strategies,
9 and pre-match routines, much like the psychological preparation program Blumenstein and
10 Orbach (2014) undertook within a football program. Likewise, officials could use imagery to
11 learn from mistakes by “mentally replaying and analysing them and imagining how a
12 different behaviour might have represented a more appropriate decision” (Wolfson & Neave,
13 2007, p. 242). With regard to developing strategies to enhance psychological resilience, there
14 are a number of protective factors that have been linked to coping with adversity in sport.
15 These include, having a positive personality, which embraces optimism, adaptive
16 perfectionism, hope and proactivity, along with motivation, self-confidence, focus and
17 concentration, perceived social support (Fletcher & Sarkar, 2012; 2014; Galli & Vealey,
18 2008), and adopting rational beliefs (Deen et al., 2017; Turner, 2016a). Sporting officials
19 could be encouraged to appraise pressure as a challenge, rather than a threat, with the current
20 findings supporting this.

21 There are a variety of methods that can be used to facilitate officials’ psychological
22 resilience through challenge appraisal (see Turner & Barker, 2014; Turner & Jones, 2014;
23 Turner & Jones, 2018). For example, coaches who are supporting officials could use
24 challenge-framed language prior to imminent pressure situations to encourage officials to
25 bolster their self-efficacy, perceptions of control, and approach focus, whilst retaining the

1 important and meaningfulness of the event (Turner et al., 2014). Officials could also develop
2 their ability to apply cognitive reappraisal (Gross, 2014), which is the most researched and
3 demonstrably effective emotion regulation strategy (Boehme et al., 2019). Officials could be
4 encouraged to understand that their thoughts are important for their emotions and could be
5 encouraged to weaken irrational beliefs and develop rational beliefs concerning their
6 performance (e.g., Turner, 2016b). Indeed, contemporary theory (Meijen et al., 2020)
7 indicates that irrational/rational beliefs are important determinants of challenge and threat.
8 Also in line with cognitive reappraisal, officials could develop their ability to reappraise the
9 arousal they experience in the lead up to important events. That is, officials could be
10 encouraged to believe that arousal doesn't hurt performance and officials who feel anxious
11 during a match might actually do better (Jamieson et al., 2010). This strategy can encourage
12 challenge and enhance performance (Moore et al., 2015). A broader way to help officials to
13 appraise events as a challenge is to develop their psychological skills, such as imagery, self-
14 talk, concentration, goal-setting, and concentration (Andersen, 2009). For example, imagery
15 has been used in research to encourage challenge appraisal (Hale & Whitehouse, 1998;
16 Williams & Cumming, 2012), and quiet eye training has been shown to enable challenge
17 appraisals, effective gaze control, and skill execution (golf putting; Moore et al., 2013).

18 Several limitations need to be highlighted in the current study. Firstly, the most
19 significant limitation of the current study was that we used an atemporal cross-sectional
20 design, and thus, we cannot speak of causation in the findings. Future researchers could
21 collect temporal data to conduct more complex theoretical-driven models using mediation
22 analyses, for example. Second, the uneven numbers between males and females may have
23 impacted the results, given that only 32% of the study were female. Indeed, Tennis Australia
24 currently states that females represent 37% of tennis officials in Australia, thus the current
25 sample under-represents females. Further, the data was based on self-report measures, which

1 is potentially subject to socially desirable responding or the tendency to give answers that
2 make the respondent look good (Paulhus, 1991). This also opens up a broader issue of
3 psychometrics in the area of challenge and threat appraisals. In the current study, to assess
4 challenge and threat appraisals the CAS (Skinner & Brewer, 2002) was used because it
5 offered a trait indication of how people generally approach situations. The sport version of
6 the CAS (Rossato et al., 2016) assesses the approach to an imminent task, and so too does the
7 oft-used in sport Demand Resource Evaluation Score (DRES; e.g., Moore et al., 2012), and
8 the appraisal of life events scale (ALE-scale; e.g., Dixon et al., 2017). However, there are
9 various other measures that could be used to assess challenge and threat appraisal (the stress
10 appraisal scale; Schneider, 2008, the challenge and threat scale; Mendes et al., 2007). For a
11 non-sport specific measure, future researchers could use the Appraisal of Challenge and
12 Threat Scale (ACTS; Tomaka et al., 2018). But to date, no measure is aligned with the
13 TCTSA or TCTSA-R (Meijen et al., 2020), and thus, future researchers should work to
14 develop measurement that is consistent with both TCTSA and resilience theories.

15 Whilst there were several limitations, the results of the study suggest that the REFS is
16 a suitable tool to use with tennis officials. However, more research is required, specifically
17 with more participants. Examining the self-efficacy and qualities of resilience of tennis
18 officials from different cultures to note any differences, as differences have been noted in
19 coping styles between American and Australian basketball referees (Anshel & Weinberg,
20 1999). Alternatively, examining the factors that predict self-efficacy and psychological
21 resilience in officials in a range of sports, could provide interesting results, as officiating in
22 tennis is relatively inactive compared to other forms of officiating, such as football where
23 referees run more than ten kilometres per match and have an average heart rate of 160-165
24 beats per minute (Reilly & Gregson, 2006), which may create stress. Finally, future research

1 assessing self-efficacy and resilience in longitudinal-mediational studies is recommended to
2 test complex theoretical models of psychological resilience and self-efficacy.

3 In conclusion, this study adds to the extant literature concerning the relationship
4 between resilience and challenge and threat appraisals. Higher levels of challenge appraisal
5 and lower levels of threat appraisal were associated with psychological resilience. Further,
6 higher levels of self-efficacy were associated with higher levels of psychological resilience.
7 This study explicitly examined psychological resilience, self-efficacy, and challenge and
8 threat appraisal in sporting officials via a unique study with a sample of officials who are
9 under-researched in the sport psychology literature. Based on the findings, it is recommended
10 that tennis officials are given education on resilience, self-efficacy, and challenge and threat
11 appraisal not only when they commence their initial officiating courses and workshops, but
12 throughout their officiating career. Specifically, a range of strategies have been found to elicit
13 a challenge appraisal, including imagery (Williams et al., 2010), reappraising threat (Moore
14 et al., 2015), and instructional sets (Turner et al., 2014). While Fletcher and Sarkar (2016)
15 developed a mental fortitude training program to develop psychological resilience.

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1 Table 1. Correlations and descriptive statistics (N = 140)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	-													
2. Years officiating	.38**	-												
3. Primary role	.09	.08	-											
4. Previous tournaments	.08	.08	.13	-										
5. Resilience	.25**	-.02	-.01	.05	-									
6. REFS (Total)	.27**	.22*	.01	.19*	.43**	-								
7. Challenge Appraisal	.07	-.14	-.02	-.01	.49**	.34**	-							
8. Threat Appraisal	-.25**	-.02	-.08	-.13	-.42**	-.32**	-.11	-						
9. Social Support	-.07	-.06	.04	.07	-.07	.00	.12	.25**	-					
10. Situational Favourableness	-.08	-.04	.04	-.09	-.05	.01	.29**	.30**	.60**	-				
11. Environmental Comfort	-.08	-.04	.02	-.22*	-.13	-.01	.34**	.34**	.44**	.71**	-			
12. Vicarious Experience	.01	-.13	.06	.03	.05	.09	.25**	.10	.51**	.63**	.42**	-		
13. Physical & Mental Prep.	.07	.04	-.07	-.08	.27**	.38**	.38**	-.19**	.24**	.26**	.15	.34**	-	
14. Past Accomplishments	-.19*	-.05	-.09	-.16	-.02	.04	.30**	.30**	.58**	.59**	.41**	.40**	.43	-

PSYCHOLOGICAL RESILIENCE IN TENNIS OFFICIALS

M	49.90	10.15	1.79	11.07	31.82	95.25	37.17	24.90	26.35	16.14	10.36	22.90	28.62	15.49
SD	16.15	8.76	1.01	8.51	4.86	11.45	5.48	10.35	4.08	4.41	4.38	5.56	4.01	2.70

1 *p < .05. **p < .01.

1 Table 2. Hierarchical linear regression model of psychological resilience in Australian tennis
 2 officials.

	β	SE B	t	F
<i>Step 1</i>				
Age	.31	0.03	3.41**	2.85*
Gender	.09	0.90	1.04	
Years officiating	-.15	0.52	-1.67	
Primary Role	-.01	0.42	-0.08	
Previous Tournaments	.05	0.06	0.57	
<i>Step 2</i>				
Age	.14	0.03	1.81	11.70***
Gender	.08	0.78	1.15	
Years officiating	-.02	0.04	-0.27	
Primary Role	-.04	0.34	-0.51	
Previous Tournaments	.02	0.05	0.27	
Challenge Appraisal	.44	0.07	6.17***	
Threat Appraisal	-.32	0.04	-4.32***	
<i>Step 3</i>				
Age	.12	0.03	1.56	11.42***
Gender	.09	0.77	1.22	
Years officiating	-.06	0.04	-0.79	
Primary Role	-.02	0.34	-0.33	
Previous Tournaments	-.01	0.05	-0.13	

Challenge Appraisal	.40	0.07	5.05***
Threat Appraisal	-.27	0.04	-3.63***
REFS (Total)	.20	0.03	2.46*

1 * $p < .05$, ** $p < .01$, *** $p < .001$

1 Table 3. Hierarchical linear regression model of self-efficacy in Australian tennis officials.

	β	SE B	t	F
<i>Step 1</i>				
Age	.25	0.06	2.80**	3.90**
Gender	.01	2.08	0.10	
Years officiating	.13	0.12	1.50	
Primary Role	-.03	0.91	-0.32	
Previous Tournaments	.15	0.10	1.73	
<i>Step 2</i>				
Age	.22	0.06	2.55*	4.36***
Gender	-.12	2.10	-1.49	
Years officiating	.15	0.10	1.80	
Primary Role	.01	0.90	0.08	
Previous Tournaments	.20	0.11	2.34*	
Social Support	-.08	0.29	-0.77	
Situational Favourableness	-.17	0.38	-1.14	
Environment Comfort	.14	0.31	1.21	
Vicarious Experience	.09	0.22	0.74	
Physical and Mental Preparation	.41	0.27	4.35***	
Past Accomplishments	-.01	0.50	-0.04	

2 * $p < .05$, ** $p < .01$, *** $p < .001$