International Review of Sport and Exercise Psychology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rirs20

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To cite this article: Jordan T. Sutcliffe, Scott Graupensperger, Matthew J. Schweickle, Simon M. Rice, Christian Swann & Stewart A. Vella (2021): Mental health interventions in non-elite sport: a systematic review and meta-analysis, International Review of Sport and Exercise Psychology, DOI: 10.1080/1750984X.2021.2001839

To link to this article: https://doi.org/10.1080/1750984X.2021.2001839

Published online: 18 Nov 2021.

INTERNATIONAL REVIEW OF SPORT AND EXERCISE PSYCHOLOGY
https://doi.org/10.1080/1750984X.2021.2001839

Mental health interventions in non-elite sport: a systematic review and meta-analysis

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ABSTRACT

Organised sport is a widely accessible context that can promote health and health behaviours among participants. For that reason, recent decades have brought forth a number of sport-based interventions aimed at improving mental health literacy and symptoms. Despite this trend, there has yet to be a systematic review and meta-analysis to synthesise and estimate the efficacy of published sport-based intervention studies in non-elite sport. Following a systematic search of the literature, we conducted seven independent meta-analyses to test the effect of sport-based interventions on mental health outcomes (depression, anxiety, psychological distress, and wellbeing) and mental health literacy (stigmatising attitudes, knowledge of mental health, and help-provision). A total of 19 articles reporting 47 distinct effect sizes revealed moderate to strong favourable effects of interventions on stigmatising attitudes, knowledge of mental health, and help-provision. Small favourable effects were detected for anxiety, psychological distress, and wellbeing. Finally, sport-based interventions had no significant synthesised effect on depressive symptoms. Although we comment on the need for stronger intervention designs, the field can be optimistic with respect to the mental health literacy findings from the current study and their potential downstream effects on mental health symptoms.

ARTICLE HISTORY
Received 14 March 2021
Accepted 26 October 2021

KEYWORDS
Non-elite sport; interventions; mental health; mental health literacy; meta-analysis

Organised sport participation is recognised as a valuable context for the healthy development of participants (Bruner et al., 2021; Eime et al., 2013). Among a range of positive outcomes related to participation in organised non-elite sport, the study of mental health has burgeoned in both academic and public domains (Vella & Swann, 2020). As a result, several reviews have been published on the relations between sport participation and, for example: symptoms of depression and anxiety in youth sport (Panza et al., 2019); mental health problems among elite athletes (Rice et al., 2016); psychotherapy for mental health problems among elite athletes (Stillman et al., 2019); the management of mental health emergencies among elite athletes (Currie et al., 2019); and mental health awareness interventions in sport (Breslin et al., 2017b). Although these reviews

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offer rich information on mental health in sport, there has yet to be a systematic review and meta-analysis of mental health and mental health literacy interventions specifically in non-elite sport. This is important because the large majority of global sports participants are non-elite, and these participants are typically not afforded the support systems available to elite athletes such as sports physicians, psychologists, and athletic trainers (Vella & Swann, 2020). For context, we operationalise non-elite sport as any sport context that is not classified as semi-elite, competitive elite, successful elite, or world-class elite (i.e. scoring a '0' in 'eliteness' as per Swann et al., 2015). Furthermore, the proliferation of mental health programs and prioritisation of mental health outcomes in non-elite sport has brought the availability of effective programs into sharp focus. In this review, we seek to systematically search for, synthesise, and evaluate the effectiveness of interventions aimed at promoting mental health and mental health literacy in non-elite sports.

Mental health interventions in non-elite sport

Mental health is defined as 'a state of wellbeing in which the individual realises their own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to contribute to society' (WHO, 2014). Researchers have been interested in non-elite sport as a context for mental health promotion and intervention due to the inherent physical activity, the opportunity to develop and strengthen social relationships, and the security and comfort athletes often perceive in sport groups (Ahn & Fedewa, 2011; Graupensperger et al., 2020; Vella et al., 2021). In fact, interventions that have attempted to improve common mental health outcomes (i.e. depression, anxiety, psychological distress, and wellbeing) have utilised both psychological (e.g. sport psychology skills training; Edwards & Steyn, 2008) and physiological (e.g. progressive muscle relaxation; Haney, 2004) approaches. More recently, however, educational interventions that are specifically tailored to group or individual needs have begun to emerge in the literature. For example, a recently piloted intervention (RISE program) by Dowell et al. (2021) aimed to reduce non-elite sport participants' symptoms of depression and anxiety by providing online resources along with a group-based intervention grounded in grit and optimism, emotional self-control, kindness and gratitude, and physical health and wellbeing (i.e. sleep, nutrition, and time use). This program primarily targeted adolescent boys, although parents, coaches, and officials were also provided with mental health resources, which ultimately enhanced adolescents' access to care (Dowell et al., 2021). Although a worthwhile endeavour, reducing symptomology of mental health problems through sport-based interventions may be a difficult task and, therefore, some researchers have opted to improve mental health indirectly by improving mental health literacy.

Mental health literacy encompasses knowledge, attitudes, and help-seeking practices in an effort to prevent, identify, and manage mental health problems and disorders (Jorm, 2012). Considering the stigma and misconception that often surround mental ill-health (Wu et al., 2017), non-elite sport may be well positioned as a vehicle through which to facilitate mental health literacy in a psychologically safe environment (Purcell et al., 2019). As an example, Vella and colleagues developed the *Ahead of the Game* (AOTG; Vella et al., 2018) program – a multi-level, multi-component intervention delivered through non-elite sport clubs. The AOTG program aims to increase mental health literacy among adolescents and their social support systems (e.g. coaches and parents); increase help-seeking

intentions and attitudes among adolescent male sport participants; and increase wellbeing. Since the inception of AOTG, studies have evaluated the effectiveness of specific intervention components in adolescent male athletes (e.g. Liddle et al., 2021; Swann et al., 2018), and parents (e.g. Hurley et al., 2018; Hurley et al., 2021). In addition, the program has been scaled up globally, for example as the official program of the Rugby League Word Cup 2021 (RLWC, 2021). Furthermore, similar mental health literacy programs such as the *Mood Matters in Sport Mental Health Program* (Breslin et al., 2017a), and the *State of Mind Ireland Program* (Breslin et al., 2018; Breslin et al., 2019) have also been evaluated within non-elite sport contexts. In sum, the last decade has brought forth numerous interventions aimed at reducing mental health problems or increasing mental health literacy in non-elite sports that are becoming increasingly influential through translation initiatives.

Considering the number of available mental health interventions in sport, practitioners and policymakers may find it difficult to decide which programs are worth large-scale implementation and translation, and smaller-scale clubs and organisations may find it difficult to know which programs work and which they should invest in. Non-elite sport clubs are almost always limited in monetary resources and time for health promotion, thus highlighting the importance of knowing which mental health programs are most effective for their desired outcomes. Additionally, several of the available interventions are specifically tailored to benefit one gender exclusively, which poses barriers for coaches and practitioners that work in mixed-gender sport. Given the proliferation of sport-based mental health interventions in recent years, there is now a need to synthesise this literature to examine the overall efficacy of sport-based interventions and to uncover which domain of outcomes (mental health problems or mental health literacy) can be reasonably held to benefit from sport-based programs.

The current study

This study sought to systematically review and meta-analyse interventions for mental health and mental health literacy in non-elite sport. As such, the purpose of this study is threefold. First, we aimed to systematically review all available interventions published in peer-reviewed scientific journals that have targeted a mental health or mental health literacy outcome among non-elite sport stakeholders (i.e. athletes, coaches, or parents). We did not include officials as we were solely interested in the athlete's primary support system. Second, we aimed to test the effects of mental health interventions in non-elite sport as an indicator of their efficacy, and to test for potential moderators that may strengthen our understanding of such effects such as for whom those interventions are most likely to be effective (e.g. age, sex, and study quality). Finally, we evaluated the quality of the studies that were included in this review as an indicator of quality of the work to date, to help establish the level of confidence in the findings, and to help guide future research.

Methods

Procedure

In this systematic-review and meta-analysis we have applied the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al.,

2009). Details of the protocol for this systematic review were preregistered on PROSPERO and can be accessed at https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=187675

Search process

The search strategy utilised six electronic databases: SPORTDiscus, PSYCInfo, PSYCArticles, Academic Search Complete, Medline, and Web of Science. The primary search was conducted on 25 November 2019, and then repeated on 12 June 2020 and 5 February 2021 (see Figure 1). We piloted potential search terms that were collaboratively generated by the authors (all of whom have published in the area of mental health and sport) and trialled in the EBSCOhost database. Through this step we aimed to develop search terms that captured relevant articles but limited the number of irrelevant results (Siddaway et al., 2019). Our final search string was: (intervention OR program OR workshop OR control*) AND (mental health OR wellbeing OR anxi* OR depressi* OR illbeing OR stress*) AND (sport* OR athlet*).

Inclusion and exclusion criteria

Studies were included if they reported the effect of a sport-based intervention on a mental health (e.g. anxiety, depression, stress, and wellbeing) or mental health literacy (e.g. help-provision, symptom recognition, knowledge of mental health) outcome. If outcomes pertained to competitive states, such as performance-related stress or anxiety, they

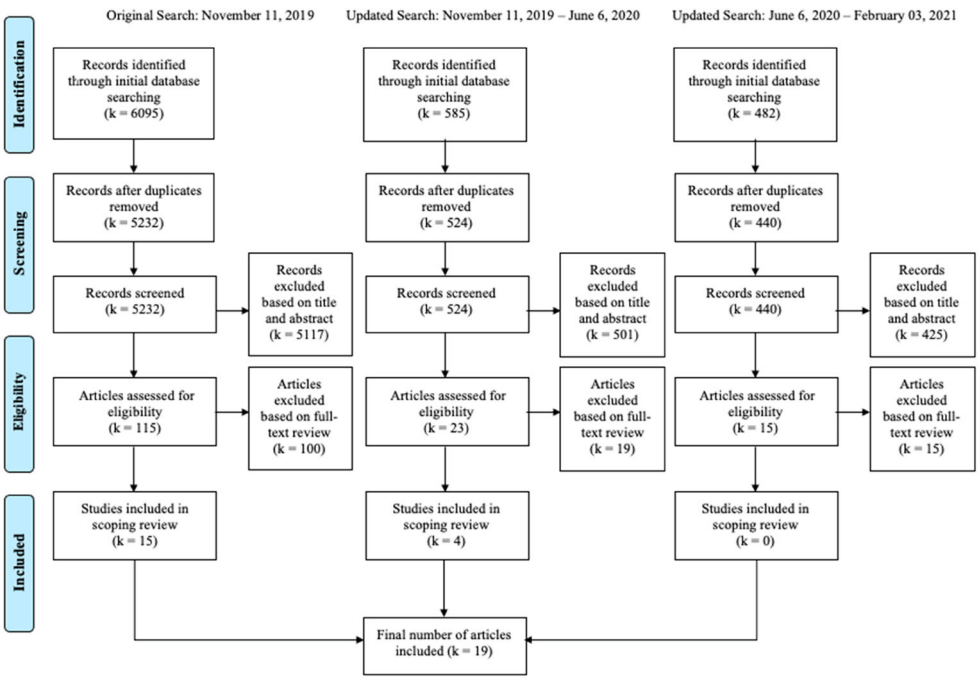

Figure 1. Prisma flow diagram.

were excluded. With respect to study design, we included intervention studies that were either observational (i.e. pre/post designs) and controlled studies (non-randomised and randomised trials). Further, the research must have been conducted with athletes, parents, or coaches in organised non-elite sport. We determined whether samples were non-elite based on recommendations put forth by Swann et al. (2015). Study samples must have scored a '0' after accounting for the athlete's highest standard of performance at the athlete's highest level, experience at the athlete's highest level, competitiveness of sport in the athlete's country, and the global competitiveness of the sport. More specifically, to score a '1' within this framework (i.e. lowest level of elite-sport), athletes must compete at the regional, university, semi-professional, or fourth-tier tour level, and have success at this level for two years or less. As such, athlete samples in this study competed in community-level sport. Finally, studies must have had a primary or secondary purpose related to mental health, and therefore interventions that were not specifically designed to target mental health outcomes were excluded. Articles that either did not contain original data or had not been subjected to peer review were excluded.

Article screening and data extraction

A complete breakdown of our screening protocol can be found in Figure 1. Covidence software was used to conduct article screening. This software allows independent screening at each level (i.e. abstract, full text), identifies and removes duplicates, and documents each step using a PRISMA reporting approach (Moher et al., 2009). Our original search returned 5232 articles following the removal of duplicates (848 duplicates were automatically removed in Covidence). Two authors (*this information has been masked for review*) led all phases of article screening, while the remaining co-authors were consulted when the two primary screening authors disagreed on the inclusion of a study. As such, the original 5232 articles were double-screened at the title and abstract level, which resulted in 115 articles for full-text screening (5117 articles were deemed irrelevant). Following double screening of all eligible full texts, 19 articles that met inclusion criteria remained for data extraction.

An excel spreadsheet was used to facilitate data extraction. The spreadsheet used in this review included columns for study ID, country, details of the study sample, study design, outcomes measured, the general effect of intervention on participants, and study quality. At this stage, the first author led the majority of data extraction, however the third author double-checked five randomly selected articles to confirm the first-author's accuracy (approximately 25% of included studies). Once all necessary data were extracted from the included studies, we categorised outcomes to facilitate meta-analysis. We outline our categorisation procedures in the meta-analytic procedures section.

Assessment of study quality

To evaluate study quality at the individual-study level, we applied the Joanna Briggs Institute's (JBI) critical appraisal for systematic reviews (Joanna Briggs Institute, 2017). The JBI is a tool that offers separate approaches for different study designs (e.g. controlled trials and quasi-experimental) and accounts for varying aspects of study design, the

appropriateness of data analysis, and transparency of reporting. Previous work reports that the JBI is a well-accepted and valid tool to evaluate the methodological quality of studies included in systematic reviews (Munn et al., 2014). Both (this has been masked for a blind review) and (this has been masked for a blind review) independently screened each article and discussed disagreements. Regarding randomised controlled trials, most of the discrepancy between screeners was due to a lack of clarity regarding whether participants were blind to treatment assignment. Discrepancy with quasi-experimental studies often stemmed from ambiguity on whether follow-up was complete, and whether any changes in the follow-up sample were accurately analysed and described.

Meta-analytic procedures

Following initial search and coding procedures, outcomes of interest were categorised into two domains: mental health outcomes and mental health literacy outcomes. Within these broader domains, outcomes were further organised into more specific domains. Mental health outcome domains included: depression; anxiety; psychological distress; and wellbeing. Mental health literacy outcomes included: stigmatising attitudes; knowledge of mental health; knowledge of stigma towards eating disorders; and help provision. Separate meta-analyses were conducted for each outcome domain. Note that because these outcomes reflect both positively and negatively valanced constructs (e.g. wellbeing and depression, respectively) all outcomes were coded so that stronger effect sizes indicated more favourable outcomes. Using a rule-of-thumb with consideration for logistical constraints, we decided a priori to conduct meta-analysis on outcome domains only if there were 3 or more effect sizes that could be synthesised.

In a preliminary step, effect sizes of individual studies were converted to standardised mean difference (SMD) scores for the sake of quantitative synthesis. When a study reported multiple effect sizes categorised into the same outcome domain, each effect size was first converted to SMD and then the average of these effect sizes was calculated and used within the meta-analysis (see Bruner et al., 2021 for similar procedures). This within-study pooling approach accounts for the non-independence of having several effect sizes derived from a single study (i.e. meta-analysis assumes that effect sizes are independent). Effect sizes were then pooled and quantitatively synthesised using the 'meta' package in R (Balduzzi et al., 2019; Schwarzer, 2007). We employed a random-effects approach with maximum-likelihood estimation that is recommended for meta-analyses in the psychological sciences, which relaxes the assumption of fixed-effects models that all studies come from one single population (Borenstein et al., 2007). Thus, the effect sizes from individual studies are thought to deviate from the true effect of interventions due to sampling error and other sources of variance related to intervention design and sample. From these meta-analytic models, we derive a pooled SMD (corrected for error) and a corresponding 95% confidence interval to determine statistical significance. The magnitude of pooled effect sizes can be interpreted using Cohen's (1988) rule of thumb: *small* (SMD = .2), *medium* (SMD = .5) and *large* (SMD = .8).

Heterogeneity and moderation analyses

A central step to meta-analysis is estimating the heterogeneity in pooled effect estimates; the extent to which effect sizes vary within a meta-analysis. Heterogeneity was estimated

by calculating I^2, which is the percentage of variability in effect sizes that is *not* caused by sampling error (Borenstein et al., 2017). I^2 values indicate the level of heterogeneity (25% = low, 50% = moderate, 75% = high) and, when statistically significant, warrant further exploration of potential moderators that partially explain the heterogeneity (Higgins & Thompson, 2002). Although I^2 is the most commonly used estimate of heterogeneity in medical and psychological meta-analyses, it is recommended to also estimate prediction intervals that provide a range of effect sizes that we can expect future studies to fall within (IntHout et al., 2017). If the prediction interval overlaps with zero, then tests of moderation are prudent. When indices of heterogeneity were significant, we conducted follow-up meta-regression analyses (i.e. moderation) to examine the extent that heterogeneity was explained by (a) mean age of the sample, (b) gender composition of the sample (i.e. percent female), and (c) study quality (coding procedures are described above).

Publication bias

The final step entailed estimating the likelihood of publication bias that may result from non-significant studies being unpublished (i.e. file-drawer effect) and/or from larger studies being more likely to be published even without strong or statistically significant effect sizes. To examine potential publication biases, we modelled and inspected a contour-enhanced funnel plot with effect size on the *X*-axis and sample size (i.e. standard error) on the Y-axis. Publication bias is determined through visual inspection of this plot, but we also calculated a quantitative estimate in the form of Egger's test (Egger et al., 1997).

Results

Nineteen articles that were published between 2004 and 2020 were included in this review (see Table 1). The majority of sport-based mental health interventions in non-elite sport were conducted in Australia ($n = 7$; 37%), with the remaining taking place in: Ireland ($n = 3$; 16%); Canada ($n = 2$; 11%); the United-States ($n = 2$; 11%); South Africa ($n = 2$; 11%); Bulgaria ($n = 1$; 5.3%); Poland ($n = 1$; 5.3%); and the United-Kingdom ($n = 1$; 5.3%). Further, interventions were largely delivered to athletes ($n = 15$; 79%), however coaches ($n = 2$; 11%), and parents ($n = 2$; 11%) were also recipients of mental health interventions. It should be noted that although some interventions were delivered to coaches or parents, they were all aimed at benefitting athletes' mental health. Finally, there was a disproportionate representation of gender among mental health interventions with only 33.88% of the total sample being female.

Study quality

The two independent quality assessors had high agreement across all interventions (Cohen's Kappa of 0.89). The overall score for study quality across all 19 studies was 0.75 out of a possible score of 1.00. Although a reasonable overall score, only 5 studies (26%) scored above 0.8, indicating the absence of high reporting quality across most studies. The remaining 14 studies (74%) scored between 0.5 and 0.79, indicating moderate reporting quality for the majority of included studies. As such, no articles were excluded from our analysis based on poor quality.

Table 1. Study summary and quality assessment.

Author(s) & year	Intervention	Participants	Study Characteristics	Outcomes Assessed	Outcome Category	Effect of Intervention	Quality Index
Bapat et al. (2009)	Read the Play Program Three-session workshop (8 h total) of mental health first aid	$N_{INT} = 40$ $N_{CTL} = 0$ $M_{age} = 38.62$ (range 20–59) 60.0% female	Design: Pre/Post Sport type(s): Club football and netball	Confidence to help someone with depression Confidence to help someone with psychosis Knowledge about depression Knowledge about psychosis Changes in attitudes toward depression Changes in attitudes toward psychosis	Help provision Help provision Knowledge of mental health Knowledge of mental health Stigmatising attitudes Stigmatising attitudes	Read the Play participants reported increased knowledge of mental health and decreased mental health stigma post intervention	Moderate (0.67)
Boguszewski et al. (2012)	Five sport-massage procedures Martial art athletes who were cutting weight for competition were provided sport-massage to reduce anxiety	$N_{INT} = 18$ $N_{CTL} = 30$ $M_{age} = 21.72$ 33.3% female	Design: NRCT Sport type(s): Kickboxing and judo	Trait Anxiety	Anxiety	Only men who received sport-massage reported less anxiety than the control group	Moderate (0.56)
Breslin et al. (2017)	Mood Matters in Sport Mental Health Educational Program The three-hour coach program covers mental health awareness, mental health factors, mental health problems and illnesses, signs and symptoms of mental illness, treatments, self-help strategies and sources of aid	$N_{INT} = 184$ $N_{CTL} = 60$ 47.5% female	Design: Quasi-experimental Sport type(s): Gaelic sports, swimming, soccer, and rugby	Mental health knowledge Confidence to help Intentions to help	Knowledge of mental health Help provision Help provision	Coaches' knowledge of mental health increased as did their intentions to offer support to someone with a mental health problem	Moderate (0.78)
Breslin et al. (2018)	State of Mind Ireland (SOMI) Pilot Program Multicomponent mental health awareness program focused on an intro to mindfulness practice and promotion of well-being	$N_{INT} = 56$ $N_{CTL} = 44$ $M_{age} = 20.78$ 41.0% female	Design: Quasi-experimental Sport type(s): Most prevalent sports were soccer, Gaelic football, rugby, hockey, netball, and golf	Intended behaviour Mental health knowledge Wellbeing	Stigmatising attitudes Knowledge of mental health Wellbeing	Knowledge of mental health, and help provision improved at follow up compared to the control group. Intervention participants did not experience improved wellbeing	High (0.89)

Breslin et al. (2019)	State of Mind Ireland (SOMI) Program The program focuses on symptoms and signs of stressors and their impact mental health, how to self-manage difficult mental health symptoms, and to identify self-management resources and strategies.	$N_{INT} = 146$ $N_{CTL} = 54$ $M_{age} = 21.10$ 47.0% female	Design: Quasi-experimental Sport type(s): Gaelic games, football, rugby, hockey, basketball, and others (e.g. netball, golf, archery, rowing)	Subjective norms Attitudes Perceived behavioural control Self-management intentions	Stigmatising attitudes Stigmatising attitudes Help provision Symptom recognition	The intervention group significantly improved perceived behavioural control, attitudes, and self-management intentions in comparison to the control group but not for subjective norms.	High (0.89)
Buchholz et al. (2008)*	Body Sense Basics Program The multi-faceted prevention program featured the which provided education on eating attitudes and beliefs, accurate information about body health, unique body size and shape, resisting pressures to diet, physical activity for enjoyment, helping an athlete feel good about herself, encouraging assertion in athletes, stress management, modelling attitudes and behaviours, and promoting balance between sport participation and life outside of sport.	$N_{INT} = 31$ $N_{CTL} = 31$ $M_{age} = 13.4$ 100.0% female	Design: RCT Sport type(s): Gymnastics	Pressure to be thin Eating attitudes and behaviours	Eating disorders Eating disorders	The Body Sense intervention was found to have a modest but positive influence on participants' perceptions of pressure from within their club to be thin. There were no significant changes on eating attitudes and behaviours	Moderate (0.54)
Chervencova et al. (2015)	Short-term multidisciplinary intervention (remedial training physical therapy procedures, training in shooting and psychological sessions)	$N_{INT} = 8$ $N_{CTL} = 0$ $M_{age} = 37.50$ 60.0% female	Design: Pre/post Sport type(s): Physically disabled sport shooters	Trait anxiety Positive affect Negative affect	Anxiety Wellbeing Depression	Reductions in Trait Anxiety and Negative Affect in the tested athletes was observed	Moderate (0.67)
Davis and Turner (2020)	Rational Emotive Behaviour Therapy (REBT) on the irrational beliefs, self-determined motivation, vitality, and sleep quality	$N_{INT} = 4$ $N_{CTL} = 0$ $M_{age} = 41.75$ 50.0% female	Design: Single case Sport type(s): Triathlon	Vitality	Wellbeing	Vitality increased across all time points from baseline to follow-up	Moderate (0.67)
Dowell et al. (2021)	RISE development program A four-session multicomponent, holistic program specifically tailored to individual and group needs	$N_{INT} = 74$ $N_{CTL} = 0$ $M_{age} = 13.23$ 0.0% female	Design: Pre/post Sport type(s): Rugby	Anxiety Depression	Anxiety Depression	Anxiety significantly decreased from pre to post program, however only a trend-level decrease was observed for depression	Moderate (0.78)

(*Continued*)

Table 1. Continued.

Author(s) & year	Intervention	Participants	Study Characteristics	Outcomes Assessed	Outcome Category	Effect of Intervention	Quality Index
Edwards and Steyn (2008)	Sport psychology theory intervention (6 sessions across six weeks) Sessions included training in physiological arousal, cognitive arousal, mental imagery, attention and concentration, and goal setting and motivation	$N_{INT} = 9$ $N_{CTL} = 7$ $M_{age} = 16\text{-}18$ (range) 100% female	Design: NRCT Sport type(s): Track and field	Wellbeing Anxiety	Wellbeing Anxiety	The sport psychology theory intervention did not significantly increase athlete wellbeing nor did it decrease anxiety	High (0.89)
Elliot et al. (2004)*	ATHENA intervention The peer-lead intervention was delivered during a team's sport season, and its eight 45-minute classroom sessions were integrated into a team's usual practice activities. Topics included a balanced presentation concerning the consequences of substance use and other unhealthy behaviours and the beneficial effects of appropriate sport nutrition and effective exercise training.	$N_{INT} = 337$ $N_{CTL} = 331$ $M_{age} = 15.4$ 100% female	Design: RCT Sport type(s): Dance and cheerleading	Intentions to use a diet pill Intentions to bulimia Knowledge of disordered eating Depression Positive body image Knowledge of unhealthy weight behaviours	Eating disorders Eating disorders Eating disorders Depression Eating disorders Eating disorders	Intervention participants reported less ongoing and new diet pill use and less new use of athletic-enhancing, body-shaping substances (amphetamines, anabolic steroids, and muscle-building supplements)	Moderate (0.77)
Haney (2004)	Two separate intervention protocols were tested (progressive relaxation and cognitive therapy) Progressive muscle relaxation intervention was delivered across six sessions. The cognitive intervention was based on the stress inoculation manual and aimed to help athletes identify cognitive self-statements that are not productive and how to cope with them	$N_{INT} = 47$ $N_{CTL} = 0$ $M_{age} = 24.4$ 100% female	Design: Pre/post Sport type(s): Young female athletes	Trait Anxiety	Anxiety	Both interventions reduced anxiety from pre to post treatment	Moderate (0.67)

Hurley et al. (2018)	Ahead of the Game (Parent Program) Parents were delivered a one-hour workshop focused on mental health literacy for adolescents	$N_{INT} = 42$ $N_{CTL} = 24$ $M_{age} = 44.86$ 77% female	Design: NRCT Sport type(s): Parents of community adolescent athletes	Depression literacy Anxiety literacy Confidence to provide help Mental health literacy Knowledge of help seeking intentions Stigmatising attitudes MHLS attitudes Psychological distress	Knowledge of mental health Knowledge of mental health Help provision Knowledge of mental health Knowledge of mental health Stigmatising attitudes Stigmatising attitudes Psychological distress	Significant differences emerged between groups on depression literacy, anxiety literacy, mental health literacy knowledge, and parental confidence.	Moderate (0.67)
Hurley et al. (2021)	Ahead of the Game (Parent Program) Parents were delivered a one-hour workshop focused on mental health literacy for adolescents	$N_{INT} = 352$ $N_{CTL} = 188$ $M_{age} = 47.42$ 59.4% female	Design: NRCT Sport type(s): Parents of community adolescent athletes	Depression literacy Anxiety literacy Confidence and knowledge Stigmatising attitudes Attitudes that promote help-seeking Personal informal help-seeking Personal formal help-seeking Informal help-seeking for child Formal help-seeking for child Psychological distress	Knowledge of mental health Knowledge of mental health Knowledge of mental health Stigmatising attitudes Help-provision Help provision Help provision Help provision Help provision Psychological distress	Parents in the intervention group improved their confidence and knowledge to assist someone experiencing a mental health disorder and were more likely to seek out formal sources of help. However, parental depression and anxiety literacy, intentions to seek help for their adolescent, and attitudes towards mental health and help-seeking did not significantly improve in the intervention group compared to the control group	High (1.00)

(*Continued*)

Table 1. Continued.

Author(s) & year	Intervention	Participants	Study Characteristics	Outcomes Assessed	Outcome Category	Effect of Intervention	Quality Index
Laureano et al. (2014)	The intervention consisted of six 1-hr sessions presented over two consecutive weeks The session content included psycho-educational material, which included guidelines and practical recommendations for enhancing coping self-efficacy and psychological well-being	$N_{INT} = 20$ $N_{CTL} = 21$ $M_{age} = 18.9$ 0% female	Design: NRCT Sport type(s): First-year University Rugby athletes	Psychological wellbeing	Wellbeing	Athletes in the intervention group experienced increased wellbeing compared to the control group	Moderate (0.78)
Liddle et al. (2021)	Ahead of the Game (Help Out a Mate Program) The 45 min HOAM intervention addressed components of mental health literacy and was delivered within community sport clubs	$N_{INT} = 40$ $N_{CTL} = 53$ $M_{age} = 14.3$ 0% female	Design: RCT Sport type(s): Community football athletes	Intentions to provide help Depression literacy Anxiety literacy Confidence in helping Knowledge of information Attitudes to promote recognition Informal help seeking Formal help seeking Psychological distress	Help provision Knowledge of mental health Knowledge of mental health Help provision Knowledge of mental health Stigmatising attitudes Help provision Help provision Psychological distress	The HOAM program decreased stigmatising attitudes, increased intentions to provide help, and increased knowledge about depression and anxiety	Moderate (0.77)
Luetmer et al. (2019)	Effect of acupuncture on athlete's subjective wellbeing	$N_{INT} = 42$ $N_{CTL} = 0$ $M_{age} = 16.0$ 0% female	Design: Pre/post Sport type(s): High-school aged American-football athletes	Wellbeing	Wellbeing	The acupuncture protocol had no effect on athlete wellbeing	Moderate (0.56)

Varela et al. (2020)	The Resilience in Sport (RIS) Program The effect of the RIS program for coaches on athlete stress was testing. The intervention covered: relationship building; awareness of body; awareness of self; awareness of mind; setting values–directed goals; attention training; imagery and the brain; role models and support networks; solving problems and dealing with conflict; and planning for the worst/expecting the best	$N_{INT} = 86$ $N_{CTL} = 0$ $M_{age} = 15.88$ 53.5% female	Design: Pre/post Sport type(s): Community rowers	Perceived Stress	Psychological distress	The RIS intervention had no effect on their athlete's ratings of perceived stress	Moderate (0.78)
Vella et al. (2021)	Ahead of the Game (AOTG) Program The overarching AOTG intervention includes four separate components: (a) Help Out a Mate (delivered to adolescents); (b) Youth Path to Success (delivered to adolescents); (c) Mental Health Literacy for Parents; and (d) Mental Health Literacy for Coaches	$N_{INT} = 86$ $N_{CTL} = 0$ $M_{age} = 14.53$ 0.0% female	Design: NRCT Sport type(s): Community soccer, rugby league, and swimming	Depression Literacy Anxiety Literacy Confidence to seek help Help seeking intentions Stigmatising attitudes Psychological distress Wellbeing	Knowledge of mental health Knowledge of mental health Help provision Help provision Stigmatising attitudes Psychological distress Wellbeing	The AOTG program led to favourable outcomes with regard to knowledge of mental health, help provision, and wellbeing	High (1.00)

Notes: Outcomes assessed and outcome category are aligned to reflect our outcome categorisation decisions.

Meta-analyses

Although meta-analyses were planned for each of the four mental health outcomes and five mental health literacy outcomes, we could not conduct meta-analyses for two of the literacy outcomes that had fewer than three effect sizes (i.e. symptom recognition, knowledge and stigma towards eating disorders). In total, 47 unique effect sizes were included in the meta-analyses.

Mental health outcomes

The results of the meta-analyses on mental health outcomes are displayed in Figure 2. Pertaining to intervention effects on depression, the pooled SMD was not statistically significant and there was substantial heterogeneity among studies (Figure 2A). Notably, three of the four studies entailed very small sample sizes. Meta-regression analyses revealed that the effects of intervention on depression was not moderated by mean age (b=.05, p=.242), percent female (b=.00, p=.574), or study quality (b=−9.87, p=.262).

The pooled SMD for intervention effects on anxiety was statistically significant (SMD = 0.48; Figure 2B). Despite having seven effect sizes to pool, we note that all seven featured small samples (e.g. <47 participants). Heterogeneity indices indicated that there was minimal heterogeneity, so meta-regression analyses to identify moderators were not conducted.

As shown in Figure 2C, the pooled SMD for the effects of intervention on psychological distress indicated a small but significant overall effect estimate (SMD = 0.22). Meta-regression analyses were not conducted as heterogeneity was minimal.

Pertaining to the final domain of mental health, wellbeing, the pooled SMD (SMD = 0.29) was small but statistically significant (Figure 2D). Although I^2 was not quite statistically significant, the prediction interval overlapped with zero, so meta-regression analyses tested for moderation. The effect of intervention on wellbeing was not moderated by mean age (b=.00, p=.844) or percent female (b=.00, p=.847), but was moderated by study quality (b=.93, p=.049) such that higher quality studies found a more favourable effect of intervention on wellbeing. We note, however, that the significant moderation effect by study quality was very close to the .05 threshold used to signify statistical significance.

Mental health literacy outcomes

The results of the meta-analyses on mental health outcomes are displayed in Figure 3 and recall that meta-analyses were not conducted for symptom recognition or disordered eating domains as there were fewer than three effect sizes to be synthesised. The pooled SMD for intervention effects on stigmatising attitudes was statistically significant (SMD = 0.27), indicating a small favourable effect (Figure 3A). There was significant heterogeneity among studies, thus meta-regression analyses were conducted to identify potential moderators. However, the effects of intervention on stigmatising attitudes were not moderated by mean age (b=-.01, p=.852), percent female (b=.00, p=.545), or study quality (b=-.78, p=.302).

Pertaining to intervention effects on knowledge of mental health, the pooled SMD (SMD = 0.62) indicated a relatively strong favourable effect (Figure 3B). There was substantial heterogeneity across the synthesised effect sizes. Meta-regression analyses indicated

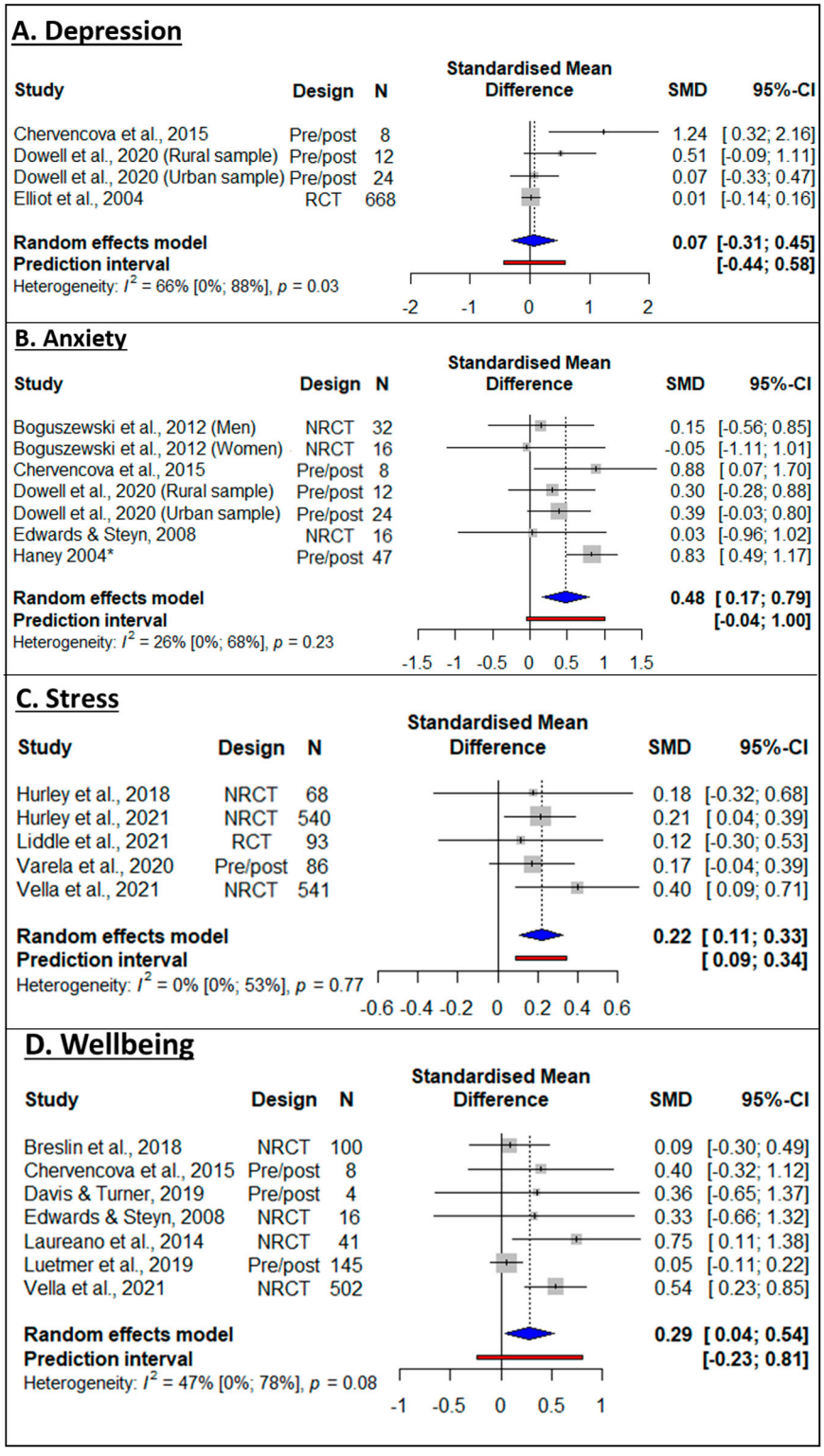

Figure 2. Meta-analyses for each of the mental health outcome domains. *Denotes that SMD was combined from several effect sizes in a single study.

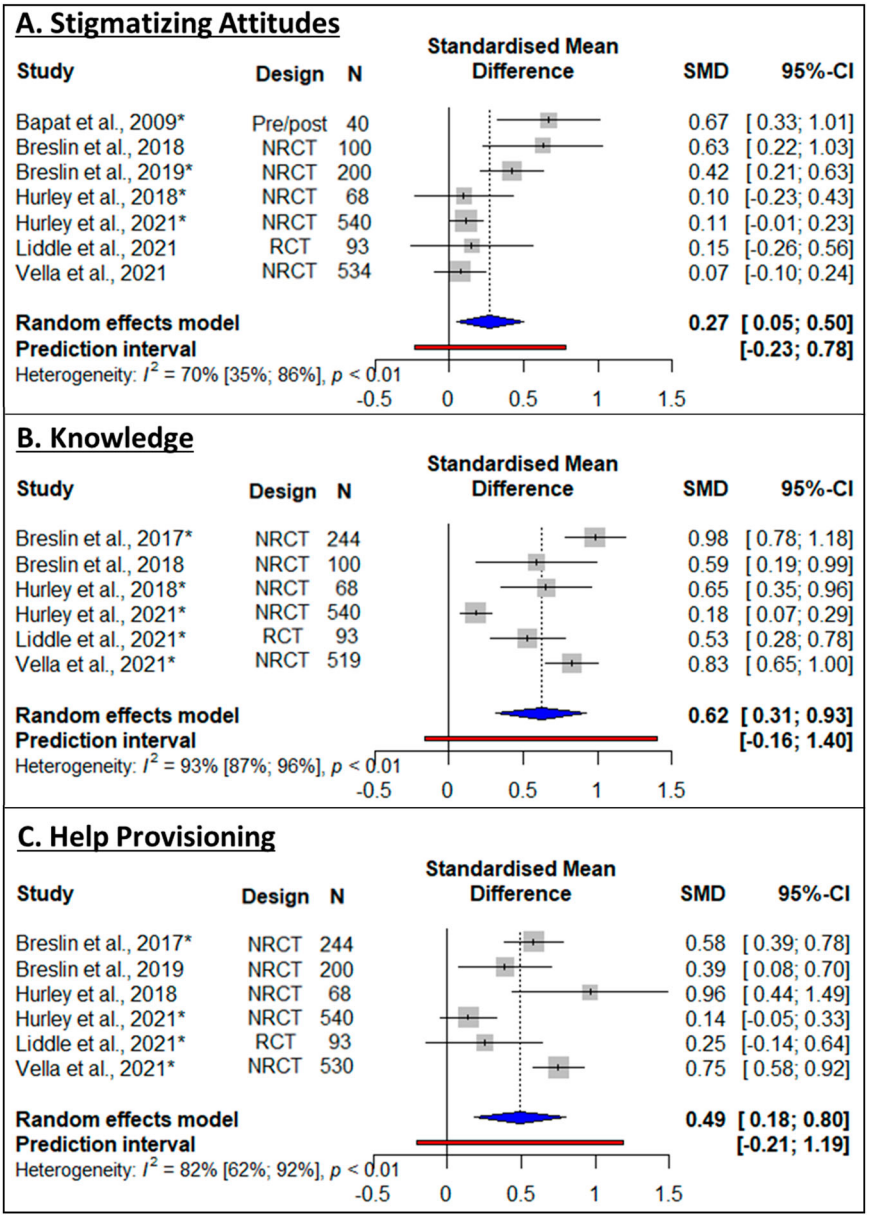

Figure 3. Meta-analyses for each of the mental health literacy outcome domains. *Denotes that SMD was combined from several effect sizes in a single study.

that the effects of intervention on knowledge of mental health was not significantly moderated by mean age (b=-.01, p=.164), percent female (b=.00, p=.635), or study quality (b= −0.776, p=.484).

Regarding the final outcome domain of mental health literacy, help provisioning, the pooled SMD (SMD = 0.49) indicated a significant moderate effect of intervention (Figure 3C). Heterogeneity indices showed that there was substantial variability among the synthesised effect sizes. Meta-regression revealed that the effects of intervention

on help provisioning was not significantly moderated by mean age (b=-.01, p=.716), percent female (b=.00, p=.862), or by study quality (b=−0.731, p=.535).

Publication bias

Several follow-up analyses were conducted to estimate the potential likelihood of publication bias influencing the available literature in the domain of sport-based interventions on mental health and mental health literacy. The contour-enhanced funnel plot shown in Figure 4 plotted each study based on standard error and effect size. Visual inspection of this funnel plot shows several patterns of asymmetry that may indicate potential publication bias. Most notably, there is a cluster of studies (in the top left of the plot) that had small effect sizes with large sample sizes (i.e. small standard errors). This is a hallmark of publication bias as larger studies with null or small effects are more likely to be published, relative to smaller studies with similar effect sizes. This interpretation of our visual inspection was confirmed quantitatively using Egger's (1997) test, which was significant (Intercept = 1.34, 95% confidence interval [0.12, 2.56], p = .037). This signifies substantial asymmetry in the funnel plot that is likely a reflection of publication bias.

Discussion

The purpose of this study was to systematically review and evaluate sport-based mental health interventions in non-elite sport. To do this, we conducted seven independent meta-analyses. With respect to the mental health outcomes, we found marginally significant effects of interventions on anxiety, psychological distress, and wellbeing. Conversely,

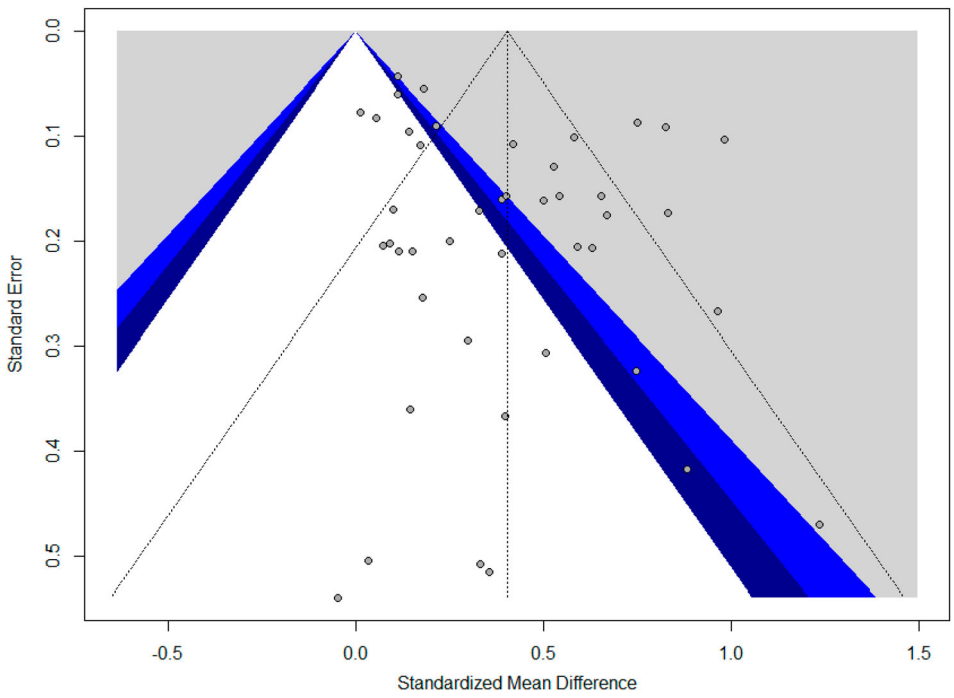

Figure 4. Contour-enhanced funnel plot. Egger's test = 1.34 [0.12, 2.56], p = .037.

our meta-analysis on symptoms of depression did not show a significant effect. Pertaining to outcomes of mental health literacy, we found significant effects of intervention on stigmatising attitudes, knowledge of mental health, and help-provisioning. Despite heterogeneity across all mental health literacy outcomes, our selected moderators (i.e. age, sex, and study quality) were not significant. In sum, although it appears as though several mental health and mental health literacy outcomes can be effectively targeted through sport-based interventions, there remains substantial room to further improve the efficacy and quality of mental health interventions delivered in non-elite sport.

With regard to the pooled effects of sport-based interventions on mental health outcomes, we found mixed evidence across four separate meta-analyses. We did not find evidence that sport-based interventions reduce symptoms of depression in non-elite sport participants. More specifically, three studies (75%) employed a pre/post design with very small sample sizes (44 participants across all three studies). As such, few efforts have been made to reduce depression in non-elite sport contexts, and the attempts that have been made (and published) have much room for improvement. Furthermore, despite finding significant heterogeneity in interventions that measured depression, we found no evidence that participant age, sex, or study quality moderated these effects. Considering the alarmingly high rates of depression in both youth and adult populations (Mojtabai et al., 2016), and the association between participation in organised sport and lower depressive symptoms (Graupensperger et al., 2021; Panza et al., 2019), there is substantial opportunity for researchers to address this through well-designed community sport programs.

Conversely, sport-based interventions had favourable effects with regard to symptoms of anxiety in non-elite sport participants. Similar to depression, many studies within this meta-analysis featured small samples, and either included pre/post or non-randomised designs, which leads to a decrease in the level of confidence in the existing evidence. In addition, significant heterogeneity was not detected in reports of anxiety symptoms, and therefore the underlying contextual elements that may explain the effect of interventions on anxiety remain largely unknown. However, one may look to a recent systematic review and meta-analysis of anxiety in elite athletes for preliminary guidance (Rice et al., 2016). Rice and colleagues noted that symptoms of anxiety among elite athletes did not differ from the general population, and that elite athletes were more likely to experience anxiety if they were dissatisfied with their career, female, relatively younger, and have recently experienced an injury. Although we acknowledge there are asynchronies between elite and non-elite sport, many of these factors permeate both contexts. Taken together, we encourage more attention to the mental health of non-elite sport participants, and work conducted in elite contexts may serve as a valuable template.

Our final two mental health outcomes that underwent meta-analyses include psychological distress and wellbeing. Pertaining to psychological distress, we found small pooled effects for sport-based interventions. The five included studies were not significantly heterogenous and therefore no further information was gathered through moderation analysis. It is important to note that four studies (80%) were interventions primarily aimed at increasing mental health literacy (Hurley et al., 2018; Hurley et al., 2021; Liddle et al., 2021; Vella et al., 2021), but nonetheless measured psychological distress. As such, there remains a gap with respect to specifically targeted interventions for psychological distress in non-elite sport, and thus scholars and policymakers should proceed with

caution when implementing currently available interventions. Furthermore, pooled perceptions of wellbeing also appeared to benefit from sport-based interventions. Although studies that measured wellbeing were not significantly heterogenous, moderation analysis was performed as the prediction interval overlapped with zero. As a result, study quality appeared to moderate this effect, whereby studies of higher quality showed more favourable effects on participants' wellbeing. Considering all studies that measured wellbeing were either pre/post designs or non-randomised trials, robust randomised controlled trials may offer further room for improvement. Altogether, despite the optimism that can be gleaned from the recent push to intervene on mental health in sport, it is clear that research designs must be improved before policymakers can be confident in wide-scale implementation.

In contrast to the mixed evidence found across mental health outcomes, the effects of sport-based interventions on mental health literacy offer a favourable narrative. Beginning with stigmatising attitudes, meta-analysis revealed a small favourable effect of pooled interventions. The seven studies included in this meta-analysis were largely controlled trials (five NRCT's and one RCT), while one utilised a pre/post design. Similarly, our meta-analysis of intervention effects on knowledge of mental health revealed a strong favourable effect, whereas a moderately favourable effect was uncovered for outcomes related to help-provisioning. One potential explanation for such promising findings is that both of the latter outcomes (knowledge of mental health and help-provisioning) included only controlled trials with adequate sample sizes. Alternatively, it is likely that improving mental health literacy (i.e. improving one's knowledge, attitudes, and beliefs) in non-elite sport participants is accompanied with fewer challenges than reducing clinical symptoms of illbeing. As a final point, although all of the aforementioned mental health literacy outcomes were significantly heterogenous, participant sex, age, or study quality did not moderate any of these outcomes. In all, this review reports stronger confidence in the overall effects of sport-based intervention on outcomes pertaining to mental health literacy; however, there remains a need to further explore whether increased mental health literacy has positive downstream effects on mental health symptoms of participants and surrounding agents (e.g. teammates).

Moving forward, a recurring theme of the current study pertains to the variability in design and quality of mental health interventions in non-elite sport. Although our assessment of study quality found moderate to high quality across studies, separate tools were used for observational and controlled studies, and therefore the relatively higher quality of some of the observational studies may be an artefact of the tools used rather than an indication of the strength of the evidence across the field. Further, we conducted several analyses to investigate potential publication bias. Upon inspection of our funnel plot and subsequent results from an Egger's (1997) test, publication bias is likely to exist within the sport-based mental health intervention literature. Considering the variability of study quality (particularly for mental health outcomes) and evidence for publication bias, a troubling reality is revealed for the field. Similar to comments made in a recent meta-analysis of sport-based interventions on positive youth development (Bruner et al., 2021), stronger designs and transparency of effects would be beneficial for sport psychology researchers, stakeholders, and policy makers going forward.

Another issue uncovered in this review that warrants discussion is the inconsistency in which researchers describe the competitive level of their sample (i.e. elite vs. non-elite).

For context, we screened elite status based on recommendations put forth by Swann et al. (2015). This approach takes into account athletes': (a) highest standard of performance; (b) degree of success at their highest level; (c) experience at their highest level; (d) the competitiveness of the sport depending on country; and (e) the global competitiveness of the sport. In our study, we only included studies that scored '0' across all variables. An inherent limitation with this approach is that researchers seldom report sufficient information to accurately evaluate the aforementioned categories, particularly in youth sport. Additionally, youth sport competition level exists along a continuum and young sampling athletes often compete at various levels across multiple sports. Therefore, we strongly encourage researchers to provide ample information with respect to the elite status of athletes.

Limitations and future directions

Our preregistration and adherence to systematic review guidelines should be considered when evaluating the quality of the current review. Nonetheless, common limitations specific to systematic reviews (e.g. unintended excluded studies) do apply. Further, the inclusion of studies that measured mental health symptoms or mental health literacy across various stakeholders (i.e. athletes, coaches, and parents) may limit the generalizability of the findings. Despite all included interventions being conceived to service athletes, disentangling youth and adult samples could provide more in-depth understanding. Moreover, this review is limited by the relatively undeveloped nature of mental health research in sport. Despite commendable research efforts over the last two decades, there remains considerable variability in conceptualizations and definitions of mental health symptoms and mental health literacy in non-elite sport. We encourage scholars to consider embedding future intervention designs in accepted and standardised mental health in sport frameworks (see Purcell et al., 2019). Finally, there is a need to test whether increased mental health literacy (e.g. help provisioning) may have downstream effects on the mental health of others (e.g. teammates). Indeed, young men are particularly subject to stigmatisation, and therefore learning the skills required to offer help to their peers could serve as a powerful approach to reduce stigma. Scholars are encouraged to utilise more intensive study designs (e.g. social network analysis or social network interventions) that may improve the understanding of this relationship in non-elite sport.

From a study design perspective, our meta-analyses included both observational (i.e. pre/post) and controlled studies. Although our decision to include both types of intervention design allowed for more studies to be included in our analysis, the abundance of observational studies decrease the quality of the evidence. Additionally, each study included in this review measured symptoms of mental health and perceptions of mental health literacy via self-report instruments. This raises a number of concerns, including the validity of assessments (e.g. not confirmed via clinician interview or diagnosis), in addition to the wide range of instruments used to measure outcomes of interest to this review. To better illustrate this point, a recent scoping review of depressive symptoms in athletes report an overwhelming 28 different instruments used to measure depression in sport research (Tahtinen et al., 2021). As commented on in Rice et al. (2016), research on mental health in sport is encouraged to move beyond self-reported symptoms and consider more detailed and standardised clinical diagnostics (e.g. Diagnostic and Statistical

Manual of Mental Disorders; DSM-5). Finally, we were unable to run meta-analyses on symptom recognition and eating-disorder related outcomes, which highlights a large gap of knowledge on these outcomes in non-elite sport.

Conclusion

In conclusion, this review and meta-analysis found mixed evidence regarding the effect of sport-based interventions on mental health and mental health literacy outcomes. Specifically, the pooled effects of interventions on mental health outcomes were small or undetectable, whereas moderate to strong favourable outcomes were detected for mental health literacy outcomes. Nevertheless, both outcome domains have substantial room for improvement with respect to study design, conceptualisation and measurement, and transparency of reporting. We hope that this review shines a light on both good and poor practices regarding designing mental health interventions in non-elite sport, and in turn, leads to stronger sport-based programs in the coming decades.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This project was funded in part by the Movember Foundation.

Data availability statement

Further information regarding the data reported on in the current study can be requested by contacting the corresponding author.

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