

# Investigating the interconnectedness of athletes' performance beliefs, coping ability, and mental health, and the efficacy of a REBT-inspired mobile app intervention

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## ABSTRACT

**Objective:** This study explored the interrelatedness between athletes' performance beliefs, coping ability, and mental health, and evaluated a four-week Rational Emotive Behaviour Therapy (REBT) mobile app intervention targeting these factors

**Design and Methods:** A multiphase randomised comparative design was used where 155 athletes ( $M_{age} = 26.93$ ,  $SD = 11.32$ ) completed an online survey. A subset of 23 athletes ( $M_{age} = 33.70$ ,  $SD = 14.15$ ) participated in a four-week mobile-app intervention of which the experimental group received eight micro-learning sessions focused on REBT principles and self-help activities to challenge and replace irrational thinking in sport, while the control group received conventional psychological skills training

**Results:** Correlation analyses revealed significant associations between the factors. Further analyses using Hayes' PROCESS macro revealed that both coping ability and irrational beliefs mediated the relationship between them and mental health, with coping ability showing a stronger mediation effect. Furthermore, independent samples *t*-tests analyses confirmed significant improvements in participants' exhibition of irrational performance beliefs upon completion of the RBT-inspired mobile app intervention, with thematic analyses of qualitative feedback highlighting the mobile app's utility as a tool for self-management of cognitions and emotions in sport

**Conclusion:** The incorporation of psychological skills training to enhance coping ability should remain integral to REBT approaches aimed at improving athletes' mental health in sport. Additionally, mobile web-based interventions hold potential as a valuable and easily accessible tool to support athletes' psychological needs.

## 1. Introduction

Sport in many ways is considered a high-pressure environment where athletes are exposed to a multitude of stressors, ranging from physical stressors such as injury and exhaustion to psychological stresses associated with competition, performance pressures, and juggling personal commitments (Arnold et al., 2017; Poulus et al., 2022). Competitive sport makes it more difficult for athletes to deal with, since the athletes are not only facing internal expectations, but also external pressure from coaches, the public, and sponsors. Unless mitigated, these stressors have negative consequences, such as compromised mental health, performance decline, and maladaptive coping behaviours (Rice et al., 2016; McLoughlin et al., 2021). Because stress has a negative impact on both well-being and performance, it is essential to examine the psychological mechanisms through which coping and mental health

in sport can be promoted among athletes.

### 1.1. Mental health, coping ability, and performance beliefs in sport

Mental health refers to the psychological well-being of a person in relation to their emotional, cognitive, and social functioning. In sport, it is often reflected by an athlete's ability to manage stress, cope with competitive demands, maintain motivation, and sustain positive mental states throughout the process of engagement in sport-related activities (Gulliver et al., 2022). Therefore, mental health in sport is closely linked to adaptive coping behaviours such the openness to constructive criticism, ability to stay focused under pressure/after setbacks, as well as having clear goals, and mentally prepare for competition (Nuetzel, 2023). However, athletes with poor coping ability who use maladaptive strategies (i.e., avoidance, self-criticism, dysfunctional striving,

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substance use) are more susceptible to psychological strain, anxiety, depression, and performance deterioration (González & Tomás, 2020). The Revised Theory of Challenge and Threat in Athletes (TCTSA-R; Meijen et al., 2020) provides a useful framework for understanding how athletes appraise and respond to stress. According to this theory, athletes who interpret stressors as challenges are more likely to engage in adaptive coping responses that facilitate performance and mental well-being. Conversely, when stress is perceived as a threat, it has the potential to trigger physiological and psychological reactions (e.g., heightened anxiety, cognitive interference, and avoidance behaviours) that weaken performance and mental well-being (Meijen et al., 2020). The way in which athletes interpret and respond to stressful situations, is also highly dependent on their underlying performance beliefs, which make cognitive interventions aimed at these beliefs particularly relevant (Chadha et al., 2019; Turner, 2019). This raises an important question as to how irrational performance beliefs (IPBs) and coping ability interact to influence athletes' mental health.

### 1.2. Rational Emotive Behaviour Therapy (REBT) in sport

One approach that is increasingly adopted in contemporary sport psychology practices dealing with performance issues and poor mental health is Rational Emotive Behaviour Therapy (REBT), a cognitive-behavioural approach aimed at addressing dysfunctional emotions that stem from rigid and maladaptive beliefs (Turner, 2019). REBT interventions have demonstrated significant efficacy in sports, leading to improved performance under pressure (Nejati et al., 2024), enhanced executive functions (e.g., inhibition and cognitive flexibility), and better regulation of competitive anxiety and perfectionistic tendencies (Tóth et al., 2023). In tradition with the ABC[DE] model of broader cognitive therapy (Ellis, 1957), REBT suggests that emotional and behavioural consequences (C - Consequence) do not follow from stressors per se (A - Adversity) but from the belief (B - Belief) concerning those stressors (Ellis & Dryden, 2007; Turner, 2016). If the adopted beliefs are of an irrational nature, they are most likely to cause disturbance and maladaptive behaviour. Irrational beliefs in this respect, are subdivided into primary and secondary beliefs. The primary irrational beliefs or core beliefs are basic, rigid, absolute demands one makes on themselves, others, or the world (e.g., 'must', 'should', 'ought to'). In athletes, primary irrational beliefs can take the form of 'musturbatory' thinking such as, "I *must* always perform at my best or else I am a failure", or "I *must* have my coach's approval at all times". Secondary irrational beliefs arise from primary irrational beliefs and can be expressed as catastrophizing (e.g. "Losing this game will completely ruin my reputation"), frustration intolerance (e.g., "I just can't stand the pressure of competition"), awfulizing (e.g., "Injury is the very worst thing that could happen to me"), and self-/other depreciation (e.g. "Since I made that mistake, I'm a terrible athlete"). Irrational performance beliefs (IPB) foster negative emotional states, such as anxiety and self-doubt, which adversely affect performance and well-being. On the contrary, rational beliefs (e.g., "A single performance cannot determine my ability") help athletes effectively manage their emotions and respond constructively in adverse/stressful situations (Turner, 2016). Given the 'win at all costs' thinking that is notoriously linked to high-performance sports and often perpetuated by club slogans, fans, and media, along with the uncertainties that are inherent in sport, IPBs are quickly assimilated by athletes (Jooste et al., 2023). Research evidence on the utility of REBT in treating performance-related concerns in sport suggests that when athletes learn to challenge (Dispute - D) the irrational beliefs by questioning their logic, evidence, and helpfulness (e.g., "Is this belief realistic?"), and replace any irrational beliefs with more rational, adaptive alternatives (Effective new belief = E), they build greater emotional resiliency, healthier self-conceptions, and adaptive ways to cope with stressors. This ultimately leads to better regulation of emotions, improved performance, and mental well-being (Turner & Barker, 2015; Everson & Terjesen, 2023).

### 1.3. Digital interventions and the potential of REBT-based mobile learning

While sports psychologists play a critical role in equipping athletes with effective coping strategies, traditional psychological support is often inaccessible. Financial, logistical, and cultural barriers often limit the availability of one-to-one psychological services, especially at grassroots and semi-professional levels (Gulliver et al., 2012; Ferraro & Rust, 2000). This highlights the desperate need for scalable, cost-effective psychological interventions that can be accessed remotely. Mobile learning applications offer a promising solution by providing structured, accessible, and cost-effective access to sport psychology support. Digital interventions, such as biofeedback, virtual reality, and mobile apps, have been increasingly integrated into sport psychology to enhance self-regulation and mental performance (Giblin et al., 2016). In particular, mobile applications offer significant advantages owing to their portability, adaptability, and suitability. Despite the proliferation of general mental health apps (e.g., Calm, Headspace) and sport-specific platforms (e.g., 'A Champion's Mind'), few mobile applications have integrated evidence-based cognitive restructuring techniques, such as REBT, that are tailored to the demands of competitive sport. This represents a critical gap in digital sport psychology. Furthermore, while younger generations, particularly Gen Z, exhibit a significant reliance on mobile devices for communication, information access, entertainment, and social interaction (Milne-Ives et al., 2023), research suggests that engagement with existing digital interventions and adoption among athletes is often low due to lack of personalisation and poor interface design (Rist & Pearce, 2017).

### 1.4. The present study

Given the rising prevalence of mental health challenges in sport (Håkansson et al., 2020), this study examined the co-occurrence of athletes' IPBs, coping ability, and their combined influence on mental health. While the stress-coping model (Lazarus & Folkman, 1984) conceptualises coping ability as a foundational determinant of psychological outcomes, REBT posits that irrational beliefs are primary causal agents in the development of mental health difficulties (Ellis & Dryden, 2007). This theoretical divergence highlights a gap in current understanding regarding the directionality of influence between IPBs and coping capacity. Specifically, it remains unclear whether IPBs are antecedents or consequences of coping ability. To the best of our knowledge, limited research has directly examined the unique interplay between IPBs and athletic coping ability in relation to mental health outcomes in sport. Elucidating how coping resources function during stress-inducing or activating situations, particularly in the presence of maladaptive cognitions implicated in psychopathology, may offer valuable insights into the psychological risk factors that contribute to athlete mental health. Such insights may also enable practitioners to refine and expand their application of Rational Emotive Behaviour Therapy (REBT) to better support athletes' mental health in sport. Furthermore, considering the barriers to traditional psychological support, scalable evidence-based interventions that enhance athletes' mental health by targeting maladaptive thinking patterns adopted in sport are needed. Mobile learning platforms offer a promising avenue for delivering structured and engaging psychological interventions that are accessible to athletes at all levels. Therefore, this study aims to answer the following research question: How do IPBs and coping ability interact to influence athletes' mental health, and what is the efficacy of a four-week REBT-inspired mobile learning intervention on improving these factors?

Based on the reviewed literature, we hypothesised that; H1: higher IPBs levels correspond with lower athletic coping ability. Additionally, IPBs will be inversely related to mental health, whereas athletic coping ability will be positively associated with mental health. It is also expected that; H2: athletic coping ability will attenuate the detrimental influence of IPBs on athletes perceived mental health. This hypothesis

aligns with findings demonstrating that aspects underscoring cognitive schemas account for the impact of irrational beliefs on psychological distress in mediation models (Buschmann et al., 2018; Turner et al., 2019). Finally, we assume that H3: athletes who complete the REBT-inspired mobile learning intervention will exhibit significant improvements in their exhibition of IPBs, overall coping ability, and mental health in sport compared to baseline measures.

By testing these hypotheses, this study intends to deepen the understanding of the dynamic interplay between athletes' performance beliefs, coping ability, and mental health for a more nuanced and refined approach in sport psychology practice. Additionally, the findings may contribute to the use of scalable and easily accessible mobile technology as a tool that supplements psychological interventions aimed at promoting athletes' belief systems, coping mechanisms, and overall mental health in sport.

## 2. Methods

### 2.1. Participants

A total of 155 athletes ( $M_{age} = 26.93$ ,  $SD = 11.32$ ) from different sporting codes (i.e., rowing, basketball, volleyball, football, futsal, running, boxing, paddling, sailing, ultimate frisbee, and weightlifting) and levels of competition were recruited for the first phase of the study, which was to determine the interrelationship between athletes' IPBs, coping ability, and mental health in sport based on data gathered through an online survey on the Qualtrics Platform. Twenty-three of these participants ( $M_{age} = 33.70$ ,  $SD = 14.15$ ) consented to proceed and participated in a second phase of the study comprising a four-week web-based intervention with post-intervention and retention testing. The inclusion criteria required participants to have a good command of English language, be competing athletes aged 18 and older, and have no medical condition or clinical problem that would put them in any harm when requested for information pertaining to the study variables. Additional information about the study sample is presented in Table 1. Participants were recruited by the researcher, who posted a study advert on relevant social media pages to access sport clubs, teams and, coaches in England. Most of the participants were enlisted through face-to-face meetings with sports clubs and teams, where the athletes were explained the study nature and requirements. Although the sample size of the first objective ( $N = 155$ ) of the study exceeded the suggested sample size for testing the mediation effects across various conditions (i.e., medium effect,  $a = 0.39$ ,  $b = 0.39$ ,  $R^2 \approx 0.06$ )  $\rightarrow N \approx 78$ ; Fritz & Mackinnon, 2007), a GPower analysis with F tests (repeated measures

ANOVA within-between interaction) with a medium effect size ( $f = 0.25$ ) assumed, an error of probability of 0.05 at 80 % power with 2 groups entered, indicated a total sample of 40 participants (20 participants in each group) for the intervention component of the study. Regrettably, only 25 participants commenced the intervention phase, which was delivered in staggered manner over a six-month period to coincide with participants' in-season training and competition schedules. Subsequently, two participants from the control group did not complete the intervention and were therefore excluded from post-intervention testing (T2). This was further reduced to 15 participants for the three-week retention test (T3).

### 2.2. Research design and procedures

The study adopted a multiphase randomised comparative design, which was reviewed and approved through the Health and Life Sciences Research Ethics Review system at Northumbria University (Ref: 53037). The study advert that had been circulated to the athletes contained a link and a scannable QR code that led them to an online survey designed on the Qualtrics platform. The online survey was opened with an information sheet that provided a detailed description of the study, after which prospective participants were required to electronically provide informed consent before being allowed access to the survey items. The survey items requested the participants to provide demographic data and their responses to items on the Irrational Performance Beliefs Inventory, the Athletic Coping Skill Inventory, and the Athlete Psychological Strain Questionnaire (study phase 1). After completing the online survey (T1), the participants downloaded the mobile app TalentCards on their mobile phones. Using the site [www.randomizer.org](http://www.randomizer.org), interested participants were randomly assigned either to an REBT-inspired content (experimental group) or a psychological skills training (PST)-based content program (control group). Each program consisted of eight micro-learning sessions (two sessions per week for four weeks), each consisting of 20 to 30 flashcards and interactive questions, that took approximately 5 to 10 min to complete (phase 2 of the study). Participants were asked to work through the content and activities presented via the TalentCards app on their own internet-enabled devices, with reminders being sent each Monday and Thursday for four weeks. Progress and reminders were transmitted via smartphone/app notifications and email correspondence. After completion of all eight sessions, participants received an email with a new link to the original survey, which they were asked to complete for post-intervention testing (T2). Although a separate hypothesis was not formulated specifically to assess the maintenance of intervention effects, participants were contacted via

**Table 1**  
Sample demographic information for aims one and two of the study.

|                                        |                          | Aim/Phase 1 (Interrelationship between variables) |  | Aim/Phase 2 (REBT-inspired web-based intervention) |                                 |
|----------------------------------------|--------------------------|---------------------------------------------------|--|----------------------------------------------------|---------------------------------|
|                                        |                          |                                                   |  | Control group ( $N = 9$ )                          | Experimental group ( $N = 14$ ) |
| <b>No of Participants</b>              |                          | Athletes ( $N = 155$ )                            |  | Athletes ( $N = 23$ )                              |                                 |
| <b>Mean age in years</b>               |                          | 26.93 ( $SD = 11.32$ )                            |  | 33.70 ( $SD = 14.15$ )                             |                                 |
| <b>Gender Identification</b>           | Female                   | 44.5 %                                            |  | 33.3 %                                             | 35.7 %                          |
|                                        | Male                     | 54.2 %                                            |  | 66.7 %                                             | 64.3 %                          |
|                                        | Non-binary/ third gender | 0.6 %                                             |  | 0 %                                                | 0 %                             |
|                                        | Prefer not to say        | 0.6 %                                             |  | 0 %                                                | 0 %                             |
| <b>Sport involvement</b>               | Individual               | 13.5 %                                            |  | 11.1 %                                             | 14.3 %                          |
|                                        | Individual & Team        | 5.2 %                                             |  | 11.1 %                                             | 7.1 %                           |
|                                        | Team                     | 81.3 %                                            |  | 77.8 %                                             | 78.6 %                          |
| <b>Level of competition</b>            | Club                     | 27.1 %                                            |  | 44.4 %                                             | 42.9 %                          |
|                                        | County                   | 1.3 %                                             |  | 0 %                                                | 0 %                             |
|                                        | National                 | 7.7 %                                             |  | 11.1 %                                             | 21.4 %                          |
|                                        | Professional             | 9.7 %                                             |  | 0 %                                                | 0 %                             |
|                                        | Semi-professional        | 3.9 %                                             |  | 11.1 %                                             | 0 %                             |
| <b>Experience at the current level</b> | University               | 50.3 %                                            |  | 33.3 %                                             | 35.7 %                          |
|                                        | 0–2 years                | 27.7 %                                            |  | 55.6 %                                             | 28.6 %                          |
|                                        | 3–6 years                | 29.0 %                                            |  | 11.1 %                                             | 28.6 %                          |
|                                        | 7+ years                 | 43.2 %                                            |  | 33.3 %                                             | 42.9 %                          |

email and invited to complete the same survey three weeks post-intervention (T3). This follow-up assessment was intended to evaluate the short-term durability of the intervention effects over time (Davis & Turner, 2020). In the final survey, the participants were provided with an opportunity to provide qualitative feedback on their app experience through open-ended questions. During the intervention, the researcher was available for email and telephone contact to answer any queries. This approach is in line with that used in previous REBT studies (e.g., Bailey & Turner, 2023; Cunningham & Turner, 2016).

TalentCards is a cloud-based, mobile application platform for microlearning. This platform supports bite-sized learning over mobile Android and IOS-driven devices. In addition, it offers tailored content creation and design to suit any training intended on the platform. The intervention material in the REBT-inspired and PST-based modules was designed by the researchers, one of whom is a United Kingdom Health and Care Professions Council (HCPC) registered practitioner Sport and Exercise Psychologist and the other a British Psychological Society (BPS) Stage 2 Sport and Exercise Psychology trainee. Although a control group does not necessarily eliminate all psychological bias, the provision of an intervention other than nothing to the control group may yield more reliable results (Freedland et al., 2011; Boot et al., 2013). The PST module content was inspired by the so called 'canon' of psychological skills in sport (Andersen, 2009) and started with an introduction of sport psychology skills followed by session material on relaxation, self-talk, imagery, goal setting, and concentration training, which are generally used to enhance athletes' motivation and support the regulation of their mental state, stress, and anxiety (Andersen, 2009). Evidence of the effectiveness of PST includes a meta-analysis by Brown and Fletcher (2017) that concluded that PST enhances athletes' sport performance, and a study by Barker et al. (2020) showing significant improvements in psychological and behavioural outcomes. However, Lange-Smith et al. (2023) noted that 97 % of reviews on the effectiveness of PST are of critically low quality, suggesting these findings should be treated with caution.

The REBT-inspired sessions contained psychoeducation on the central elements of the ABC[DE] framework, challenging and disputing rigid, extreme and illogical beliefs commonly held in sport, as well as quizzes, thought-provoking activities, self-check tools and in-between session tasks. This content was created in view that REBT as a practice theoretically subscribes to a fluid approach within the ABCDE framework in which the practitioner can move between the constructs of the theory and does not necessarily follow a fixed order. As found in the 14 documented case studies collected in Turner and Bennet (2017), content creation evolved from such studies and from formal practitioner guidance on REBT practices (Turner, 2023). A pilot exploration of content quality and the user interface was conducted by three individuals resembling the sample whose feedback was filtered back to improve the final version of the content. See Appendix A for examples.

### 2.3. Measures

The online survey utilised in both phases of this study included items requesting participants' *demographic information* such as their age, gender, country of residence, level of competition they are competing at (e.g., university, club, semi/professional level), sport (e.g., team or individual sport) and, years of experience at the involved level. Subsequently, participants completed Likert scale items from the Irrational Performance Beliefs Inventory, the Athletic Coping Skills Inventory, and the Athlete Psychological Strain Questionnaire.

The *Irrational Performance Beliefs Inventory (iPBI-2)* by Turner et al. (2018) is a theory-driven performance-relevant irrational belief measure created for use in sport. It is a 20-item scale divided into four subscales, namely primary beliefs, low frustration tolerance, awfulness, and depreciation, each containing five items. Scores from each subscale are summed to form a composite irrational performance belief score with higher scores indicating greater endorsement of irrational beliefs.

Turner et al. (2018) contended that iPBI-2 has demonstrated high concurrent and predictive validity in accordance with established belief measures on anxiety, depression, and anger dimensions. Responses were made on a 5-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). The iPBI-2 has also been applied in the sport literature with athletes (Turner et al., 2019) and to date has enjoyed acceptable reliability across various sporting samples, with Cronbach's alpha coefficients within the relevant sub-scales ranging from 0.63 to 0.87 (Turner & Allen, 2018).

The *Athletic Coping Skills Inventory (ACSI-28)* by Smith et al. (1995) represents a multidimensional measure of the athlete's coping ability under pressure, given that it provides the aggregated personal coping resources score through seven, sport-specific subscales, such as coping with adversity, peaking under pressure, goal setting, concentration, freedom from worry, confidence and achievement motivation, and coachability (Smith et al., 1995). Peaking under pressure refers to being challenged rather than threatened by the pressure situation, while freedom from worry refers to not placing pressure on the self by worrying about poor performance or making mistakes. Its items are scored on a Likert-response scale ranging from 0 (Rarely) to 4 (Almost always). The measure yielded high internal consistency with an alpha of 0.84 ( $N = 594$ ) for males and 0.88 ( $N = 433$ ) for females and excellent test-retest reliability (0.87) after one week in a sample of college athletes ( $N = 94$ ) (Smith et al., 1995).

The *Athlete Psychological Strain Questionnaire (APSQ)* by Rice et al. (2019) is a part of the International Olympic Committee's recommended screening tools for mental health in sport. This tool quantifies distress and potential symptoms of health in an athletic context and assists in screening for psychological strain and associated mental health issues (Alhowimel et al., 2023; Rice et al., 2019). The APSQ comprises 10 items assessing three domains of self-regulation difficulties, performance concerns, and externalised coping along a 5-point Likert response scale that ranges from 1 (none of the time) to 5 (all of the time). Preliminary psychometric validation of the APSQ in a sample of elite male athletes supported this three-factor model, yielding excellent model fit indices: CFI = 0.976, TLI = 0.966, RMSEA = 0.055, SRMR = 0.032 (Rice et al., 2019). A study with male and female athletes ( $N = 1093$ ) also revealed good validity and reliability values that were benchmarked against validated measures of general psychological distress and well-being while also confirming a range of optimal mental health severity cut-off points to discriminate between 'moderate', 'high' and 'very high' levels of psychological distress in athletes (Rice et al., 2020).

The post-intervention survey also included feedback items designed to evaluate the participants' overall interest in the provided material, their experiences engaging in micro-learning sessions using their mobile technology/app, and their subjective thoughts on their general performance states in sports while participating in the study. Suggestions were sought on how the material or microlearning sessions could be improved and how using the application influenced their thoughts and behaviours. Example questions that were asked included "How did it feel using the app?", "If any - what specific changes or improvements have you noticed in your sport as a result of using the app?", "How did using the app influence your thoughts, feelings or behaviour?", "Would you say that using the app helped you in your sport - why?", "What changes would you recommend improving the user experience?"

This feedback could be useful in understanding how effective the material was and its medium of delivery to bring out any areas that would need improvement according to the user experience.

### 2.4. Data analysis

The data analysis was performed using IBM SPSS version 29. Initially, participants with <90 % complete data were excluded from the dataset. This led to the removal of incomplete data from 61 participants and resulted in 155 complete data entries for phase one of the study. Upon closer inspection, the data indicated that there were some extreme

outliers, as indicated by the boxplots and Z-scores above  $\pm 3.26$ . These included two extreme outliers for Coachability\_ACSI, one for the Awfulizing IPBs, and three for ExtCoping\_APSQ, which were winsorized ( $<1\%$  of the overall study data) (Tukey, 1979). Further analysis (i.e., skewness, kurtosis, and Shapiro-Wilk tests) indicated that most of the data was not normally distributed (Shapiro-Wilk values  $<0.05$ ). Therefore, nonparametric tests were used to identify the relationship between variables (Spearman's rho correlation). For the sample included, the reliability of the measures used (Cronbach's alpha values) was calculated and presented in descriptive statistics (Table 2). Two sets of simple atemporal mediation model analyses using syntax for Hayes (2013) PROCESS macro extension v 3.5 (model 4) in SPSS, were conducted to further investigate the role of IPBs and coping ability in relation to mental health. One of the models had total coping ability as a mediator, IPBs as the independent variable (X), and mental health as the dependent variable (Y), while the second model had IPBs as a mediator variable (M) between coping ability (X) and mental health (Y). In both mediational models, the bootstrapping function, with 5000 samples and bias-corrected 95 % CIs, was used to estimate the statistical significance of the indirect effects (Preacher & Hayes, 2008). The effect size of each mediator was estimated by considering the magnitude of the standardised indirect effect, the change in  $R^2$ , and bootstrap CI.

Upon inspection of the data derived from the intervention for the second objective (phase 2) of the study, a total of three extreme outliers for the Self-Regulation\_APSQ, Coachability\_ACSI-28, and Awfulizing IPBs scores were identified. These were, 'winsorized' and consisted of  $<1\%$  of the data collected in this phase of the study. A new variable representing the pre- and post-test scores for each of the two groups was created. After verifying normality of standardised residuals of dependent variables for the two participant groups, a series of independent samples *t*-tests were conducted to assess differences in the pre-, post-, and retention test scores for each of the study's variables between the control and experimental groups. This allowed for a straightforward examination of whether the experimental group differed significantly from the control group at each testing window on the variables of interest. To assess within-group changes over time, we employed one-way ANOVAs separately for each group. This permitted an evaluation of how participants' scores changed across the three measurement points within the experimental and control groups, respectively.

Thematic analysis (TA) was used to examine the data from open-ended questions about participants' experiences using the mobile app during the study period, since it enables identification of patterns or themes without imposition of theoretical frameworks, yielding deep insight into the feedback (Braun & Clarke, 2006; Sparkes & Smith, 2013). TA considers data as an actual reflection of the attitudes of

participants, and it offers a close mapping of people's experiences (Holloway & Todres, 2003). It is particularly useful when conducting research in under-researched areas because it offers flexibility, replicability, and transparency, all of which are critical to current research (Brinkman & Kvale, 2005).

To provide credibility for the analysis, the researcher adhered to Braun and Clarke's (2006) six-step procedure, progressing iteratively through the data to identify, analyse and report the themes. Trustworthiness was promoted by engaging in peer debriefing with another researcher skilled in qualitative analyses to review and validate the identified themes. Additionally, participants' verbatim comments were included in the results section to illustrate and support the thematic interpretations, thereby ensuring that the findings remained grounded in participants lived experiences of using the mobile application.

The online survey data were initially copied into a Word document, and the researcher read them several times in a bid to familiarise themselves with the content and gain initial impressions. The data were then translated into Excel, and features throughout the dataset were established systematically through an inductive approach. Initial codes were created to sort the data, after which potential themes and sub-themes were identified. Sorting the initial codes and themes was the second task. Non-supported themes that were too diverse and did not fit into a logical pattern were eliminated. This exercise eventually led to 4 major themes and 11 subthemes that provided an exhaustive analysis of the user experience on the app.

In the fourth step, the researcher went through the themes again and re-examined the data for a third round of coding in Excel, consolidating the findings afresh to ensure alignment of the themes and their sub-themes. This phase also included going back to the data to ensure that all the relevant codes were covered, and that no significant data were excluded. The themes were initially mapped out and then modified in later reviews. Following revision, 3 major themes and 11 subthemes were developed and named. For consistency and accuracy, the final list of themes was independently cross-checked by another qualitative research expert to determine whether they contributed value to the overall story.

### 3. Results

The Cronbach's alpha scores revealed that the measures in this sample ranged from good to excellent in terms of internal consistency, ranging from 0.74 to 0.89. There were several subscales that were lower in reliability, specifically the 'Coachability' subscale of the ACSI-28 and the 'Externalised Coping' subscale of the APSQ, which fell below the acceptable level of 0.65. These subscales were deemed to have low

**Table 2**

Descriptive statistics, reliability estimates of the employed scales, and Spearman's Rho correlation results ( $N = 155$ ).

| Variables                     |                                             | Min   | Max   | Mean  | Std. Dev. | Cronbach's $\alpha$ | IPBs     | ACSI      | APSQ      |
|-------------------------------|---------------------------------------------|-------|-------|-------|-----------|---------------------|----------|-----------|-----------|
| iPBI-2                        | Demandingness (DEM)                         | 2.00  | 5.00  | 3.69  | 0.63      | 0.72                | –        | - 0.29**  | .29**     |
|                               | Low frustration tolerance (LFT)             | 2.00  | 5.00  | 3.88  | 0.67      | 0.82                |          |           |           |
|                               | Awfulizing (AWF)                            | 1.60  | 4.80  | 3.36  | 0.67      | 0.73                |          |           |           |
|                               | Depreciation (DEP)                          | 1.00  | 4.80  | 2.59  | 0.79      | 0.82                |          |           |           |
|                               | Total irrational performance beliefs (IPBs) | 7.4   | 18.80 | 13.53 | 2.16      | 0.89                |          |           |           |
| Coping Ability (ACSI)         | Coping with Adversity                       | 0.00  | 12.00 | 6.18  | 2.25      | 0.65                | - 0.29** | –         | - 0.41 ** |
|                               | Coachability                                | 4.00  | 12.00 | 9.34  | 1.83      | 0.57                |          |           |           |
|                               | Concentration                               | 1.00  | 11.00 | 6.74  | 1.99      | 0.60                |          |           |           |
|                               | Confidence & Achievement Motivation         | 2.00  | 12.00 | 7.10  | 2.12      | 0.67                |          |           |           |
|                               | Goal setting & Mental preparation           | 0.00  | 11.00 | 4.91  | 2.35      | 0.68                |          |           |           |
|                               | Peaking under Pressure                      | 0.00  | 12.00 | 6.07  | 2.35      | 0.76                |          |           |           |
|                               | Freedom from Worry                          | 0.00  | 12.00 | 5.96  | 3.01      | 0.81                |          |           |           |
|                               | Total coping ability (ACSI)                 | 19.00 | 70.00 | 46.29 | 9.93      | 0.85                |          |           |           |
|                               | Self-regulation                             | 4.00  | 17.00 | 8.76  | 2.79      | 0.76                |          |           |           |
| Mental Health in Sport (APSQ) | Performance concerns                        | 4.00  | 19.00 | 9.31  | 3.40      | 0.66                | .29**    | - 0.41 ** | –         |
|                               | Externalised coping                         | 2.00  | 6.00  | 2.66  | 1.09      | 0.58                |          |           |           |
|                               | Total psychological strain (APSQ)           | 10.00 | 38.00 | 20.77 | 5.89      | 0.78                |          |           |           |
|                               |                                             |       |       |       |           |                     |          |           |           |

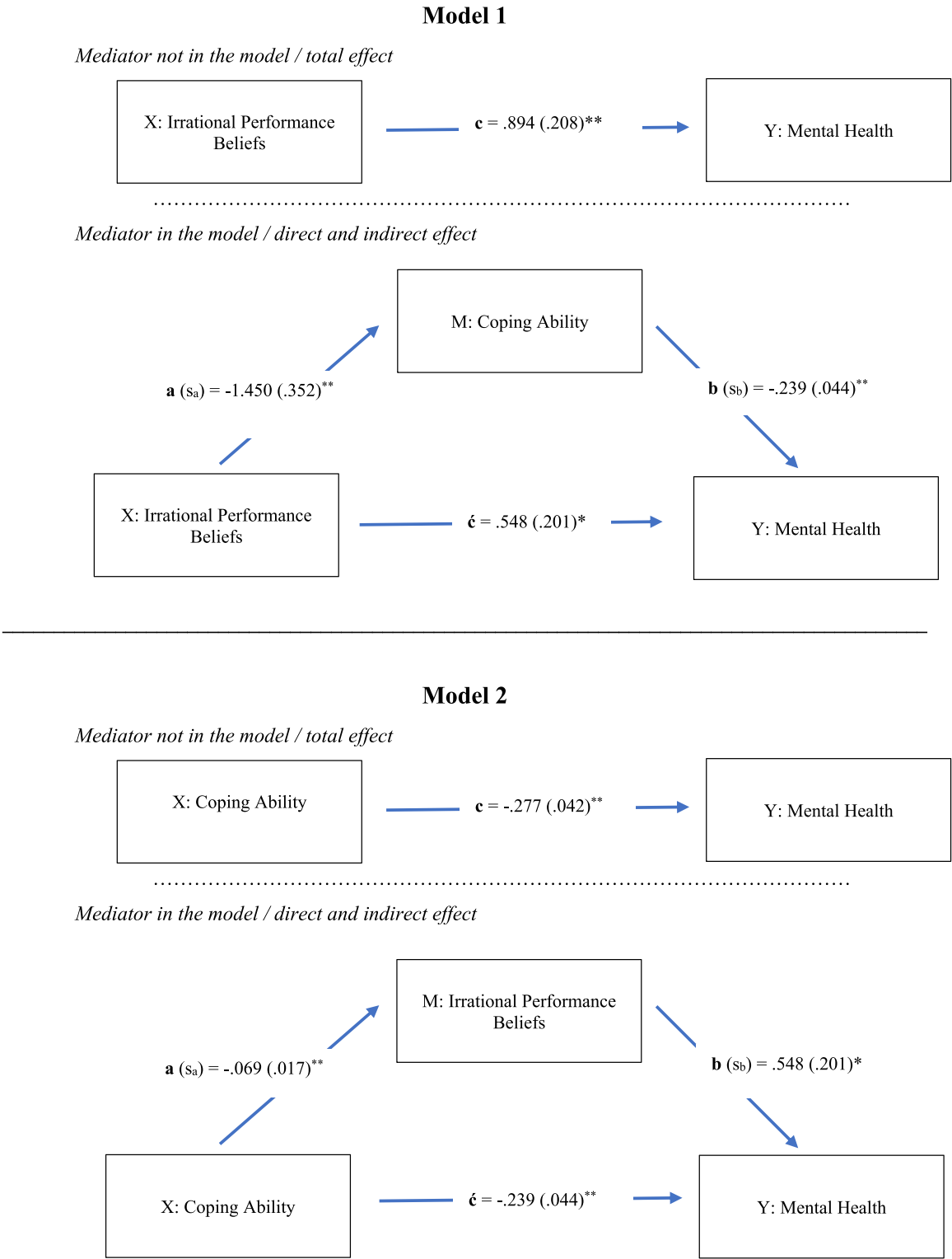
\*\* Correlation is significant at the 0.01 level (2-tailed).

IPBs = Total Irrational Performance Beliefs; ACSI = Total Coping Ability; APSQ = Total Psychological Strain.

reliability, and findings involving them must be interpreted with caution. Although less internally consistent, previous research has shown these subscales to have sufficient construct validity, thereby rendering them still useful in assessing the constructs of interest (Alhowimel et al., 2023; Rice et al., 2020). The sample demonstrated moderate-to-high levels of IPBs (Mean = 13.53), moderate sport coping ability (Mean = 46.29), and high psychological strain/poor mental

health (Mean = 20.77).

When examining the subscales of the iPBI-2, the most prominent belief to be present in the participants was ‘Low Frustration Tolerance (LFT)’, whereas ‘Self-/other Depreciation’ (DEP) was the least prevalent. In terms of coping skills, the respondents scored highest on ‘Coachability’, indicating openness to critical feedback, and lowest on ‘Goal Setting’ and ‘Mental Preparation’. In relation to mental health,



**Fig. 1.** Mediation diagrams of both models 1 and 2. Values not in parentheses reflect path coefficients, and values in parentheses reflect standard errors (Significance values were obtained by  $*p < 0.05$ ,  $**p \leq .001$ ).

participants' 'Self-regulation Difficulties' and 'Performance Concerns' were relatively high and mostly accounted for their poor overall mental health score. For the sake of simplicity and to maintain the study within manageable parameters, only the overall scores of each inventory were used in further analyses.

Spearman's rho tests indicated significant relationships between study variables, indicating that increased levels of psychological strain/poor mental health are significantly related to higher IPBs and lower coping ability. The descriptive statistics, reliability estimates, and correlation findings are presented in Table 2.

Before conducting the mediation analyses (using Hayes' PROCESS macro in SPSS), all the necessary assumptions were confirmed (i.e., ensuring that the dependent variables are continuous, the relation between the DV and IVs is linear, multicollinearity among the IV is less than expected, and influential outliers are not present – Cook's Distance < 1, the residuals are normally distributed – normal P-P Plot & normal Q-Q Plot with std residuals between – 3 and + 3). Analyses of the indirect effects revealed that athlete coping ability significantly mediated the association between their exhibition of IPBs and mental health status (Model 1). Furthermore, a significant indirect effect emerged when IPBs served as the mediator, indicating that IPBs also significantly explained the relationship between coping ability and athletes' mental health (Model 2). However, coping ability yielded narrower Bootstrapped Confidence Intervals with values further from zero (LLCI = 0.142 - ULCI

= 0.590) in comparison to IPBs (LLCI = – 0.081 - ULCI = 0.006) indicating a more robust mediation effect. This was confirmed by the size of the standardised indirect effect ( $\beta$ ), which revealed a larger absolute value ( $\beta = 0.127$ ) compared with IPBs ( $\beta = - 0.063$ ), indicating a stronger mediating effect (Figs. 1 and 2).

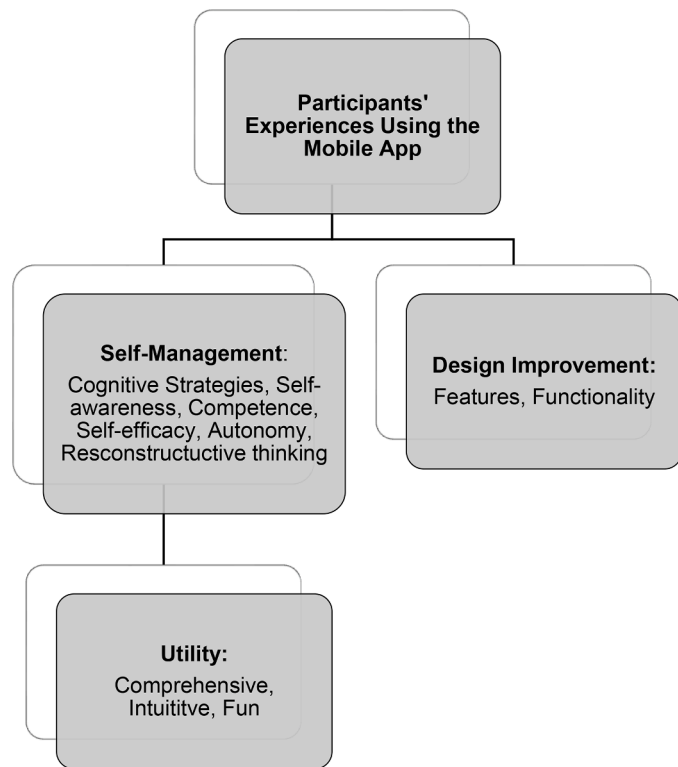
For the second phase of the study, the results from independent samples *t*-tests (Table 3) confirmed equivalency between the experimental (REBT) and control (PST) groups at baseline, indicating no significant difference in IPBs ( $t(21.70) = 0.64, p = 0.53, d = 0.25$ ), coping ability ( $t(22.72) = 0.58, p = 0.57, d = 0.23$ ), and mental health scores ( $t(21.96) = 0.04, p = 0.97, d = 0.02$ ). While the respective groups' mental health scores ( $t(18.42) = 0.19, p = 0.85, d = 0.08$ ) and coping ability scores ( $t(19.88) = - 0.70, p = 0.49, d = 0.29$ ) remained similar at the completion of the intervention, analysis revealed a significant difference between groups in IPBs ( $t(19.51) = 2.30, p = 0.032, d = 0.96$ ), yielding a greater improvement in the experimental group. The observed difference was not only statistically significant but also practically meaningful as Cohen's *d* analyses confirmed a large effect size. Although the result did not reach statistical significance, there was a trend towards significance at the three-week post-intervention retention test ( $t(12.84) = 1.98, p = 0.07, d = 0.98$ ), suggesting a potentially sustained improvement in IPBs within the experimental group compared to the control group. Notably, the magnitude of this difference was practically meaningful, as reflected by the large effect size indicated by Cohen's *d*.

Although the experimental group showed an improvement in their mental health scores ( $F(2, 35) = 0.84, p = 0.84, \eta^2 = 0.05$ ) and coping ability ( $F(2, 35) = 2.28, p = 0.12, \eta^2 = 0.12$ ) along with a reduction in the amount of IPBs ( $F(2, 35) = 2.59, p = 0.89, \eta^2 = 0.13$ ) exhibited on completion of the intervention and at retention, these improvements were not statistically significant. Nevertheless, the small-to-moderate effect sizes suggest potentially meaningful trends worthy of further investigation (Salkind & Frey, 2019). Similarly, with some improvements in the control group's mental health ( $F(2, 22) = 0.43, p = 0.66, \eta^2 = 0.04$ ), coping ability ( $F(2, 22) = 0.35, p = 0.97, \eta^2 = 0.003$ ), and the exhibition of IPBs ( $F(2, 22) = 0.86, p = 0.43, \eta^2 = 0.07$ ) upon completion of the intervention, these improvements were not statistically significant.

The themes that were generated from the athletes' open-ended responses regarding their experience with the mobile application suggest that the intervention enhanced their knowledge of the respective topics, which they subsequently learned to implement effectively in their sport. Three overarching themes, encompassing 11 sub-themes, were constructed. Two themes namely, 'self-management' and 'positive user experience', capture participants' collective experiences, while the third theme, 'design,' reflects their recommendations for app improvement. These themes should not be viewed as isolated constructs but as inter-related components that shape the overall user experience (Braun & Clarke, 2006). The following sections provide a detailed discussion of these themes.

### 3.1. Self-management

This theme encompasses strategies and personal attributes that facilitate participants' ability to regulate and control their experiences and behaviours effectively. Participants responses suggested that the



**Fig. 2.** Themes representing the participants' experiences and recommendations following their use of the mobile app material.

**Table 3**

Differences in the experimental (REBT) and control (PST) groups' variable scores at baseline, post-intervention, and during retention testing.

|                          | Control (PST) Group          |                               |                                    | Experimental (REBT) Group    |                               |                                    |
|--------------------------|------------------------------|-------------------------------|------------------------------------|------------------------------|-------------------------------|------------------------------------|
|                          | Pre-test<br><i>M</i> (Std.D) | Post-Test<br><i>M</i> (Std.D) | Retention Test<br><i>M</i> (Std.D) | Pre-test<br><i>M</i> (Std.D) | Post-Test<br><i>M</i> (Std.D) | Retention Test<br><i>M</i> (Std.D) |
| N                        | 11                           | 9                             | 5                                  | 14                           | 14                            | 10                                 |
| IPBs                     | 64.27 (7.17)                 | 60.56 (5.66)                  | 62.00 (5.61)                       | 61.79 (11.98)                | 54.50 (6.85)                  | 53.70 (10.61)                      |
| Coping Ability (ACSI-28) | 51.55 (7.23)                 | 52.33 (8.72)                  | 52.60 (10.36)                      | 49.50 (10.42)                | 55.21 (10.95)                 | 58.10 (8.46)                       |
| Mental Health            | 18.00 (4.47)                 | 16.89 (4.68)                  | 19.20 (4.44)                       | 17.93 (4.63)                 | 16.5 (5.14)                   | 15.40 (4.45)                       |

intervention material provided them with mental techniques that was used to enhance performance and cope with challenges. It enabled them to better recognise and understand their emotions, thoughts, and behaviours and promoted their perceived ability to effectively execute tasks and roles. Responses also suggested a sense of autonomy accessing and using the material independently that assist with making decisions without external influence. Furthermore, the responses suggested that the content aided in the process of reflecting on and reinterpreting past experiences for growth and adaptation. Sample responses from participants were:

“It (the mobile app) helped me to believe in my own capability, value what I know and access my mental tools at a freelance basis.” (A5)

“It (the mobile app) has made me think about how I feel, and I respond to setbacks, injury, being nervous, and to regain a sense of proportion which has enabled me to have better focus and regain control”. (A2)

### 3.2. Utility

This theme reflects the practical value and ease of use of the mobile app intervention.

Overall, the participants' responses indicated that the extent of the content provided thorough and complete information that was easy to understand and engage with. Moreover, the participants indicated that the app was appealing and enjoyable to use. Example statements from the participants included:

“It was quick, I did them straight away and looked forward to the next one.” (A9)

“Straightforward, especially for me who lives in an analogue cave. Easy to follow.” (B2)

“The app was easy to use, inspiring, and insightful.” (A6)

“The app was easy to use and aesthetically pleasing and well set out.” (B4)

### 3.3. Design improvement

This theme pertains to participants' feedback on enhancing the design and functionality of the app/material provided. While most responses did not suggest specific improvements, providing limited data for interpretation, a few participants expressed a desire for enhanced functionality that would contribute to the overall usability and effectiveness. These suggestions included features such as gamification, increased interactivity, and community engagement, all of which could contribute to a more enriching user experience. One could argue that design-related concerns fall under the broader theme of utility or user experience. However, ignoring these few perspectives would result in a lack of diversity in viewpoints and diminish the depth of this analysis. The following are some of the participants' responses:

“A smoother user interface with the app would help”. (A4)

“I liked how visual it was, but it was also clunky at times, with multiple clicks. The content of the quizzes made sense, but the app design did not seem fit for purpose.” (A10)

“A more bespoke app, but the content was good”. (B3)

## 4. Discussion

This study set out to identify the interrelationship between athletes' performance beliefs, coping ability, and mental health in sport. It also examined the effectiveness of a four-week Rational Emotive Behaviour Therapy-inspired mobile learning app intervention on these factors.

The results confirm our hypothesis (H1) revealing that higher levels of IPBs are significantly associated with lower athletic coping ability and poorer mental health, whereas greater coping ability is positively associated with better mental health. The noteworthy significant correlations between IPBs, coping ability, and mental health indicates a complex relationship between cognitive and behavioural components of psychological functioning in athletes. The nature of the correlations noted between these variables are consistent with the extensive literature on cognitive distortions that theorises that irrational, extreme, and rigid self-expectations are primary causes of psychological disturbance (Turner, 2023) characterised by increased anxiety and depression (Turner & Barker, 2014). According to stress appraisal theories, adaptive coping ability serves as primary intermediaries that attenuate the negative impacts of illogical thinking regarding performance (Lazarus & Folkman, 1984; Meijen et al., 2020). In a similar vein, it has been established through research that athletes with well-developed coping mechanisms report lower levels of stress and greater psychological resilience (Nuetzel et al., 2023).

Furthermore, the results also confirmed our second hypothesis (H2), revealing the significant mediating function of coping ability in the connection between IPBs and mental health, which indicates that athletes who acquire a better coping ability can potentially buffer themselves against the adverse impact of dysfunctional beliefs. This result aligns with findings from previous studies noting that coping ability and self-regulation, are inextricably linked with psychological resilience that attenuate stress reactions (Nicholls & Polman, 2007). Indeed, earlier research has established that competitors utilising adaptive coping strategies will have fewer negative emotional repercussions when they are exposed to highly stressful situations (Kaiseler et al., 2012) and performance pressures in sport (Leguizamo et al., 2021). Corroborating this, Griffith et al. (2024) established that psychological skills training aimed at coping and emotional regulation led to substantial enhancement in the mental health status of athletes, thereby supporting the fact that enhancing coping ability can mitigate negative effects associated with IPBs. Hence, interventions that promote adaptive coping skills usage are beneficial to improve athletes' mental health.

With this said, the bidirectional mediation noted in the study's results implies that IPBs can also influence the impact of coping ability on mental health. This indicates that negative thought patterns can in turn decrease the effectiveness of coping ability. This concept aligns with cognitive-behavioural theories, which state that distorted thinking could alter individuals' perceptions of activating events or adversity, leading athletes to perceive even minor stressors as overwhelming (Mesagno et al., 2020). For instance, a stress-coping athlete may nevertheless experience performance anxiety if he/she continues to think irrationally about failure. In this regard, Turner and Allen (2018) note that coping abilities function more effectively if negative cognitions are addressed using techniques such as Rational Emotive Behaviour Therapy. This therapeutic approach in sports has been found to minimise performance anxiety and increase mental flexibility through challenging and altering unrealistic assumptions (Turner et al., 2016). Therefore, tackling inappropriate thought patterns is essential for ensuring optimum efficacy of coping ability in sports.

Notwithstanding this bidirectional effect, the stronger mediating impact of coping ability on IPBs noted in this study suggests that treatments for coping processes may have a more direct and substantial influence on mental health outcomes. This notion aligns with the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), which underscores coping as a main predictor of psychological health and wellbeing. Likewise, Nicholls et al. (2012) study also confirms the above premise, and it reveals that athletes who apply proactive adaptive coping, experience less stress and burnout compared to athletes applying avoidance or emotion-focused coping. Because the attenuating effect of coping ability was more powerful between the two tested models, future interventions should prioritise the development of adaptive coping ability as a primary means of improving athletes'

mental health. While addressing irrational beliefs remains important, equipping athletes with effective coping skills may yield more immediate and sustained benefits.

Different to our other expectation in the study (H3), the 4-week REBT-inspired mobile app intervention yielded no significant improvement in athletes perceived coping ability and mental health perceptions. This was the same for the control group who perused general psychological skills material. This non-significant effect could be that the intervention material adopted a generic, one-size-fits-all approach rather than being tailored to an athlete's specific needs, sport culture, and psychological profile (Rice et al., 2016). Interventions that do not account for personal differences in coping styles or mental health histories may fail to fully engage athletes effectively. Another plausible reason for the reduced impact of the psychological intervention could be that athletes operate in high-pressure environments with demanding schedules as they often fulfil other roles (i.e., being a student or worker or carer etc.), making full and consistent engagement with coping and mental health interventions challenging (Purcell et al., 2019), especially if the intervention is not enforced within the athlete's organisational culture, which often prioritise performance over well-being (Roberts et al., 2016). Furthermore, the intervention was administered in a staggered manner, which means that participants did not begin or end the mobile-app program at the same time. As a result, athletes were most likely at various phases of their competition season, with some feeling increased competitive stress while others may have faced fewer expectations. Variations in contextual stressors may have influenced self-assessment of coping resources and mental health status, moderating the intervention's effectiveness. Given the heterogeneous athlete population, external demands specific to team or individual sport participants along with each participant's unique history of stressors may have diluted the intervention's potential effects. However, despite the non-significant impact on the participants' coping ability and mental health, the 4-week REBT-inspired intervention has indeed significantly reduced participants' IPBs following the completion of the intervention. Although the reduction in IPBs was not statistically significant at the extended follow-up (i.e., three weeks post-intervention completion), the observed trend towards significance suggests the intervention may have had potentially lasting effects. This gives some validation of the usefulness of our REBT-inspired material used in the form of a mobile app and how this could be further utilised and improved on in sport psychology practices aimed at altering athletes' dysfunctional beliefs in sport. In this regard, it should be noted that the participants underscored several benefits of engaging with the material on the mobile app revealing that it promoted their ability to regulate and control their experiences and behaviours effectively ('self-management') while offering practical value and ease of use ('utility') proffering their level of engagement and enjoyment. When asked for how the app and material could be improved, some participants suggested design improvements that includes features such as gamification, increased interactivity, and community engagement, which could potentially contribute to a more enriching user experience. These views offer some valuable insights into the use of mobile apps in sport psychology interventions considering that mobile application design primarily focuses on usability, functionality, and aesthetic dimensions (Huang & Benyoucef, 2023).

Our findings highlight the interconnectedness of cognitive and behavioural processes in athletes' mental health, supporting integrative interventions like Cognitive-Behavioural Stress Management (Didymus & Fletcher, 2017) that promote adaptive coping through psychological skills training and cognitive reappraisal. With this said, effective stress management strategies can significantly enhance mental health outcomes (Wood et al., 2020; Nejati et al., 2024) while approaches such as REBT and CBT help restructure irrational performance beliefs, indirectly strengthening coping efficacy by improving self-efficacy and emotional regulation (Turner et al., 2016). A combined approach that integrates cognitive restructuring with skill-based coping strategies appears most

beneficial, as multifaceted interventions targeting both cognitive distortions and coping abilities may yield more lasting mental health improvements in sport.

## 5. Conclusion

The findings of this study underscore the significance of both behavioural and cognitive aspects of sport psychology. By identifying and challenging IPBs while developing athletes' coping skills, sport psychology practitioners can strengthen resilience to sport-related adversity and stress, ultimately enhancing mental health. These results align with an emerging body of research that emphasises the interdependent nature of sport psychology constructs (Turner & Barker, 2014; Didymus & Fletcher, 2017; Wood et al., 2020). A primary strength of the present study is the identification of a reduction in athletes' IPBs following the four-week mobile app intervention. This finding suggests that mobile technology can be effectively integrated into sport psychology service delivery, providing scalable support to athletes whenever needed. Mobile technology application in sport could also promote athletes' mental health seeking behaviours, as it is often reported to be a pressing issue in sport contexts (Cosh et al., 2024). In this regard, participants' responses further reinforced the intervention's value, particularly its self-empowering effects, its perceived utility, and the comprehensiveness of the app's content. These insights justify further investigation into the use of mobile technology as a means of disseminating knowledge in sport psychology and engaging in the delivery of psychological services to athletes irrespective of their access to on-site services. However, a major limitation of this study is the relatively small sample size of athletes who completed the four-week intervention at varying stages of their respective sport season and who provided follow-up data three weeks post-intervention. This limitation underscores the need for further research to examine the effectiveness of mobile-based sport psychology interventions using larger, more diverse athlete samples, ideally assessed at the same stage of the competition season to control for contextual variability. The complex onboarding process required for the Talentcards app, such as the creation of a Gmail account for participant registration, contributed to the limited number of athletes who agreed to participate in the intervention. Therefore, participants' accessibility to mobile app intervention material should also be considered in future research. Despite this, the current results offer a useful starting point for sport psychology practitioners to begin integrating mobile technology, including app-based interventions, to supplement traditional consulting sessions and improve accessibility for athletes.

## Disclosure statement

There are no competing interests to declare. The data that support the findings of this study are uploaded to an open science framework (Zenodo.Org DOI:10.5281/zenodo.15125716).

## CRediT authorship contribution statement

**Helen Ruud:** Writing – original draft, Software, Project administration, Methodology, Investigation, Formal analysis. **Julius Jooste:** Writing – review & editing, Visualization, Supervision, Methodology, Formal analysis, Conceptualization.

## Declaration of competing interest

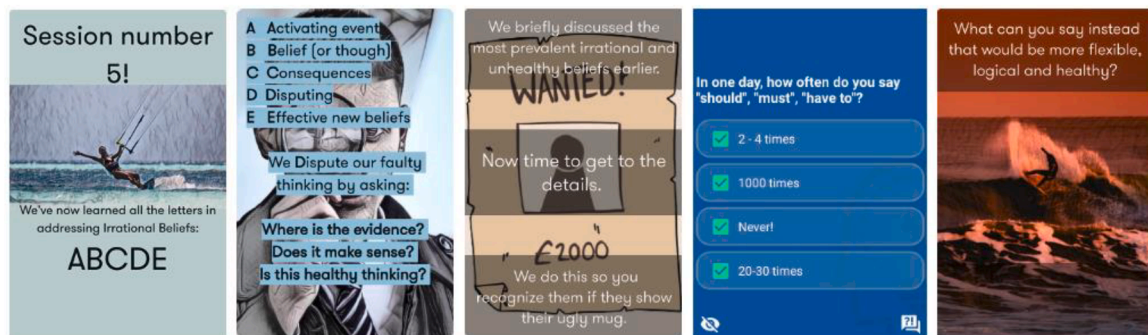
The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

None. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

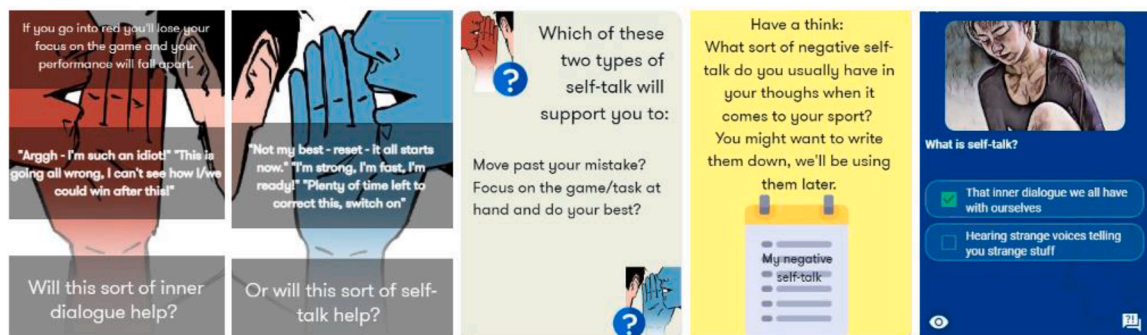
## Appendix A. Examples of mobile application content

- (i) Rational Emotive Behaviour module
- (ii) Psychological Skills Training module

### (i) Rational Emotive Behaviour module



### (ii) Psychological Skills Training module



## References

- Alhowimel, A. S., Al-Harbi, T. S., Alotaibi, M., Khalil, N. M., Alshehri, M. A., & Ahmed, N. I. (2023). Validation of the Athlete Psychological Strain Questionnaire among elite athletes in Saudi Arabia. *International Journal of Environmental Research and Public Health*, 20(3), 1234. <https://doi.org/10.3390/ijerph20032338>
- Andersen, M. B. (2009). The "canon" of psychological skills training for enhancing performance. In K. F. Hays (Ed.), *Performance psychology in action: A casebook for working with athletes, performing artists, business leaders, and professionals in high-risk occupations* (pp. 11–34). American Psychological Association.
- Arnold, R., Fletcher, D., & Daniels, K. (2017). Organisational stressors, coping, and outcomes in competitive sport. *Journal of Sports Sciences*, 35(7), 694–703. <https://doi.org/10.1080/02640414.2016.1219662>
- Bailey, R. G., & Turner, M. J. (2023). The effects of a brief online rational-emotive-behavioural-therapy program on coach irrational beliefs and well-being. *The Sport Psychologist*, 37(4), 266–273. <https://doi.org/10.1123/tsp.2023-0004>
- Barker, J. B., Slater, M. J., Pugh, G., Mellalieu, S. D., McCarthy, P. J., Jones, M. V., & Moran, A. (2020). The effectiveness of psychological skills training and behavioural interventions in sport using single-case designs. *Psychology of Sport and Exercise*, 51, Article 101746. <https://doi.org/10.1016/j.psychsport.2020.101746>
- Boot, W. R., Simons, D. J., Stothart, C., & Stutts, C. (2013). The pervasive problem with placebos in psychology: Why active control groups are not sufficient to rule out placebo effects. *Perspectives on Psychological Science*, 8(4), 445–454. <https://doi.org/10.1177/1745691613492976>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>
- Brinkmann, S., & Kvale, S. (2005). Confronting the ethics of qualitative research. *Journal of Constructivist Psychology*, 18(2), 157–181. <https://doi.org/10.1080/107205305090914789>
- Brown, D. J., & Fletcher, D. (2017). Effects of psychological and psychosocial interventions on sport performance: A meta-analysis. *Sports Medicine*, 47(1), 77–99. <https://doi.org/10.1007/s40279-016-0552-3>
- Buschmann, T., Horn, R. A., Blankenship, V. R., Garcia, Y. E., & Bohan, K. B. (2018). The relationship between automatic thoughts and irrational beliefs predicting anxiety and depression. *Journal of Rational-Emotive & Cognitive-Behaviour Therapy*, 36, 137–162. <https://doi.org/10.1007/s10942-017-0284-y>
- Chadha, N., Turner, M. J., & Slater, M. (2019). Investigating irrational beliefs, cognitive appraisals, challenge and threat, and affective states in golfers approaching competitive situations. *Frontiers in Psychology*, 10, 2295. <https://doi.org/10.3389/fpsyg.2019.02295>
- Cosh, S. M., McNeil, D. G., Jeffreys, A., Clark, L., & Tully, P. J. (2024). Athlete mental health help-seeking: A systematic review and meta-analysis of rates, barriers and facilitators. *Psychology of Sport and Exercise*, 71, Article 102586. <https://doi.org/10.1016/j.psychsport.2023.102586>
- Cunningham, R., & Turner, M. J. (2016). The utility of rational emotive behaviour therapy (REBT) in the context of mental health and sport. *Journal of Sport Psychology in Action*, 7(2), 137–146. <https://doi.org/10.1080/21520704.2016.1178129>
- Davis, H., & Turner, M. J. (2020). The use of rational emotive behavior therapy (REBT) to increase the self-determined motivation and psychological well-being of triathletes. *Sport, Exercise, and Performance Psychology*, 9(4), 489–505. <https://doi.org/10.1037/spy0000191>

- Didymus, F. F., & Fletcher, D. (2017). Effects of a cognitive-behavioural intervention on field hockey players' appraisals of organizational stressors. *Psychology of Sport and Exercise*, 30, 173–185. <https://doi.org/10.1016/j.psychsport.2017.03.005>
- Ellis, A. (1957). Rational psychotherapy and individual psychology. *Journal of Individual Psychology*, 13(1), 38–44.
- Ellis, A., & Dryden, W. (2007). *The practice of rational emotive behavior therapy*. Springer Publishing Company.
- Everson, B. L., & Terjesen, M. D. (2023). The impact of irrational beliefs on athletic performance. *Journal of Sport Psychology in Action*, 12(1), 55–70. <https://doi.org/10.1080/21520704.2021.1994246>
- Ferraro, T., & Rust, K. (2000). Access to sport psychology services: Challenges for athletes at different levels. *International Journal of Sport Psychology*, 31(4), 455–468.
- Freedland, K. E., Mohr, D. C., Davidson, K. W., & Schwartz, J. E. (2011). Usual and unusual care: Existing practice control groups in randomized controlled trials of behavioural interventions. *Psychosomatic Medicine*, 73(4), 323–335. <https://doi.org/10.1097/PSY.0b013e318218684d>
- Fritz, M. S., & Mackinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological science*, 18(3), 233–239. <https://doi.org/10.1111/j.1467-9280.2007.01882.x>
- Giblin, G., Tor, E., & Parrington, L. (2016). The impact of technology on elite sports performance. *Sensoria: A Journal of Mind, Brain & Culture*, 12(2), 2203–8469.
- González, S. P., & Tomás, I. (2020). Stress appraisals, coping strategies, and performance satisfaction in adolescent athletes: A multilevel approach. *International Journal of Environmental Research and Public Health*, 17(21), 7980. <https://doi.org/10.3390/ijerph17217980>
- Griffith, K., O'Brien, K., McGurty, S., Miller, P., & Christino, M. A. (2024). The efficacy of a mental skills training course for collegiate athletes. *Journal of Athletic Training*, 59(7), 772–778. <https://doi.org/10.4085/1062-6050-0235-23>
- Gulliver, A., Griffiths, K. M., & Christensen, H. (2012). Barriers and facilitators to mental health help-seeking for young elite athletes: A qualitative study. *BMC Psychiatry*, 12, 1–14. <https://doi.org/10.1186/1471-244X-12-157>
- Gulliver, A., Griffiths, K. M., Christensen, H., & Brewer, N. (2022). Mental health in athletes: Current perspectives. *Journal of Sports Psychology in Action*, 13(1), 29–40. <https://doi.org/10.1080/21520704.2021.1997864>
- Håkansson, A., Moesch, K., Jönsson, C., & Kenttä, G. (2020). Potentially prolonged psychological distress from postponed Olympic and Paralympic games during COVID-19—Career uncertainty in elite athletes. *International Journal of Environmental Research and Public Health*, 18(1), Article 2. <https://doi.org/10.3390/ijerph18010002>
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. The Guilford Press.
- Huang, Z., & Benyoucef, M. (2023). A systematic literature review of mobile application usability: Addressing the design perspective. *Universal Access in the Information Society*, 22(3), 715–735. <https://doi.org/10.1007/s10209-022-00912-7>
- Holloway, I., & Todres, L. (2003). The status of method: Flexibility, consistency, and coherence. *Qualitative Research*, 3(3), 345–357. <https://doi.org/10.1191/1478088703qr0>
- Jooste, J., Wolfson, S., & Kruger, A. (2023). Irrational performance beliefs and mental well-being upon returning to sport during the COVID-19 pandemic: A test of mediation by intolerance of uncertainty. *Research Quarterly for Exercise and Sport*, 94(3), 802–811. <https://doi.org/10.1080/02701367.2021.2016592>
- Kaiseler, M., Polman, R. C., & Nicholls, A. R. (2012). Effects of the Big Five personality dimensions on appraisal coping, and coping effectiveness in sport. *European Journal of Sport Science*, 12(1), 62–72. <https://doi.org/10.1080/17461391.2010.543261>
- Lange-Smith, S., Cabot, J., Coffee, P., Gunnell, K., & Tod, D. (2023). The efficacy of psychological skills training for enhancing performance in sport: A review of reviews. *International Journal of Sport and Exercise Psychology*, 21(2), 1–18. <https://doi.org/10.1080/1612197X.2023.2201314>. Advance online publication.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer.
- Leguizamó, F., Olmedilla, A., Núñez, A., Verdaguer, F. J. P., Gómez-Espejo, V., Ruiz-Barquín, R., & García-Mas, A. (2021). Personality, coping strategies, and mental health in high-performance athletes during confinement derived from the COVID-19 pandemic. *Frontiers in Public Health*, 8, Article 561198. <https://doi.org/10.3389/fpubh.2020.561198>
- McLoughlin, E., Fletcher, D., Slavich, G. M., Arnold, R., & Moore, L. J. (2021). Cumulative lifetime stress exposure, depression, anxiety, and well-being in elite athletes: A mixed-method study. *Psychology of Sport and Exercise*, 52, Article 101823. <https://doi.org/10.1016/j.psychsport.2020.101823>
- Meijen, C., Turner, M., Jones, M. V., Sheffield, D., & McCarthy, P. (2020). A theory of challenge and threat states in athletes: A revised conceptualization. *Frontiers in Psychology*, 11, 126. <https://doi.org/10.3389/fpsyg.2020.00126>
- Mesagno, C., Tibbert, S. J., Buchanan, E., Harvey, J. T., & Turner, M. J. (2020). Irrational beliefs and choking under pressure: A preliminary investigation. *Journal of Applied Sport Psychology*, 33(6), 569–589. <https://doi.org/10.1080/10413200.2020.1766072>
- Milne-Ives, M., Homer, S. R., Andrade, J., & Meinert, E. (2023). Potential associations between behaviour change techniques and engagement with mobile health apps: A systematic review. *Frontiers in Psychology*, 14, Article 1227443. <https://doi.org/10.3389/fpsyg.2023.1227443>
- Nejati, M., Parsi, A., Moteshareie, E., Miller, A., & Turner, M. J. (2024). The effects of rational emotive behaviour therapy on performance under pressure in adolescent soccer athletes: A randomised control design. *International Journal of Sport and Exercise Psychology*, 22(1), 123–140. <https://doi.org/10.1080/1612197X.2022.2152852>
- Nicholls, A. R., & Polman, R. C. (2007). Coping in sport: A systematic review. *Journal of sports sciences*, 25(1), 11–31. <https://doi.org/10.1080/02640410600630654>
- Nicholls, A. R., Polman, R. C., & Levy, A. R. (2012). A path analysis of stress appraisals, emotions, coping, and performance satisfaction among athletes. *Psychology of Sport and Exercise*, 13(3), 263–270. <https://doi.org/10.1016/j.psychsport.2011.12.005>
- Nuetzel, B. (2023). Coping strategies for handling stress and providing mental health in elite athletes: A systematic review. *Frontiers in Sports and Active Living*, 5, Article 1265783. <https://doi.org/10.3389/fsals.2023.1265783>
- Poulos, D. R., Coulter, T. J., Trotter, M. G., & Polman, R. (2022). Longitudinal analysis of stressors, stress, coping and coping effectiveness in elite esports athletes. *Psychology of Sport and Exercise*, 60, Article 102093. <https://doi.org/10.1016/j.psychsport.2022.102093>
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879–891. <https://doi.org/10.3758/BRM.40.3.879>
- Purcell, R., Gwyther, K., & Rice, S. M. (2019). Mental health in elite athletes: Increased awareness requires an early intervention framework to respond to athlete needs. *Sports Medicine - Open*, 5(1), 1–8. <https://doi.org/10.1186/s40798-019-0220-1>
- Rice, S. M., Purcell, R., De Silva, S., Mawren, D., McGorry, P. D., & Parker, A. G. (2016). The mental health of elite athletes: A narrative systematic review. *Sports Medicine*, 46(9), 1333–1353. <https://doi.org/10.1007/s40279-016-0492-2>
- Rice, S., Olive, L., Gouttebarger, V., Parker, A. G., Clifton, P., Harcourt, P., McGorry, P., & Purcell, R. (2020). Mental health screening: Severity and cut-off point sensitivity of the Athlete Psychological Strain Questionnaire in male and female elite athletes. *BMJ Open Sport & Exercise Medicine*, 6(1), Article e000712. <https://doi.org/10.1136/bmjsem-2019-000712>
- Rice, S. M., Parker, A. G., Mawren, D., Clifton, P., Harcourt, P., Lloyd, M., Blanton, C., Tottman, R., & Purcell, R. (2019). Preliminary psychometric validation of a brief screening tool for athlete mental health among male elite athletes: The Athlete Psychological Strain Questionnaire. *International Journal of Sport and Exercise Psychology*, 18(6), 850–865. <https://doi.org/10.1080/1612197X.2019.1611900>
- Rist, R. D., & Pearce, M. W. (2017). The impact of smartphone applications on mental training compliance among athletes. *Journal of Sports Sciences*, 35(5), 410–416. <https://doi.org/10.1080/02640414.2016.1168907>
- Roberts, C. M., Faull, A. L., & Tod, D. (2016). Blurred lines: Performance enhancement, common mental disorders and referral in the UK athletic population. *Frontiers in Psychology*, 7, 1067. <https://doi.org/10.3389/fpsyg.2016.01067>
- Salkind, N. J., & Frey, B. B. (2019). *Statistics for people who (think they) hate statistics* (edition 7th ed.). International student.
- Smith, R. E., Schutz, R. W., Smoll, F. L., & Ptacek, J. T. (1995). Development and validation of a multidimensional measure of sport-specific psychological skills: The athletic coping skills inventory-28. *Journal of Sport & Exercise Psychology*, 17(4), 379–398. <https://doi.org/10.1123/jsep.17.4.379>
- Sparkes, A. C., & Smith, B. (2013). *Qualitative research methods in sport, exercise and health: From process to product*. Routledge.
- Tóth, R., Turner, M. J., Mannion, J., & Tóth, L. (2023). The effectiveness of rational emotive behavior therapy (REBT) and mindfulness-based intervention (MBI) on psychological, physiological and executive functions as a proxy for sports performance. *BMC psychology*, 11(1), 442. <https://doi.org/10.1186/s40359-023-01486-8>
- Tukey, J. W. (1979). Winsorizing as a robust technique for non-normal data. *Journal of Statistical Computation and Simulation*, 9(1), 123–134.
- Turner, M. J. (2016). Rational emotive behavior therapy (REBT), irrational and rational beliefs, and the mental health of athletes. *Frontiers in Psychology*, 7, 1423. <https://doi.org/10.3389/fpsyg.2016.01423>
- Turner, M. J. (2019). REBT in sport. In M. E. Bernard, & W. Dryden (Eds.), *Advances in REBT: Theory, practice, research, measurement, prevention, and promotion* (pp. 307–335). Springer.
- Turner, M. J. (2023). *The rational practitioner: The sport and performance psychologist's guide to practicing rational emotive behaviour therapy*. Routledge.
- Turner, M. J., Allen, M. S., Slater, M. J., Barker, J. B., Woodcock, C., Harwood, C. G., & McFayden, K. (2018). The development and initial validation of the Irrational Performance Beliefs Inventory (IPBI). *European Journal of Psychological Assessment*, 34(3), 174–180. <https://doi.org/10.1027/1015-5759/a000314>
- Turner, M. J., & Allen, M. S. (2018). Confirmatory factor analysis of the irrational performance beliefs inventory (IPBI) in a sample of amateur and semi-professional athletes. *Psychology of Sport and Exercise*, 35, 126–130. <https://doi.org/10.1016/j.psychsport.2017.11.016>
- Turner, M. J., & Barker, J. B. (2014). Using rational emotive behavior therapy with athletes. *The Sport Psychologist*, 28(1), 75–90. <https://doi.org/10.1123/tsp.2013-0012>
- Turner, M. J., & Barker, J. B. (2015). Examining the effects of rational emotive behaviour therapy (REBT) on the irrational beliefs of blue-chip professionals. *Journal of Rational-Emotive & Cognitive-Behaviour Therapy*, 33(1), 17–36. <https://doi.org/10.1007/s10942-014-0199-6>
- Turner, M., & Bennett, R. (Eds.). (2017). *Rational emotive behavior therapy in sport and exercise*. Routledge.
- Turner, M., Carrington, S., & Miller, A. (2019). Psychological distress across sport participation groups: The mediating effects of secondary irrational beliefs on the relationship between primary irrational beliefs and symptoms of anxiety, anger, and depression. *Journal of Clinical Sport Psychology*, 13(1), 17–40. <https://doi.org/10.1123/jcsp.2017-0014>
- Wood, A. G., Turner, M. J., Barker, J. B., & Higgins, S. (2020). Investigating the effects of Rational Emotive Behaviour Therapy on the irrational beliefs and self-determined motivation of triathletes. *Journal of Applied Sport Psychology*, 32(2), 184–204. <https://doi.org/10.1080/10413200.2018.1561081>