



Citation for published version:

McLoughlin, E, Arnold, R, Fletcher, D, Spahr, CM, Slavich, GM & Moore, LJ 2022, 'Assessing lifetime stressor exposure in sport performers: Associations with trait stress appraisals, health, well-being, and performance', *Psychology of Sport and Exercise*, vol. 58, 102078. <https://doi.org/10.1016/j.psychsport.2021.102078>

DOI:

[10.1016/j.psychsport.2021.102078](https://doi.org/10.1016/j.psychsport.2021.102078)

Publication date:

2022

Document Version

Peer reviewed version

[Link to publication](#)

University of Bath

Alternative formats

If you require this document in an alternative format, please contact:
openaccess@bath.ac.uk

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

**Assessing Lifetime Stressor Exposure in Sport Performers: Associations with Trait
Stress Appraisals, Health, Well-Being, and Performance**

Ella McLoughlin¹, Rachel Arnold¹, David Fletcher², Chandler M. Spahr³,
George M. Slavich⁴, and Lee J. Moore¹

¹Department for Health, University of Bath

²School of Sport, Exercise and Health Sciences, Loughborough University

³Department of Psychology, University of California, Riverside

⁴Cousins Center for Psychoneuroimmunology and Department of Psychiatry and
Biobehavioral Sciences, University of California, Los Angeles

Corresponding Author: Ella McLoughlin, Department for Health, University of Bath,
Claverton Down, Bath, BA2 7AY, United Kingdom. E-mail: em2050@bath.ac.uk

Declarations of interest: None.

Funding: GMS was supported by a Society in Science—Branco Weiss Fellowship,
NARSAD Young Investigator Grant #23958 from the Brain & Behavior Research
Foundation, and National Institutes of Health grant K08 MH103443.

1 **Abstract**

2 Research has found that greater lifetime stressor exposure increases the risk for mental
3 and physical health problems. Despite this, few studies have examined how stressors occurring
4 over the entire lifespan affect sport performers' health, well-being, and performance, partly due
5 to the difficulty of assessing lifetime stressor exposure. To address this issue, we developed a
6 sport-specific stress assessment module (Sport SAM) for the Stress and Adversity Inventory
7 (STRAIN) and then analyzed the instrument's usability, acceptability, validity, and test-retest
8 reliability. Furthermore, we examined whether trait-like tendencies to appraise stressful
9 situations as a challenge or threat mediated the relationship between lifetime stressor exposure
10 and health, well-being, and performance. Participants were 395 sport performers ($M_{age} = 22.50$
11 years, $SD = 5.33$) who completed an online survey. Results revealed that the Sport SAM
12 demonstrated good usability and acceptability, good concurrent validity in relation to the Adult
13 STRAIN ($r_s = .23$ to $.29$), and very good test-retest reliability ($r_{icc} = .87$ to $.89$). Furthermore,
14 the Sport SAM was significantly associated with symptoms of depression ($\beta = .21$ to $.24$, p_s
15 $\leq .001$) and anxiety ($\beta = .13$ to $.19$, $p_s \leq .012$), and general physical ($\beta = .24$ to $.27$, $p_s = \leq .001$)
16 and mental ($\beta = .23$ to $.32$, $p \leq .001$) health complaints. Finally, we found that associations
17 between total lifetime non-sport and sport-specific stressor severity and health were mediated
18 by trait stress appraisals. Consequently, these findings may help practitioners better identify
19 sport performers who are at risk of developing stress-related health problems.

20 *Keywords:* adversity, allostatic load, assessment, challenge and threat, stressors

1 health is large, the empirical literature is surprisingly limited (Slavich & Shields, 2018). This
2 is partly because no measurement tool has existed for systematically assessing lifetime stressor
3 exposure (Slavich, 2019). To elaborate, prior research has largely defined life stress as a single
4 unitary construct even though different types of life stressors exist (e.g., acute life events vs.
5 chronic difficulties) and occur across different time periods (e.g., early life vs. adulthood), life
6 domains (e.g., housing, health, work), and social-psychological characteristics (e.g.,
7 interpersonal loss, physical danger, humiliation; Epel et al., 2018). As a result, the current
8 understanding of lifetime stressor exposure is overly simplistic and has largely ignored the fact
9 that different types of stressors can have varying effects on health (Epel et al., 2018).

10 To address these issues, G. M. Slavich developed the Stress and Adversity Inventory
11 (STRAIN), which has been used to examine associations between lifetime stressor exposure
12 and a variety of psychological, biological, and health outcomes (see Slavich and Shields 2018).
13 Most notably, greater lifetime stressor exposure has been related to more symptoms of
14 depression (e.g., Pegg et al., 2019) and anxiety disorders (e.g., Slavich et al., 2019), and more
15 physical health complaints (e.g., respiratory infections; Cazassa et al., 2020). Despite these
16 findings, the STRAIN has only been used once in a sporting context (McLoughlin et al., 2021).
17 This is particularly important given recent interest in sport performers' mental health and well-
18 being (for a review, see Rice et al., 2021), with some scholars suggesting that sport performers
19 are at increased risk of developing mental health problems (Gulliver et al., 2015).

20 The limited use of the STRAIN in the sport psychology literature is particularly
21 noteworthy given that the sporting environment imposes numerous stressors on sport
22 performers, which are associated with their competitive performance (e.g., opponent rivalry),
23 the sporting organization within which they operate (e.g., coach-athlete relationship), and
24 personal non-sporting life events (e.g., death of a relative; Arnold & Fletcher, 2021). The
25 consensus from this body of work is that exposure to such stressors can have detrimental

1 consequences for sport performers' health, well-being, and performance (Arnold & Fletcher,
2 2021). Indeed, some stressors have been found to negatively impact performance (e.g., Arnold
3 et al., 2017), well-being (e.g., Roberts et al., 2019), and health (e.g., Simms et al., 2020).
4 However, some stressors such as injury have been associated with more positive outcomes (e.g.,
5 *stress-related growth*; Roy-Davis et al., 2017). One potential explanation for these disparate
6 findings could be the ways in which sport performers appraise stressful situations (Lazarus &
7 Folkman, 1984). Although insightful, most stress-related research in the sporting domain has
8 examined certain types of life stressors in isolation (e.g., competitive, organizational, or
9 personal), as opposed to assessing the combined and cumulative effect of stressors on health
10 (Fletcher et al., 2006). Furthermore, prior studies have relied on trauma or life event checklists
11 to assess sport performers exposure to negative life events (e.g., Moore et al., 2017). Despite
12 some strengths, such as brevity, self-report checklists have been criticised for only assessing
13 the frequency of a relatively limited number of events (e.g., death of a loved one) and
14 overlooking other key dimensions of lifetime stressors (e.g., severity; Slavich, 2019).

15 To our knowledge, only one study has addressed these concerns by using the STRAIN
16 to assess how lifetime stressor exposure is associated with mental health and well-being among
17 elite athletes (McLoughlin et al., 2021). The results of this study revealed that elite athletes
18 who experienced more chronic difficulties and adulthood stressors exhibited greater symptoms
19 of depression and anxiety, and poorer psychological well-being. Additionally, the findings
20 from follow-up interviews with elite athletes suggested that cumulative lifetime stressor
21 exposure fostered poorer mental health and well-being by promoting maladaptive long-term
22 coping strategies, increasing susceptibility to stressful experiences in the future, and limiting
23 interpersonal relationships (McLoughlin et al., 2021). Notwithstanding these findings, this
24 study did not assess sport-specific stressors (e.g., underperformance) and was restricted to a
25 sample of elite athletes (McLoughlin et al., 2021). Moreover, the mechanisms linking lifetime

1 stressor exposure with health in athletes remains largely unknown despite the substantial
2 disease burden experienced by this population (McLoughlin et al., 2021).

3 Consistent with the predictions of the integrative model of lifespan stress and health
4 (Epel et al., 2018), the relationship between lifetime stressor exposure and health may be partly
5 explained by cognitive appraisals (Lazarus & Folkman, 1984). Cognitive appraisal has been
6 defined as “an evaluative process that determines why and to what extent a particular
7 transaction or series of transactions between the person and the environment is stressful”
8 (Lazarus & Folkman, 1984, p. 21). The biopsychosocial model (BPSM; Blascovich & Tomaka,
9 1996) of challenge and threat extends Lazarus and Folkman’s (1984) transactional model of
10 stress by incorporating psychophysiological responses to stress, in order to understand why
11 individuals react differently to stressful situations (Blascovich, 2008a). According to the BPSM,
12 a challenge appraisal occurs when an individual perceives that they have sufficient coping
13 resources to meet the demands of a stressful situation, whereas a threat appraisal occurs when
14 an individual perceives that the demands of a stressful situation exceed their coping resources
15 (Blascovich, 2008a). This conceptualisation differs from that of Lazarus and colleagues, who
16 consider challenge and threat as primary appraisals relating to the potential for gain or harm,
17 respectively. Although predominately situation-specific, research has illustrated that
18 individuals also have a trait-like tendency to generally appraise stressful situations as more of
19 a challenge or a threat (Moore et al., 2019; Power & Hill, 2010; Rumbold et al., 2020). This is
20 particularly important given that threat appraisals have been related to poorer health and
21 performance (Blascovich, 2008b). Therefore, an individual’s tendency to appraise stressful
22 situations as more of a challenge or a threat may be an important mechanism linking the effects
23 of lifetime stressor exposure on health and performance (Epel et al., 2018).

24 Building on existing research, the present study aimed to: (a) create a sport-specific
25 stress assessment module (Sport SAM) for the Adult STRAIN to provide an additional life

1 course assessment of sport-related stressors; (b) examine the Sport SAM's usability,
2 acceptability, validity (viz. concurrent, predictive, and comparative predictive), and test-retest
3 reliability; (c) assess how the different types of lifetime (non-sport) stressor exposure assessed
4 by the Adult STRAIN are associated with depression, anxiety, well-being, general mental and
5 physical health complaints, and subjective sports performance; and (d) investigate if the
6 relationship between lifetime stressor exposure (non-sport and sport-specific) and the
7 aforementioned outcomes is mediated by the general tendency to appraise stressful situations
8 as more of a challenge or a threat. Based on prior research, we hypothesized that greater
9 lifetime stressor exposure (non-sport and sport-specific) would be associated with poorer
10 health, well-being, and subjective sports performance. Furthermore, we hypothesized that trait
11 stress appraisals would mediate the relation between lifetime stressor exposure (non-sport and
12 sport-specific) and outcomes, such that sport performers who reported experiencing greater
13 lifetime stressor exposure would be more likely to report typically appraising stressors as more
14 of a threat, in turn leading to poorer health, well-being, and performance.

15 Method

16 Participants

17 Participants were 395 sport performers (251 female, 144 male) between the ages of 18
18 and 63 years old ($M_{age} = 22.50$ years, $SD = 5.33$). Participants were from a range of sports (e.g.,
19 swimming, soccer, netball) and had an average of 9.91 years ($SD = 6.43$) of experience in their
20 sport. Participants represented a range of competitive levels, with 8.1% performing at senior
21 international level, 12.1% at international level, 18.0% at national level, 15.4% at regional level,
22 28.6% at university level, 5.1% at county level, and 12.7% at club level. Furthermore,
23 participants represented an international sample and were from 22 different countries,
24 including the United Kingdom, America, France, and Russia. An *a priori* power calculation
25 using G*Power software (Faul et al., 2007) revealed that a minimum sample of 395 participants

1 was required to perform multiple regression analyses with six predictors (i.e., lifetime stressor
2 exposure, age, sex, sport type, performance level, and length of time competing in sport). The
3 effect size entered into this calculation was based on the small effect ($\beta = 0.16$) between stress
4 appraisals and depression reported in prior research (e.g., Tomaka et al., 2018), and was entered
5 with an alpha of 0.05 and power of 0.80. This sample size is also consistent with the
6 recommendations of Schönbrodt and Perugini (2013), who suggested that a minimum sample
7 size of 238 participants is required for correlations to stabilize.

8 **Study Design and Procedure**

9 This study used a cross-sectional design. Following institutional ethical approval
10 (University of Bath, Research Ethics Approval Committee for Health, EP 18/19 107), sport
11 performers were recruited using the research team's existing contacts, and by emailing clubs,
12 sport organizations, and universities to advertise and distribute study information. In addition,
13 the study was advertised on social media (e.g., Twitter). Data were collected between April
14 and June 2020 during the Coronavirus pandemic. Once recruited, participants were sent a link
15 to the online survey, which was created by JISC Online Surveys
16 (<https://www.onlinesurveys.ac.uk>) and took approximately 30 minutes to complete.
17 Immediately before completing the online survey, participants were advised of their ethical
18 rights (e.g., confidentiality, anonymity, right to withdraw) via an information sheet and
19 subsequently provided informed consent.

20 **Measures**

21 *Lifetime (Non-Sport) Stressor Exposure*

22 Lifetime stressor exposure was assessed using the Adult STRAIN (Slavich & Shields,
23 2018), which assesses 55 major life stressors including 26 acute life events (e.g., death of a
24 loved one) and 29 chronic difficulties (e.g., ongoing health problems). Once a stressor is
25 endorsed, and to ensure a multidimensional assessment of lifetime stressor exposure, follow-

1 up questions are asked that determine the stressor's frequency (*1 to 5 or more* times), severity
2 (*1 = not at all to 5 = extremely*), timing (*1 = ongoing to 7 = over 5 years ago*), and duration
3 (years and/or months). Stressors can be categorized by stressor type (acute life events vs.
4 chronic difficulties), timing (early life vs. adulthood), primary life domain (housing, education,
5 work, health, marital/partner, reproduction, financial, legal, other relationships, death, life-
6 threatening situations, and possessions), and core social-psychological characteristic
7 (interpersonal loss, physical danger, humiliation, entrapment, and role change/disruption). The
8 primary analyses were based on the STRAIN's two main variables: (a) total count of lifetime
9 stressors, calculated by summing the number of stressors experienced (range = 0-166); and (b)
10 total severity of lifetime stressors, calculated by summing the perceived severity of the stressors
11 experienced (range = 0-265). The Adult STRAIN has demonstrated excellent test-retest
12 reliability ($r_s = .90$ to $.95$), and very good concurrent ($r_s = .15$ to $.62$) and predictive validity
13 across a variety of health-related outcomes (e.g., Cazassa et al., 2020).

14 ***Sport-Specific Stress Assessment Module (Sport SAM)***

15 A five-step procedure was used to develop and add a sport-specific stress assessment
16 module (Sport SAM) to the Adult STRAIN. First, a detailed literature review was conducted
17 to identify stressors that have been commonly reported by sport performers (e.g., Arnold &
18 Fletcher, 2012, 2021; Rice et al., 2016). Second, existing measures of sport-specific stressors
19 were reviewed to catalogue stressors that have been frequently assessed in the sport psychology
20 literature (e.g., Organizational Stressor Indicator for Sport Performers, Arnold et al., 2013; Life
21 Events Survey for Collegiate Athletes, Petrie, 1992). Third, review articles describing stressors
22 faced by sport performers were identified and reviewed (e.g., Howells et al., 2017; Sarkar &
23 Fletcher, 2014). Fourth, an exhaustive review of studies that have examined the impact of
24 sport-specific stressors on sport performers' mental and physical health was conducted to
25 identify stressors that consistently predict poor health (Rice et al., 2016). Fifth, the stressors

1 most frequently reported by sport performers and consistently associated with poor health were
2 then identified from this rigorous literature search and selected to remain in the item set for the
3 Sport SAM. As a result, some items were removed (e.g., funding/scholarship, balancing dual
4 career, media obligations) given that they were not frequently reported by all sport performers
5 and/or consistently associated with poor health. Furthermore, stressors already assessed by the
6 Adult STRAIN were removed to avoid redundancy (e.g., illness, relocation, and finance). This
7 process resulted in an initial list of stressors that were evidence-based (see Supplementary
8 Materials Table S1). It is important to note that this instrument did not aim to assess *all* stressors
9 that sport performers experience, but rather the most prevalent and impactful stressors.

10 In accordance with scale development recommendations (DeVellis, 2017), an expert
11 and usability panel reviewed the initial list of items. Five leading sport psychologists formed
12 the expert panel and provided feedback on each stressor item in terms of its relevance (e.g.,
13 does this stressor relate to the sport environment?), clarity (e.g., is this stressor easily
14 understood?), and specificity (e.g., is this stressor specific enough?). The expert panel was also
15 asked five open-ended questions to assess: (1) whether the Sport SAM was pitched at an
16 appropriate level for all sport-performers, (2) if they would add anything to the Sport SAM to
17 improve it (e.g., other key stressors), (3) if they would delete any of the items from the Sport
18 SAM, (4) if they would make any modifications to the Sport SAM, and (5) if they had any
19 further comments on the Sport SAM. Additionally, we recruited a usability panel consisting of
20 20 sport performers from a range of individual and team sports and competitive levels to gather
21 feedback on the item set, order, and wording. Finally, the item set was finalized based on the
22 expert and usability panel feedback, and with the developer of the STRAIN (G.M. Slavich), in
23 order to maximize the clarity, readability, and item order.

24 The final version of the Sport SAM was deemed multidimensional as it assessed the
25 frequency (*1 to 5 or more times*), severity (*1 = not at all to 5 = extremely*), timing (*1 = ongoing*

1 to 7 = *over 5 years ago*), and duration (years and/or months) of eight different sport-specific
2 stressors, including four that were more competitive (i.e., overtraining; underperformance;
3 training while injured; and injury) and four that were more organizational (i.e., excessive
4 external pressure to perform; non-selection; coach-athlete relationship difficulties; and
5 bullying) in nature¹. The main variables used for analyses were: (a) total count of sport-specific
6 stressors, which was calculated by summing the number of stressors experienced (possible
7 range = 0-24)², and (b) total severity of sport-specific stressors, which was calculated by
8 summing the perceived severity of the stressors experienced (possible range = 0-40).

9 ***Depression***

10 The Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) was used to assess
11 symptoms of depression over the past two weeks. The PHQ-9 includes nine items (e.g., little
12 interest or pleasure in doing things), with each item scored on a 4-point Likert scale ranging
13 from 0 (*not at all*) to 3 (*nearly every day*). Total scores were calculated by summing participants'
14 responses for the individual items (range = 0-27). Higher total scores indicated greater
15 symptoms of depression, with scores of 5, 10, 15, and 20 representing mild, moderate,
16 moderately severe, and severe depression, respectively (Kroenke et al., 2001). Previously, the
17 PHQ-9 has demonstrated very good internal consistency ($\alpha = .86$ to $.89$) and good test-retest
18 reliability ($r = .84$), as well as good construct and criterion validity (Kroenke et al., 2001). In
19 this study, the PHQ-9 demonstrated good internal consistency ($\alpha = .82$).

20 ***Anxiety***

21 The Generalized Anxiety Disorder scale (GAD-7; Spitzer et al., 2006) was used to
22 assess symptoms of anxiety over the past two weeks. The GAD-7 includes seven items (e.g.,

¹ The Sport SAM items are available on request from the corresponding author.

² For the Sport SAM, the total number of stressors that can be endorsed is eight. However, four of these stressors are acute life events and can thus occur more than once (i.e., *1 to 5 or more times*) in the STRAIN system. In contrast, the other four stressors are chronic difficulties and, according to the STRAIN, are assessed only once for the most-severe occurrence to ensure an efficient lifetime assessment. Consequently, the maximum number of sport-specific stressors an individual could have experienced was 24.

1 feeling nervous, anxious, or on-edge), with each item scored on a 4-point Likert scale ranging
2 from 0 (*not at all*) to 3 (*nearly every day*). Total scores were calculated by summing participants'
3 responses for the individual items (range = 0-21). Higher total scores indicated greater
4 symptoms of anxiety, with scores of 5, 10, and 15 representing mild, moderate, and severe
5 anxiety, respectively (Spitzer et al., 2006). Previously, the GAD-7 has demonstrated excellent
6 internal consistency ($\alpha = .89$ to $.92$) and good test-retest reliability ($r_s = .83$), as well as good
7 convergent, construct, criterion, and factorial validity (e.g., Spitzer et al., 2006). In this study,
8 the GAD-7 demonstrated very good internal consistency ($\alpha = .88$).

9 ***Well-being***

10 The World Health Organization's Well-being Index (WHO-5) was used to assess
11 psychological well-being over the past two weeks (WHO, 1998). The WHO-5 consists of five
12 items (e.g., I have felt cheerful and in good spirits), with each item scored on a 6-point Likert
13 scale ranging from 0 (*at no time*) to 5 (*all of the time*). The total score across all five items,
14 ranging from 0-25, was multiplied by 4 to produce a final score (range = 0-100). Higher final
15 scores represented greater well-being (WHO, 1998). Previously, the WHO-5 has demonstrated
16 excellent construct and convergent validity, and excellent internal consistency ($\alpha = .90$; Topp
17 et al., 2015). In this study, the WHO-5 demonstrated good internal consistency ($\alpha = .80$).

18 ***Physical Health Complaints***

19 The Physical Health Questionnaire (PHQ; Schat et al., 2005) was used to assess general
20 physical health complaints over the past month. The PHQ includes 14 items (e.g., how often
21 have you had difficulty getting to sleep at night?) assessing sleep disturbances, headaches, and
22 respiratory infections. Responses to 11 of the items were scored on a 7-point Likert scale
23 ranging from 1 (*not at all*) to 7 (*all the time*), whereas responses to two items were scored on
24 a 7-point Likert scale ranging from 0 times to 7+ times, and one item was scored on a 7-point
25 Likert scale ranging from 1 day to 7+ days. The scores for all items were summed to produce

1 a total score (range = 12-98), with higher total scores indicating greater physical health
2 complaints. Previously, the PHQ has demonstrated acceptable factorial validity, excellent
3 convergent and divergent validity, and good internal consistency ($\alpha = .83$; Schat et al., 2005).
4 In this study, the PHQ demonstrated good internal consistency ($\alpha = .80$).

5 ***Mental Health Complaints***

6 The Kessler 6-Item Psychological Distress Inventory (K-6; Kessler et al., 2002) was
7 used to assess general mental health complaints over the past month. The K-6 consists of six
8 items (e.g., how often did you feel hopeless?), with each item scored on a 5-point Likert scale
9 ranging from 1 (*never*) to 5 (*very often*). The scores for all items were summed to produce a
10 total score (range = 6-30), with higher total scores indicating greater mental health complaints.
11 Previously, the K-6 has demonstrated very good internal consistency ($\alpha = .86$), and excellent
12 predictive validity (e.g., Kessler et al., 2002). In this study, the K-6 demonstrated very good
13 internal consistency ($\alpha = .88$).

14 ***Subjective Sports Performance***

15 Three items from the Athlete Satisfaction Questionnaire (ASQ; Riemer & Chelladurai,
16 1998) were used to assess subjective sports performance over the past four months. This
17 timeframe was used due to data collection occurring during the Coronavirus pandemic when
18 sporting involvement was largely paused. The ASQ includes three items (e.g., the degree to
19 which I have reached my performance goals), with each item scored on a 7-point Likert scale
20 ranging from 1 (*not at all satisfied*) to 7 (*extremely satisfied*). The scores for all items were
21 summed to produce a total score (range = 3-21), with higher total scores indicating greater
22 performance satisfaction. Previously, the ASQ has demonstrated good criterion and construct-
23 related validity, as well as acceptable-to-excellent internal consistency ($\alpha = .78$ to $.95$; Riemer
24 & Chelladurai, 1998). In this study, the ASQ demonstrated very good internal consistency (α
25 = $.89$).

1 ***Stress Appraisals***

2 The Appraisal of Challenge and Threat Scale (ACTS; Tomaka et al., 2018) was used to
3 assess individual differences in trait stress appraisals. In this study, the ‘transportation’
4 principal component from the ACTS (e.g., car breaks down in rush hour) was removed to
5 ensure all items were relevant to the entire sample (i.e., not all participants will have driven a
6 car). Next, we included only the highest three factor loading items for the remaining five
7 principal components (i.e., conflict situations, unexpected events, public speaking, social
8 anxiety, and financial issues) in the online survey to aid brevity. As a result, participants were
9 presented with 15 potentially stressful events (e.g., you find out that you have a chronic disease),
10 with each event followed by one item assessing primary appraisals (i.e., how demanding is this
11 event to you?), and one assessing secondary appraisals (i.e., how able are you to take action to
12 deal with it?). Both items were scored on a 5-point Likert scale ranging from 1 (*not at all*) to 5
13 (*very much*). Scores were calculated by subtracting the secondary appraisal score from the
14 primary appraisal score for each event, and then calculating the mean across all potentially
15 stressful events to derive an overall appraisal tendency score (range = -4 to +4). Positive scores
16 indicated a tendency to appraise events as threatening, whereas negative scores indicated a
17 tendency to appraise events as challenging. Previously, the ACTS has demonstrated good
18 factorial validity, reliability, and acceptable-to-good construct validity ($\alpha = .77$ to $.88$; Tomaka
19 et al., 2018). In this study, the ACTS demonstrated good internal consistency ($\alpha = .86$).

20 **Data Analysis**

21 Data were analyzed using SPSS version 25.0. First, checks revealed no missing data
22 and that all data was non-normally distributed. Second, outlier analyses were performed prior
23 to the main statistical analyses. Specifically, thirteen univariate outliers were detected by
24 identifying z-scores which were greater or less than 3.29. Moreover, multivariate outliers were
25 detected by considering Cook’s distance (values <1.000) and Mahalanobis distance (cut-off

1 value of 10.828). Third, square root transformations were performed to ensure that all data was
2 normally distributed (i.e., skewness and kurtosis z-scores <1.96). Fourth, checks for the other
3 assumptions of linear regression analyses were conducted, with visual inspection of bivariate
4 scatterplots confirming that all data were linearly related and homoscedastic. Finally, no
5 multicollinearity was evident between the independent variables (i.e., variance inflation factor
6 [or VIF] values <10.00).

7 First, descriptive statistics (i.e., medians, standard deviations) for, and correlations
8 between, all study variables were computed. Second, to verify the concurrent validity of the
9 Sport SAM in relation to the Adult STRAIN, Pearson correlations and hierarchical linear
10 regression analyses were conducted. Specifically, total count or severity of lifetime (non-sport)
11 stressors were entered into separate models as dependent variables. In each model, total count
12 or severity of sport-specific stressors were entered as independent variables at Step 1 and *a*
13 *priori* covariates were entered at Step 2 (i.e., age; sex; sport type; highest performance level;
14 and length of time competing in sport). Third, to assess predictive validity, Pearson correlations
15 and hierarchical linear regression models were used to evaluate the Sport SAM in relation to
16 the outcomes assessed. Specifically, depression, anxiety, well-being, physical and mental
17 health complaints, and subjective sports performance were entered into separate models as
18 dependent variables. In each model, the independent variables were entered at Step 1 (e.g., total
19 count or severity of stressors) and the *a priori* covariates were entered at Step 2. These
20 hierarchical linear regression analyses were repeated with the same independent variables, but
21 in reverse order, to verify whether the predictive validity held true regardless of the order in
22 which the variables were entered into the regression models. Fourth, to examine the
23 comparative predictive validity of the Sport SAM in relation to the Adult STRAIN, each scale
24 was included in the regression models simultaneously. Specifically, hierarchical linear
25 regression analyses were conducted to examine the percentage of variance explained by the

1 Sport SAM over and above the total variance previously explained by *a priori* covariates and
2 the Adult STRAIN. Specifically, *a priori* covariates were entered at Step 1, and independent
3 variables were entered at Step 2 (e.g., Adult STRAIN) and Step 3 (e.g., Sport SAM). Fifth,
4 test-rest reliability of the Sport SAM was examined using intraclass correlation coefficients,
5 which were based on absolute agreement in a two-way mixed effects model. Values of <0.50,
6 0.50-0.75, 0.75-0.90, and >0.90 indicated poor, moderate, good, and excellent reliability,
7 respectively (Koo & Li, 2016).

8 Next, a series of hierarchical linear regression analyses were conducted to examine if
9 the different lifetime (non-sport) stressor types (acute life events vs. chronic difficulties), time
10 periods (early life vs. adulthood), life domains (e.g., work, health, death), and core social-
11 psychological characteristics (e.g., physical danger, humiliation, entrapment) from the Adult
12 STRAIN were significantly associated with the outcomes assessed, above and beyond the *a*
13 *priori* covariates. Specifically, study outcomes were entered into separate models as dependent
14 variables. In each model, the independent variables were entered at Step 1 (e.g., total count or
15 severity of stressors) and the *a priori* covariates were entered at Step 2. However, due to space
16 constraints, we only report Step 2 of these hierarchical linear regression models. Four life
17 domains (i.e., education; work; reproduction; and legal/crime) were excluded from these
18 analyses as very few participants reported experiencing these stressors.

19 Finally, to examine if trait stress appraisals (i.e., challenge and threat) mediated the
20 relations between stressor exposure [i.e., total count or severity of lifetime (non-sport) stressors,
21 total count or severity of sport-specific stressors] and the outcomes assessed, mediation
22 analyses were conducted using the Process SPSS custom dialog (Hayes, 2018). This custom
23 dialog tests the total, direct, and indirect effect of an independent variable on a dependent
24 variable through a proposed mediator and allows inferences regarding indirect effects using

1 10,000 bootstrap confidence intervals. The total, direct, and indirect effects were deemed
2 significant if the 95% confidence intervals did not contain zero.

3 **Results**

4 **Descriptive Statistics**

5 All descriptive statistics including the medians and standard deviations for, and
6 correlations between, the main study variables are shown in Table 1.

7 **Usability and Acceptability of the Sport SAM**

8 The Adult STRAIN and Sport SAM were completed together, taking an average of 18
9 minutes and 58 seconds to complete ($SD = 8 \text{ min } 47 \text{ s}$; interquartile range = 13 min 52 s to 21
10 min 23 s). The acceptability of the Sport SAM was excellent, with only 21 (5%) participants
11 failing to complete the instrument, producing a very high completion rate (95%). Following
12 completion of the Sport SAM and Adult STRAIN, participants were asked to provide feedback
13 on whether any of the items were upsetting or distressing. No participants reported any distress
14 because of answering the Sport SAM or Adult STRAIN questions.

15 **Concurrent Validity**

16 Next, we examined how the Sport SAM performed in relation to the Adult STRAIN.
17 In Step 1 of the regression analyses, total count of sport-specific stressors was significantly
18 associated with total count of lifetime (non-sport) stressors ($\beta = .23, p < .001$). Similarly, total
19 severity of sport-specific stressors was significantly associated with the total severity of
20 lifetime (non-sport) stressors ($\beta = .29, p < .001$). In Step 2 of the regression analyses, these
21 effects were robust while controlling for covariates, with total count of sport-specific stressors
22 still significantly associated with total count of lifetime (non-sport) stressors ($\beta = .23, p < .001$),
23 and total severity of sport-specific stressors still significantly associated with total severity of
24 lifetime (non-sport) stressors ($\beta = .30, p < .001$). Therefore, these results provide initial
25 evidence for the concurrent validity of the Sport SAM.

1 **Predictive Validity**

2 The predictive validity of the Sport SAM was evaluated in relation to mental and
3 physical health, well-being, and sports performance. In Step 1 of the regression analyses, total
4 count of sport-specific stressors was significantly associated with greater symptoms of
5 depression ($\beta = .21, p < .001$) and anxiety ($\beta = .13, p = .012$), and more physical ($\beta = .20, p$
6 $< .001$) and mental ($\beta = .22, p < .001$) health complaints, but not well-being ($\beta = -.07, p = .182$)
7 or subjective sports performance ($\beta = -.09, p = .078$). Importantly, these effects were robust
8 while controlling for covariates in Step 2 of the regression analyses, with total count of sport-
9 specific stressors still significantly associated with greater symptoms of depression ($\beta = .21, p$
10 $< .001$) and anxiety ($\beta = .13, p = .012$), and more physical ($\beta = .24, p < .001$) and mental (β
11 $= .23, p < .001$) health complaints, but not well-being ($\beta = -.05, p = .309$) or subjective sports
12 performance ($\beta = -.05, p = .379$)³.

13 Likewise, in Step 1 of the regression analyses, total severity of sport-specific stressors
14 was significantly associated with greater symptoms of depression ($\beta = .24, p < .001$) and
15 anxiety ($\beta = .20, p < .001$), and more physical ($\beta = .28, p < .001$) and mental ($\beta = .32, p < .001$)
16 health complaints, but not well-being ($\beta = -.06, p = .259$) or subjective sports performance (β
17 $= -.06, p = .263$). Again, these effects were robust while controlling for covariates in Step 2 of
18 the regression analyses, with total severity of sport-specific stressors still significantly
19 associated with greater symptoms of depression ($\beta = .24, p < .001$) and anxiety ($\beta = .19, p$
20 $< .001$), and more physical ($\beta = .27, p < .001$) and mental ($\beta = .32, p < .001$) health complaints,
21 but not well-being ($\beta = -.05, p = .350$) or subjective sports performance ($\beta = -.02, p = .752$).
22 Therefore, overall, the Sport SAM exhibited very good predictive validity for mental and
23 physical health but not well-being or subjective sports performance.

³ When these regression analyses were repeated with the same independent variables but in reverse order, the results were nearly identical to those observed here, thus providing further support for the predictive validity of the Sport SAM.

1 **Comparative Predictive Validity**

2 As shown in Table 2, total count and severity of sport-specific stressors from the Sport
3 SAM were significantly associated with all the outcomes assessed except well-being and
4 subjective sports performance. Moreover, these results were nearly identical to those observed
5 for the Adult STRAIN, with total count and severity of lifetime (non-sport) stressors
6 significantly associated with all outcomes except for subjective sports performance.

7 Next, to directly compare the Sport SAM and Adult STRAIN, we examined the
8 percentage of variance that was explained by the Sport SAM out of the total variance explained
9 by the complete model (i.e., age; sex; sport type; highest performance level; length of time
10 competing in sport; Adult STRAIN; and Sport SAM). To calculate the increase in variance
11 explained by the Sport SAM over and above the total variance previously explained, we
12 divided the ΔR^2 of the third model (i.e., Covariates + Adult STRAIN + Sport SAM) by the
13 Total R^2 from the second model (i.e., Covariates + Adult STRAIN). Total count of sport-
14 specific stressors explained a significant amount of variance in symptoms of depression (10.26%
15 increase in variance explained), physical health complaints (13.86% increase in variance
16 explained), and mental health complaints (13.87% increase in variance explained), but not
17 symptoms of anxiety, well-being, or subjective sports performance. Furthermore, total severity
18 of sport-specific stressors explained a significant amount of variance in symptoms of
19 depression (7.53% increase in variance explained), physical health complaints (13.70%
20 increase in variance explained), and mental health complaints (19.81% increase in variance
21 explained), but not symptoms of anxiety, well-being, or subjective sports performance (see
22 Table 3). Therefore, assessing sport-related stressors added significant value over and
23 above assessing non-sport-related stressors over the life course for several outcomes.

24 **Test-Retest Reliability**

25 To assess the test-retest reliability of both the Sport SAM and Adult STRAIN, 135

1 participants recompleted these instruments on a second occasion approximately two months
2 after the first administration ($M = 52.80$ days; $SD = 11.78$; Range = 20-76 days). For the Sport
3 SAM, very good test-retest reliability was observed for both total count ($r_{icc} = .87, p < .001$)
4 and total severity ($r_{icc} = .89, p < .001$) of sport-specific stressors. In turn, excellent test-retest
5 reliability was observed for the Adult STRAIN for both total count ($r_{icc} = .95, p < .001$) and
6 total severity ($r_{icc} = .93, p < .001$) of lifetime (non-sport) stressors.

7 **Lifetime (Non-Sport) Stressor Count Characteristics**

8 Next, a series of hierarchical linear regression analyses were conducted to examine
9 associations between the different types of lifetime (non-sport) stressor count and sport
10 performers' health, well-being, and subjective sports performance. With respect to stressor type
11 (acute vs. chronic), total count of acute life events was significantly associated with symptoms
12 of depression ($\beta = .24, p < .001$) and anxiety ($\beta = .20, p < .001$), as well as physical ($\beta = .19, p$
13 $< .001$) and mental ($\beta = .20, p < .001$) health complaints, above and beyond covariates, but not
14 well-being ($\beta = -.04, p = .410$) or subjective sports performance ($\beta = -.04, p = .439$). In contrast,
15 total count of chronic difficulties was significantly associated with symptoms of depression (β
16 $= .41, p < .001$) and anxiety ($\beta = .35, p < .001$), as well as well-being ($\beta = -.23, p < .001$),
17 physical ($\beta = .32, p < .001$) and mental ($\beta = .36, p < .001$) health complaints, and subjective
18 sports performance ($\beta = -.12, p = .014$), above and beyond covariates.

19 With respect to the timing of stressor exposure (early life vs. adulthood), total count of
20 early life stressors was significantly associated with symptoms of depression ($\beta = .26, p < .001$)
21 and anxiety ($\beta = .22, p < .001$), as well as physical ($\beta = .16, p = .001$) and mental ($\beta = .20, p$
22 $< .001$) health complaints, above and beyond covariates, but not well-being ($\beta = -.05, p = .337$)
23 or subjective sports performance ($\beta = -.07, p = .171$). In contrast, total count of adulthood
24 stressors was significantly associated with symptoms of depression ($\beta = .33, p < .001$) and
25 anxiety ($\beta = .28, p < .001$), as well as well-being ($\beta = -.18, p = .001$), and physical ($\beta = .29, p$

1 < .001) and mental ($\beta = .30, p < .001$) health complaints, above and beyond covariates, but not
2 subjective sports performance ($\beta = -.07, p = .194$).

3 As shown in Figure 1, most primary life domains assessed by the Adult STRAIN were
4 significantly associated with outcomes for lifetime (non-sport) stressor count ($ps \leq .040$).
5 Stressors involving other relationships were most strongly associated with outcomes, whereas
6 stressors involving death and possessions were not related to outcomes. As shown in Figure 2,
7 most social-psychological characteristics were significantly associated with outcomes for
8 lifetime (non-sport) stressor count ($ps \leq .017$), except for subjective sports performance.
9 Stressors involving role change/disruption were most strongly associated with outcomes.

10 **Lifetime (Non-Sport) Stressor Severity Characteristics**

11 Next, a series of hierarchical linear regression analyses were conducted to examine
12 associations between the different types of lifetime (non-sport) stressor severity and sport
13 performers' health, well-being, and subjective sports performance. With respect to stressor type
14 (acute vs chronic), the total severity of acute life events was significantly associated with
15 symptoms of depression ($\beta = .29, p < .001$) and anxiety ($\beta = .24, p < .001$), as well as physical
16 ($\beta = .23, p < .001$) and mental ($\beta = .25, p < .001$) health complaints, above and beyond covariates,
17 but not well-being ($\beta = -.08, p = .118$) or subjective sports performance ($\beta = -.04, p = .468$). In
18 contrast, total severity of chronic difficulties was significantly associated with symptoms of
19 depression ($\beta = .42, p < .001$) and anxiety ($\beta = .38, p < .001$), as well as well-being ($\beta = -.23, p$
20 $< .001$), physical ($\beta = .33, p < .001$) and mental ($\beta = .39, p < .001$) health complaints, and
21 subjective sports performance ($\beta = -.10, p = .041$), above and beyond covariates.

22 With respect to the timing of stressor exposure (early life vs adulthood), total severity
23 of early life stressors was significantly associated with symptoms of depression ($\beta = .30, p$
24 $< .001$) and anxiety ($\beta = .25, p < .001$), as well as physical ($\beta = .20, p < .001$) and mental (β
25 $= .24, p < .001$) health complaints, above and beyond covariates, but not well-being ($\beta = -.09,$

1 $p = .081$) or subjective sports performance ($\beta = -.07, p = .161$). In contrast, total severity of
2 adulthood stressors was significantly associated with symptoms of depression ($\beta = .34, p < .001$)
3 and anxiety ($\beta = .31, p < .001$), as well as well-being ($\beta = -.20, p < .001$), and physical ($\beta = .30,$
4 $p < .001$) and mental ($\beta = .34, p < .001$) health complaints, above and beyond covariates, but
5 not subjective sports performance ($\beta = -.07, p = .154$).

6 As shown in Figure 1, most primary life domains were significantly associated with
7 outcomes for lifetime (non-sport) stressor severity ($ps \leq .049$). Stressors involving other
8 relationships were most strongly associated with outcomes, whereas those involving death and
9 possessions were not associated with outcomes. As shown in Figure 2, most social-
10 psychological characteristics were significantly associated with outcomes for lifetime (non-
11 sport) stressor severity ($ps \leq .013$), except for subjective sports performance. Stressors
12 involving role change/disruption were most strongly associated with outcomes.

13 **Mediation Analyses**

14 Finally, we examined whether the relationships between stressor exposure (non-sport
15 and sport-specific) and outcomes were mediated by participants' trait stress appraisals. The
16 results revealed no significant indirect effects between total count of lifetime (non-sport) or
17 sport-specific stressors and outcomes (see Table 4). Therefore, trait stress appraisals did not
18 mediate the relationship between stressor count and the sport performers' mental and physical
19 health, well-being, or sports performance. In contrast, mediation analyses revealed significant
20 indirect effects between total severity of lifetime (non-sport) stressors and symptoms of
21 depression (95% CI = .005 to .037) and anxiety (95% CI = .007 to .052), well-being (95% CI
22 = -.038 to -.005), and physical (95% CI = .006 to .045) and mental (95% CI = .006 to .039)
23 health complaints, but not subjective sports performance (95% CI = -.003 to .003). Similarly,
24 there were significant indirect effects between total severity of sport-specific stressors and
25 symptoms of depression (95% CI = .003 to .055) and anxiety (95% CI = .003 to .073), well-

1 being (95% CI = -.054 to -.002), and physical (95% CI = .002 to .061), and mental (95% CI
2 = .002 to .052) health complaints, but not subjective sports performance (95% CI = -.004
3 to .003). Therefore, trait stress appraisals appeared to mediate the effects of total stressor
4 severity (both non-sport and sport-specific) on sport performers' health and well-being.

5 **Discussion**

6 Prior research has documented the health-damaging consequences of greater lifetime
7 stressor exposure for a variety of mental and physical health outcomes (e.g., Slavich & Shields,
8 2018). Despite this, few studies have examined the combined and cumulative effect of stressors
9 occurring across the lifespan on sport performers' health, well-being, and performance, partly
10 due to the absence of an appropriate instrument for assessing these stressors. Furthermore,
11 researchers in sport have predominantly assessed the *frequency* of a limited number of adverse
12 life (non-sport) stressors and have overlooked other key dimensions such as stressor severity
13 (Moore et al., 2017). This is surprising given that stressor severity is a key dimension that
14 contributes to the development of stress-related illness (Arnold & Fletcher, 2021). To address
15 these issues, we (a) created a Sport SAM for the Adult STRAIN to provide an additional life
16 course assessment of sport-related stressors; (b) examined the Sport SAM's usability,
17 acceptability, validity, and test-retest reliability; (c) assessed how the different types of lifetime
18 (non-sport) stressor exposure assessed by the Adult STRAIN were associated with study
19 outcomes; and (d) investigated the extent to which the relationship between lifetime stressor
20 exposure (non-sport and sport-specific) and outcomes are mediated by trait stress appraisals.

21 The Sport SAM that we created and validated to accompany the Adult STRAIN
22 assesses eight sport-specific stressors that have frequently been reported by sport performers
23 and are consistently associated with poor health—namely, overtraining; excessive external
24 pressure to perform; underperformance; non-selection; training while injured; injury; coach-
25 athlete relationship difficulties; and bullying (Rice et al., 2016). The development of the Sport

1 SAM advances extant literature by providing the first multidimensional instrument that can
2 assess both the frequency and severity of sport-specific stressors over the entire lifespan. The
3 results revealed that participants completed the Adult STRAIN and Sport SAM together in
4 approximately 19 minutes, with minimal missing data and no reported complaints; therefore,
5 it is deemed a usable and acceptable measure. Moreover, this usability and acceptability data
6 was collected from a diverse sample of performers from a variety of sports and competitive
7 levels. Further, the Sport SAM demonstrated very good concurrent validity and test-retest
8 reliability. Finally, in terms of predictive validity, the Sport SAM was associated with four out
9 of the six outcomes assessed, including symptoms of depression and anxiety, and physical and
10 mental health complaints, but not well-being or subjective sports performance. Therefore, sport
11 performers who were exposed to greater and more severe sport-specific stressors over the
12 lifespan were more likely to exhibit poorer health outcomes.

13 Turning to the comparative predictive validity data, the results observed for the Sport
14 SAM were almost identical to those obtained for the Adult STRAIN, with the exception that
15 the Adult STRAIN (i.e., non-sport stressor count and severity) was also significantly associated
16 with lower levels of well-being. One potential explanation for these contrasting findings could
17 be the antithetical nature of sporting participation, whereby sport can contribute to, or detract
18 from, sport performers' well-being (Giles et al., 2020). Therefore, although experiencing sport-
19 specific stressors might have a detrimental impact on a sport performers' well-being, this effect
20 could be attenuated by the benefits of sports participation, such as having a sense of belonging
21 with teammates, coaches, or competitors (Beauchamp & Eys, 2014). Additionally, when
22 directly comparing the Sport SAM and Adult STRAIN, the Sport SAM explained substantial
23 variance in physical and mental health over and above the Adult STRAIN and covariates
24 assessed. This finding emphasizes the importance of assessing sport-specific stressors in
25 addition to lifetime (non-sport) stressors to provide further insight into sport performers' health.

1 Moreover, the results revealed that the perceived severity of lifetime stressors (i.e., non-sport
2 and sport-specific) was more strongly associated with outcomes than the count of such
3 stressors. These findings reinforce the importance of assessing other dimensions beyond count
4 (e.g., severity; Arnold & Fletcher, 2021). An interesting lack of association was observed
5 between stressor exposure (non-sport and sport-specific) and subjective sports performance.
6 One potential explanation for this could be due to the equivocal research findings in the sport
7 psychology literature which have found support for both positive and negative relationships
8 between stressor exposure and performance-related outcomes. Indeed, although some research
9 indicates that experiencing stressors can have a positive impact on performance-related
10 outcomes (e.g., McLoughlin et al., 2021; Moore et al., 2017), some studies have suggested that
11 exposure to stressors can negatively impact performance (e.g., Arnold et al., 2017). In
12 explaining these equivocal findings, scholars have suggested that future research needs to
13 consider the role of key mediators, such as coping strategies, and develop and validate more
14 robust measures of subjective sports performance (Arnold et al., 2018).

15 To address the third aim, we examined how lifetime (non-sport) stressors assessed
16 using the Adult STRAIN were associated with sport performers' health, well-being, and
17 performance. The results revealed that the total count and severity of chronic difficulties were
18 more strongly associated with the outcomes assessed than the total lifetime count and severity
19 of acute life events. These findings are consistent with extant theory and literature indicating
20 that chronic stressors play a key role in shaping negative health outcomes (e.g., Epel et al.,
21 2018; Slavich et al., 2019). Furthermore, the results revealed that stressors occurring in
22 adulthood were more strongly associated with outcomes than early life stressors. These
23 findings are congruent with prior research showing that exposure to greater and more severe
24 recent lifetime stressors is more predictive of ill-health (e.g., Lam et al., 2019; McLoughlin et
25 al., 2021). Finally, the stressor indices that were consistently and significantly associated with

1 the outcomes assessed were other relationships (e.g., parental or non-intimate relationship
2 problems) and role change/disruption (e.g., starting a new job). These results are contrary to
3 classic stress theories (e.g., Selye, 1976) and support the idea that different types of stressors
4 (e.g., acute vs. chronic) might have varying effects on health (Epel et al., 2018).

5 To address the fourth aim, we examined whether trait stress appraisals mediated the
6 effects of lifetime stressor exposure (non-sport and sport-specific) on sport performers' health,
7 well-being, and performance. The results provided some support for the predictions of the
8 integrative model of lifespan stress and health (Epel et al., 2018), demonstrating that sport
9 performers who had experienced greater lifetime stressor severity (non-sport and sport-specific)
10 were more likely to appraise stressors as threatening (i.e., situational demands exceed personal
11 coping resources), leading to poorer health-related outcomes such as greater symptoms of
12 depression. Although these results were significant, it is important to note that the mediation
13 effects were cross-sectional and relatively small in size. Despite this, however, the data
14 suggests that a severe history of lifetime stressor exposure increases the likelihood of
15 developing maladaptive stress responses that are predictive of ill-health (Epel et al., 2018). An
16 interesting lack of association was observed between trait stress appraisals and subjective
17 sports performance. This is surprising given that research has revealed a relation between
18 cognitive appraisals and performance, with challenge appraisals predicting superior
19 performance (e.g., Hase et al., 2019). One potential explanation for this finding could be due
20 to the challenges associated with assessing subjective sports performance (Arnold et al., 2018).

21 Despite the novel findings of this study, several limitations should be noted. First, the
22 study design was cross-sectional, which limits the conclusions that can be drawn from the
23 mediation analyses and in determining directionality or causality. Future research should thus
24 use longitudinal study designs that yield prospective data on the associations between lifetime
25 stressor exposure and health, well-being, and performance (Roberts et al., 2019). Second, the

1 study used self-report measures, which could have been influenced by cognitive bias and social
2 desirability. Therefore, additional research is needed to examine how lifetime stressor exposure
3 (non-sport and sport-specific) influences objective physiological markers of disease (e.g.,
4 immune responses) and trait stress appraisals (e.g., cardiovascular reactivity; Hase et al., 2019)
5 that cannot be affected by self-report biases. Third, although participants represented a wide
6 range of ages (i.e., 18-63 years), the average age of participants was relatively young at 23
7 years old, which could have limited the number of stressors the sample had experienced. While
8 age was included as a covariate in the statistical analyses, future research should attempt to
9 replicate these findings in an older and more experienced sample of sport performers.

10 Notwithstanding these limitations, this study is the first to develop and preliminarily
11 validate a life course assessment of sport-specific stressors (i.e., Sport SAM for the Adult
12 STRAIN). This more holistic assessment tool developed for the sporting domain will advance
13 research on this topic by enabling researchers to examine the combined and cumulative effect
14 of non-sport and sport-specific stressors, which has rarely been done (Fletcher, 2019).
15 Furthermore, this instrument can provide researchers and practitioners with important
16 information indicating which stressors are particularly harmful for sport performers' health,
17 well-being, and performance (e.g., chronic difficulties, recent life events). In addition, we
18 examined a variety of outcomes relating to sport performers' health, well-being, and
19 performance, which is noteworthy considering that prior research has typically focused on only
20 one of these outcomes in isolation (e.g., performance; Moore et al., 2017). Finally, we
21 examined a potential cognitive mechanism (i.e., trait stress appraisals) underpinning the
22 lifetime stressor-health relation, which has not been examined previously.

23 As a result of these strengths, this study has some important theoretical and applied
24 implications. From a theoretical perspective, the findings support the predictions of the
25 integrative model of lifespan stress and health by highlighting which stressors (i.e., chronic

1 difficulties, adulthood stressors) are particularly harmful for sport performers' health, well-
2 being, and performance, as well as improving our understanding of how stressor exposure over
3 the lifespan influences sport performers' general tendencies to appraise stressful situations as
4 a challenge or threat (Epel et al., 2018). Furthermore, this study supports the predictions of the
5 BPSM (Blascovich, 2008b), illustrating that threat appraisals, when frequently experienced,
6 may influence important outcomes beyond sports performance, including health and well-
7 being. As a result, we believe these findings can help guide practitioners in developing
8 interventions designed to mitigate the negative effects of lifetime stressor exposure.

9 From an applied perspective, practitioners and sporting organizations could use the
10 Sport SAM together with the Adult STRAIN to proactively identify, and provide tailored
11 support to, sport performers who are at elevated risk of developing stress-related health
12 problems (e.g., those currently experiencing chronic difficulties). Moreover, where possible,
13 practitioners and sporting organizations should attempt to eliminate or reduce the quantity,
14 frequency, or intensity of stressors by altering the environment in which sport performers
15 operate (Fletcher & Arnold, 2021). We believe that adopting such preventative stress
16 management techniques will help alleviate the overall demand placed upon sport performers
17 (Fletcher et al., 2006). Despite these efforts, it is not always possible to prevent, reduce, or
18 eliminate stressors (Fletcher & Arnold, 2021). As a result, practitioners should also work with
19 sport performers to help them appraise, manage, and deal with stressors more effectively
20 (Fletcher & Arnold, 2021). Indeed, the mediation results support the importance of
21 interventions that encourage sport performers to appraise potentially stressful situations as
22 more a challenge, as opposed to a threat. Research has shown that several intervention
23 strategies could be effective at promoting challenge appraisals (e.g., arousal reappraisal; Moore
24 et al., 2015). Indeed, as part of an arousal reappraisal intervention, practitioners and sporting
25 organizations could encourage sport performers to view pressure-induced elevations in

1 physiological arousal (e.g., racing heart) as a tool that can aid performance (Moore et al., 2015).
2 Finally, sporting organizations must view mental health as a priority by fostering an
3 environment where sport performers feel comfortable seeking help (Rice et al., 2021).

4 In conclusion, this study summarized the development and preliminary validation of
5 the Sport SAM to accompany the Adult STRAIN, as well as examining how lifetime non-sport
6 and sport-specific stressors were related to sport performers' health, well-being, and
7 performance. We also investigated whether trait stress appraisals mediated the relationship
8 between lifetime non-sport and sport-specific stressor exposure and health and performance.
9 The results revealed that the Sport SAM demonstrated good usability and acceptability,
10 concurrent and predictive validity, and test-retest reliability. More specifically, the findings
11 suggest that exposure to stressors that are either chronic, or have occurred in adulthood, are
12 particularly pernicious to sport performers' health and well-being. Finally, the findings
13 demonstrated that athletes who experienced more severe lifetime non-sport and sport-specific
14 stressors tended to appraise stressors as more of a threat (than a challenge), leading in turn to
15 poorer health. Looking forward, additional research is needed to replicate these findings in
16 longitudinal studies; to elucidate the biological mechanisms linking lifetime stress exposure,
17 health, and well-being; and to determine the interventions that are most helpful for mitigating
18 negative stress-related effects.

References

- 1
- 2 Arnold, R., & Fletcher, D. (2012). A research synthesis and taxonomic classification of the
3 organizational stressors encountered by sport performers. *Journal of Sport and Exercise*
4 *Psychology, 34*(3), 397-429. doi:10/f323cj
- 5 Arnold, R., & Fletcher, D. (2021). Stressors, hassles, and adversities. In R. Arnold & D.
6 Fletcher (Eds.), *Stress, well-being, and performance in sport* (pp. 31-62). Routledge.
- 7 Arnold, R., Edwards, T., & Rees, T. (2018). Organizational stressors, social support, and
8 implications for subjective performance in high-level sport. *Psychology of Sport and*
9 *Exercise, 39*, 204-212. doi:10/gfm5g6
- 10 Arnold, R., Fletcher, D., & Daniels, K. (2013). Development and validation of the
11 Organizational Stressor Indicator for Sport Performers (OSI-SP). *Journal of Sport and*
12 *Exercise Psychology, 35*(2), 180-196. doi:10/f4rrsz
- 13 Arnold, R., Fletcher, D., & Daniels, K. (2017). Organizational stressors, coping, and outcomes
14 in competitive sport. *Journal of Sports Sciences, 35*, 694-703. doi:10/ggxtw3
- 15 Beauchamp, M. R., & Eys, M. A. (2014). Group dynamics in exercise and sport psychology.
16 (2nd ed). Routledge.
- 17 Blascovich, J. (2008a). Challenge and threat. In A. J. Elliot (Ed.), *Handbook of approach and*
18 *avoidance motivation* (pp. 431-445). Psychology Press.
- 19 Blascovich, J. (2008b). Challenge, threat, and health. In J. Y. Shah & W. L. Gardner (Eds.),
20 *Handbook of motivation science* (pp. 481-493). Guildford Press.
- 21 Blascovich, J., & Tomaka, J. (1996). The biopsychosocial model of arousal regulation. In M.
22 Zanna (Ed.), *Advances in experimental social psychology* (pp. 1-51). Academic Press.
- 23 Cazassa, M., Oliveira, M., Spahr, C., Shields, G., & Slavich, G. (2020). The Stress and
24 Adversity Inventory for Adults (Adult STRAIN) in Brazilian Portuguese: Initial

- 1 validation and links with executive function, sleep, and mental and physical
2 health. *Frontiers in Psychology*, *10*, 30383. doi:10/gmr8
- 3 DeVellis, R. F. (2017). *Scale development theory and applications* (4th ed.). Sage.
- 4 Epel, E. S., Crosswell, A. D., Mayer, S. E., Prather, A. A., Slavich, G. M., Puterman, E., &
5 Mendes, W. B. (2018). More than a feeling: A unified view of stress measurement for
6 population science. *Frontiers in Neuroendocrinology*, *49*, 146-169. doi:10/gdp5hv
- 7 Faul, F., Erdfelder, E., Lang, A., & Buchner, A. (2007). G*Power 3: A flexible statistical power
8 analysis program for the social, behavioral, and biomedical sciences. *Behavior*
9 *Research Methods*, *39*(2), 175-191. doi:10/bxjdcg
- 10 Fletcher, D. (2019). Psychological resilience and adversarial growth in sport and performance.
11 In E. O. Acevedo (Ed.), *The Oxford encyclopedia of sport, exercise, and performance*
12 *psychology* (pp. 731-756). Oxford University Press.
- 13 Fletcher, D., & Arnold, R. (2021). Stress and pressure training. In R. Arnold & D. Fletcher
14 (Eds.), *Stress, well-being, and performance in sport* (pp. 261-296). Routledge.
- 15 Fletcher, D., Hanton, S., & Mellalieu, S. D. (2006). An organizational stress review:
16 Conceptual and theoretical issues in competitive sport. In S. Hanton & S. D. Mellalieu
17 (Eds.), *Literature reviews in sport psychology* (pp. 321-373). Nova Science.
- 18 Giles, S., Fletcher, D., Arnold, R., Ashfield, A., & Harrison, J. (2020). Measuring well-being
19 in sport performers: Where are we now and how do we progress? *Sports Medicine*,
20 *50*(7), 1255-1270. doi:10/gj2fgq
- 21 Gulliver, A., Griffiths, K. M., Mackinnon, A., Batterham, P. J., & Stanimirovic, R. (2015). The
22 mental health of Australian elite athletes. *Journal of Science and Medicine in*
23 *Sport*, *18*(3), 255-261. doi:10/gc95hq

- 1 Hase, A., O'Brien, J., Moore, L., & Freeman, P. (2019). The relationship between challenge
2 and threat states and performance: A systematic review. *Sport, Exercise, and*
3 *Performance Psychology*, 8(2), 123-144. doi:10/gmr9
- 4 Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis:*
5 *A regression-based approach* (2nd ed.). Guilford Press.
- 6 Howells, K., Sarkar, M., & Fletcher, D. (2017). Can athletes benefit from difficulty? A
7 systematic review of growth following adversity in competitive sport. *Progress in*
8 *Brain Research*, 234, 117-159. doi: doi:10/fctp
- 9 Kessler, R., Andrews, G., Colpe, L., Hiripi, E., Mroczek, D., Normand, S., ... & Zaslavsky, A.
10 M. (2002). Short screening scales to monitor population prevalences and trends in non-
11 specific psychological distress. *Psychological Medicine*, 32(6), 959-976.
12 doi:10/bt5xdw
- 13 Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation
14 coefficients for reliability research. *Journal of Chiropractic Medicine*, 15, 155-163.
15 doi:10/b84r
- 16 Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression
17 severity measure. *Journal of General Internal Medicine*, 16(9), 606-613. doi:10/btcq9f
- 18 Lam, J. C. W., Shields, G. S., Trainor, B. C., Slavich, G. M., & Yonelinas, A. P. (2019). Greater
19 lifetime stress exposure predicts blunted cortisol but heightened DHEA responses to
20 acute stress. *Stress and Health*, 35, 15-26. doi:10/gd3p4k
- 21 Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer.
- 22 McLoughlin, E., Fletcher, D., Slavich, G. M., Arnold, R., & Moore, L. J. (2021). Cumulative
23 lifetime stress exposure, depression, anxiety, and well-being in elite athletes: A mixed
24 method study. *Psychology of Sport and Exercise*, 52, 101823. doi:10/gfj5

- 1 Moore, L., Freeman, P., Hase, A., Solomon-Moore, E., & Arnold, R. (2019). How consistent
2 are challenge and threat evaluations? A generalizability analysis. *Frontiers in*
3 *Psychology, 10*, 1778. doi:10/gmsb
- 4 Moore, L., Vine, S., Wilson, M., & Freeman, P. (2015). Reappraising threat: How to optimize
5 performance under pressure. *Journal of Sport and Exercise Psychology, 37*(3), 339-
6 343. doi:10/f7n6rv
- 7 Moore, L., Young, T., Freeman, P., & Sarkar, M. (2017). Adverse life events, cardiovascular
8 responses, and sports performance under pressure. *Scandinavian Journal of Medicine*
9 *& Science in Sports, 28*(1), 340-347. doi:10/gjgb7k
- 10 Pegg, S., Ethridge, P., Shields, G., Slavich, G., Weinberg, A., & Kujawa, A. (2019). Blunted
11 social reward responsiveness moderates the effect of lifetime social stress exposure on
12 depressive symptoms. *Frontiers in Behavioral Neuroscience, 13*, 178. doi:10/gmsc
- 13 Petrie, T. (1992). Psychosocial antecedents of athletic injury: The effects of life stress and
14 social support on female collegiate gymnasts. *Behavioral Medicine, 18*(3), 127-138.
15 doi:10/bmgt2n
- 16 Power, T., & Hill, L. (2010). Individual differences in appraisal of minor, potentially stressful
17 events: A cluster analytic approach. *Cognition & Emotion, 24*(7), 1081-1094.
18 doi:10/bf7vtm
- 19 Rice, S. M., Purcell, R., De Silva, S., Mawren, D., McGorry, P. D., & Parker, A. G. (2016).
20 The mental health of elite athletes: A narrative systematic review. *Sports*
21 *Medicine, 46*(9), 1333-1353. doi:10/f9bvq9
- 22 Rice, S. M., Walton, C. C., Gwyther, K., & Purcell, R. (2021). Mental health. In R. Arnold &
23 D. Fletcher (Eds.), *Stress, well-being, and performance in sport* (pp. 167-188).
24 Routledge.

- 1 Riemer, H., & Chelladurai, P. (1998). Development of the Athlete Satisfaction Questionnaire
2 (ASQ). *Journal of Sport and Exercise Psychology*, 20(2), 127-156. doi:10/gmsd
- 3 Roberts, G., Arnold, R., Turner, J., Colclough, M., & Bilzon, J. (2019). A longitudinal
4 examination of military veterans' Invictus Games stress experiences. *Frontiers in*
5 *Psychology*, 10, 1934. doi:10/gmsf
- 6 Roy-Davis, K., Wadey, R., & Evans, L. (2017). A grounded theory of sport injury-related
7 growth. *Sport, Exercise, and Performance Psychology*, 6(1), 35-52. doi:10/f9xbp4
- 8 Rumbold, J., Fletcher, D., & Daniels, K. (2020). An experience sampling study of
9 organizational stress processes and future playing time in professional sport. *Journal of*
10 *Sports Sciences*, 38(5), 559-567. doi:10/ghc9tw
- 11 Sarkar, M., & Fletcher, D. (2014). Psychological resilience in sport performers: A review of
12 stressors and protective factors. *Journal of Sports Sciences*, 32(15), 1419-1434. doi:
13 doi:10/bchc
- 14 Schat, A., Kelloway, E., & Desmarais, S. (2005). The Physical Health Questionnaire (PHQ):
15 Construct validation of a self-report scale of somatic symptoms. *Journal of*
16 *Occupational Health Psychology*, 10(4), 363-381. doi:10/cxd9xq
- 17 Schönbrodt, F., & Perugini, M. (2013). At what sample size do correlations stabilize? *Journal*
18 *of Research in Personality*, 47(5), 609-612. doi:10/f496x4
- 19 Selye, H. (1976). *The Stress of Life*. (2nd ed). McGraw-Hill.
- 20 Simms, M., Arnold, R., Turner, J., & Hays, K. (2020). A repeated-measures examination of
21 organizational stressors, mental and physical health, and perceived performance over
22 time in semi-elite athletes. *Journal of Sport Sciences*, 39(1), 64-77 doi:10/gmsg
- 23 Slavich, G. M. (2019). Stressnology: The primitive (and problematic) study of life stress
24 exposure and pressing need for better measurement. *Brain, Behavior, and Immunity*,
25 75, 3-5. doi:10/gg3rcr

- 1 Slavich, G. M. (2020). Social safety theory: A biologically based evolutionary perspective on
2 life stress, health, and behavior. *Annual Review of Clinical Psychology, 16*, 265-295.
3 doi:10/ggxxvs
- 4 Slavich, G. M., & Shields, G. S. (2018). Assessing lifetime stress exposure using the Stress
5 and Adversity Inventory for Adults (Adult STRAIN). *Psychosomatic Medicine, 80*(1),
6 17-27. doi:10/ggvnmjk
- 7 Slavich, G. M., Stewart, J. G., Esposito, E. C., Shields, G. S., & Auerbach, R. P. (2019). The Stress
8 and Adversity Inventory for Adolescents (Adolescent STRAIN): Associations with mental
9 and physical health, risky behaviors, and psychiatric diagnoses in youth seeking treatment.
10 *Journal of Child Psychology and Psychiatry, 60*(9), 998-1009. doi:10/gg8ggf
- 11 Spitzer, R., Kroenke, K., Williams, J., & Löwe, B. (2006). A brief measure for assessing
12 generalized anxiety disorder. *Archives of Internal Medicine, 166*(10), 1092-1097.
13 doi:10/d7z8rz
- 14 Tomaka, J., Palacios, R., Champion, C., & Monks, S. (2018). Development and validation of
15 an instrument that assesses individual differences in threat and challenge
16 appraisal. *Journal of Depression and Anxiety, 7*(3), 1-10. doi:10/gmsm
- 17 Topp, C., Østergaard, S., Søndergaard, S., & Bech, P. (2015). The WHO-5 Well-Being Index: A
18 systematic review of the literature. *Psychotherapy and Psychosomatics, 84*(3), 167-176.
19 doi:10/f678mq
- 20 World Health Organization. (1998). *Well-being measures in primary health care/The*
21 *Depcare Project*. WHO Regional Office for Europe: Copenhagen.

Table 1*Medians, standard deviations, and intercorrelations for main study variables*

	Median	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Depression	5.00	4.44	-														
2. Anxiety	4.00	4.40	.70***	-													
3. Well-being	64.00	15.94	.50***	.40***	-												
4. Mental Health Complaints	13.00	5.23	.67***	.72***	.43***	-											
5. Physical Health Complaints	32.00	10.84	.51***	.54***	.34***	.57***	-										
6. Subjective Sporting Performance	4.00	1.36	.20***	.14**	.31***	.22***	.17**	-									
7. Total count of lifetime stressors	9.00	7.70	.34***	.28***	.13**	.27***	.26***	.11*	-								
8. Total severity of lifetime stressors	19.00	18.24	.37***	.33***	.16**	.33***	.30***	.10*	.92***	-							
9. Total count of sport stressors	5.00	4.21	.21***	.13*	.07	.22***	.20***	.09	.22***	.24***	-						
10. Total severity of sport stressors	9.00	7.39	.24***	.20***	.06	.32***	.28***	.06	.24***	.29***	.84***	-					
11. Age	21.00	5.33	-.12*	-.07	-.13*	-.18***	-.11*	.09	.16**	.19***	-.03	-.13	-				
12. Sex	-	-	.07	.15**	-.05	.17**	.32***	-.06	.002	.05	-.09	.05	.04	-			
13. Sport type	-	-	-.03	-.05	-.03	-.04	-.01	-.08	-.01*	-.07	-.21***	-.24***	-.11*	-.02	-		
14. Highest performance level	-	-	-.02	.03	-.07	-.004	.01	.017**	.09	.11*	.13**	.15**	.60***	.14**	-.12*	-	
15. Length of time competing in sport	10.00	6.43	-.02	-.04	-.01	-.01	.07	.01	.02	.04	.08	.10	-.04	.08	.22***	.14**	-

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2*Comparative predictive validity of the Sport SAM and Adult STRAIN*

		Sport SAM	Adult STRAIN
		β	
Stressor Count:	Depression (PHQ-9)	.21***	.37***
	Anxiety (GAD-7)	.13*	.30***
	Well-being (WHO-5)	-.05	-.15**
	Physical Health (PHQ)	.24***	.29***
	Mental Health (K-6)	.23***	.31***
	Subjective Sports Performance (ASQ)	-.05	-.09
Stressor Severity:	Depression (PHQ-9)	.24***	.41***
	Anxiety (GAD-7)	.19***	.36***
	Well-being (WHO-5)	-.05	-.19***
	Physical Health (PHQ)	.27***	.32***
	Mental Health (K-6)	.32***	.37***
	Subjective Sports Performance (ASQ)	-.02	-.09

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed. All associations are adjusted for relevant covariates including age, sex, sport type, highest performance level, and length of time competing in sport.

Table 3

Comparative predictive validity of the Adult STRAIN and Sport SAM by highlighting the variance explained in each outcome in each multiple linear regression model

Model	Depression			Anxiety			Well-being			Physical Health			Mental Health			Performance		
	R ²	Adj. R ²	ΔR ²	R ²	Adj. R ²	ΔR ²	R ²	Adj. R ²	ΔR ²	R ²	Adj. R ²	ΔR ²	R ²	Adj. R ²	ΔR ²	R ²	Adj. R ²	ΔR ²
Count:																		
Covariates	.03	.01	-	.04	.03	-	.02	.01	-	.12	.11	-	.08	.07	-	.04	.03	-
Covariates + Adult STRAIN	.16	.14	.13***	.13	.11	.09***	.04	.03	.02**	.20	.19	.08***	.16	.16	.09***	.05	.03	.01
Covariates + Adult STRAIN + Sport SAM	.17	.16	.02**	.13	.11	.00	.04	.03	.00	.23	.22	.03***	.18	.18	.02***	.05	.03	.00
% of variance explained by the Sport SAM over and above the total variance previously explained		10.26%			3.17%			0%			13.86%			13.87%			2.08%	
Severity:																		
Covariates	.03	.01	-	.04	.03	-	.02	.01	-	.12	.11	-	.08	.07	-	.04	.03	-
Covariates + Adult STRAIN	.19	.17	.16***	.16	.15	.12***	.06	.04	.04***	.22	.21	.01***	.21	.20	.13***	.05	.03	.01
Covariates + Adult STRAIN + Sport SAM	.20	.19	.01**	.17	.15	.01	.06	.04	.00	.25	.24	.03***	.25	.24	.04***	.05	.03	.00
% of variance explained by the Sport SAM over and above the total variance previously explained		7.53%			3.70%			0%			13.70%			19.81%			0%	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$, two-tailed. To calculate the increase in variance explained by the Sport SAM over and above the total variance previously explained, we divided the ΔR^2 of the third model (i.e., Covariates + Adult STRAIN + Sport SAM) by the Total R^2 from the second model (i.e., Covariates + Adult STRAIN).

Table 4

Mediation analyses with stressor exposure (i.e., total count of lifetime stressors, total severity of lifetime stressors, total count of sport-specific stressors, and total severity of sport-specific stressors) entered as the independent variable; study outcomes (i.e., depression, anxiety, well-being, general physical and mental health complaints, or subjective sports performance) entered as the dependent variable; and trait stress appraisals (i.e., challenge and threat) entered as the potential mediator

IV	DV	Effect	SE	LL 95% CI	UL 95% CI
Total Count of Lifetime Stressors	Depression	.010	.015	-.021	.040
	Anxiety	.013	.020	-.027	.052
	Well-being	-.009	.014	-.036	.019
	Physical Health Complaints	.011	.018	-.024	.047
	Mental Health Complaints	.010	.015	-.020	.039
	Subjective Sports Performance	-.001	.001	-.002	.003
Total Severity of Lifetime Stressors	Depression	.021	.008	.005	.037*
	Anxiety	.029	.011	.007	.052*
	Well-being	-.020	.009	-.038	-.005*
	Physical Health Complaints	.025	.010	.006	.045*
	Mental Health Complaints	.022	.008	.006	.039*
	Subjective Sports Performance	.000	.002	-.003	.003
Total Count of Sport-Specific Stressors	Depression	.004	.018	-.030	.042
	Anxiety	.005	.024	-.041	.053
	Well-being	-.003	.017	-.040	.039
	Physical Health Complaints	.004	.020	-.034	.046
	Mental Health Complaints	.004	.018	-.032	.038
	Subjective Sports Performance	.000	.001	-.003	.002
Total Severity of Sport-Specific Stressors	Depression	.027	.013	.003	.055*
	Anxiety	.036	.018	.003	.073*
	Well-being	.025	.013	-.054	-.002*
	Physical Health Complaints	.030	.015	.002	.061*
	Mental Health Complaints	.027	.013	.002	.052*
	Subjective Sports Performance	.000	.002	-.004	.003

Note. LL = lower limit; CI = confidence interval; UL = upper limit. * = significant indirect effect.

Figure 1

Multiple linear regression models examining associations between the primary life domains assessed by the Adult STRAIN and the six outcomes assessed

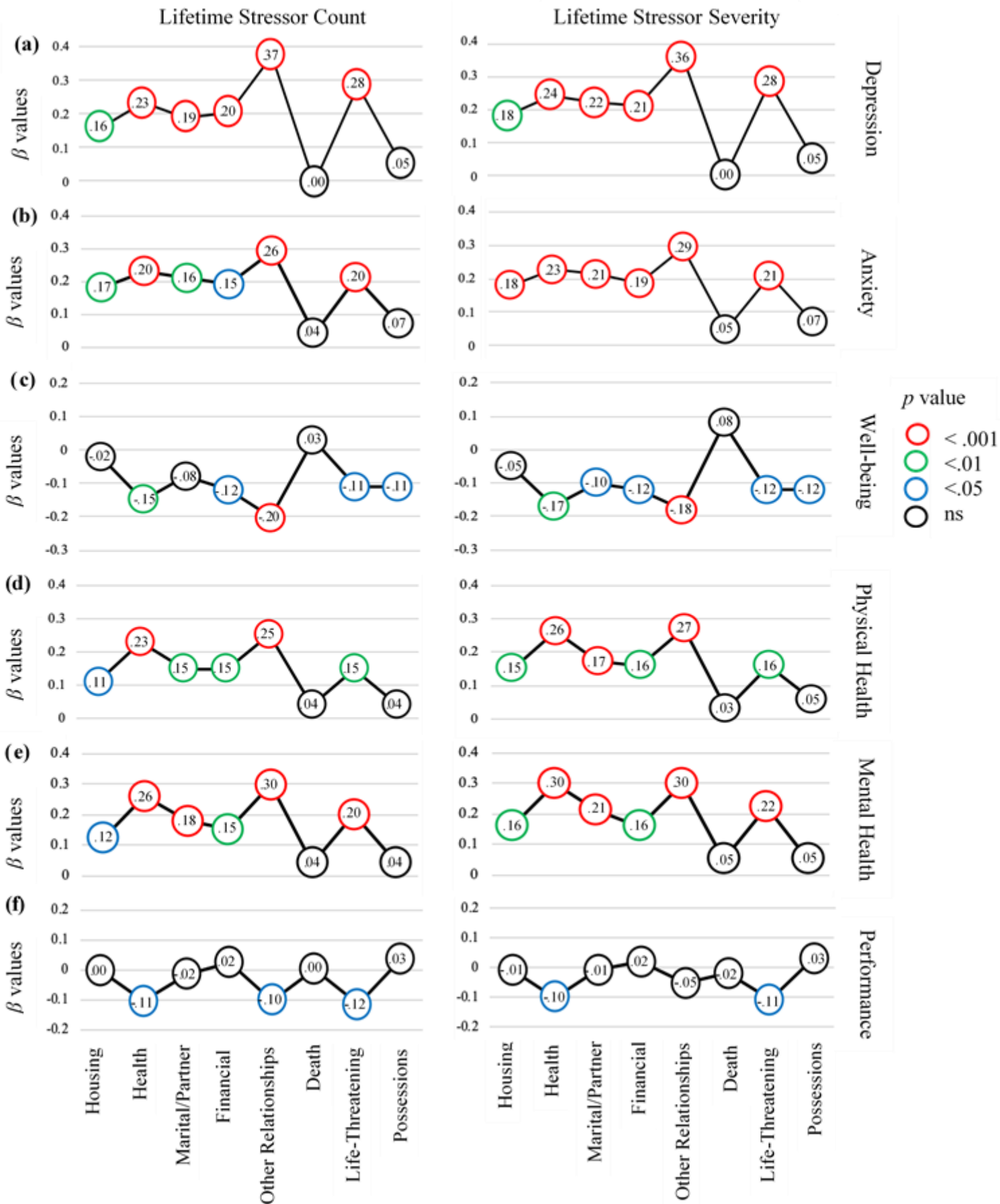


Figure 2

Multiple linear regression models examining associations between the core social-psychological characteristics assessed by the Adult STRAIN and the six outcomes assessed

