HHS Public Access

Author manuscript

J Sport Exerc Psychol. Author manuscript; available in PMC 2021 November 21.

Published in final edited form as:

J Sport Exerc Psychol. 2020 June 01; 42(3): 201–218. doi:10.1123/jsep.2019-0235.

Adolescent Sport Participation and Symptoms of Anxiety and Depression: A Systematic Review and Meta-Analysis

Michael J. Panza[1], **Scott Graupensperger**[2], **Jennifer P. Agans**[1], **Isabelle Doré**[3], **Stewart A. Vella**[4], **Michael Blair Evans**[1]

[1]Pennsylvania State University

[2]University of Washington, School of Medicine

[3]Université de Montréal

[4]University of Wollongong

Abstract

Sport may protect against symptoms of mental disorders that are increasingly prevalent among adolescents. This systematic review explores the relationship between adolescent organized sport participation and self-reported symptoms of anxiety and depression. From 9,955 records screened, 29 unique articles were selected that included 61 effect sizes and 122,056 participants. Effects were clustered into four categories based on the operationalization of sport involvement: absence or presence of involvement, frequency of involvement, volume of involvement, and duration of participation. Results from the random-effects meta-analyses indicated that symptoms of anxiety and depression were significantly lower among sport-involved adolescents than in those not involved in sport, although this effect size was small in magnitude. Meta-regression was used to identify how age and sex explained heterogeneity in effects. Although these results do not signify a causal effect, they do support theorizing that sport participation during adolescence may be a protective environment against anxiety and depressive symptoms.

Keywords

mental health; sport psychology; well-being; youth development; youth sport

Mental health is a critical component of health and development throughout adolescence. When considering how to delineate a mentally healthy adolescent, definitions integrate the common perspective of the absence of clinically significant mental disorder along with an optimal state of well-being (World Health Organization, 2014). Specifically, mental health refers to a state of internal equilibrium and well-being where individuals are capable of responding to demands of life and contributing to their community, while actualizing their potential in agreement with societal values (Galderisi, Heinz, Kastrup, Beezhold, &

Panza (mjp674@psu.edu) is corresponding author.

Panza, Agans, and Evans are with the Dept. of Kinesiology, the Pennsylvania State University, University Park, PA, USA. Graupensperger is with the School of Medicine, University of Washington, Seattle, WA, USA. Doré is with the Université de Montréal, Montréal, QC, Canada. Vella is with the University of Wollongong, Wollongong, NSW, Australia.

Sartorius, 2015). Applying this perspective, adolescents who are mentally healthy possess cognitive and social skills that are typical for their development, along with abilities related to emotional regulation, empathy, stress management, and engagement in social roles (Galderisi et al., 2015).

Although mental health is fundamental for development, mental disorders occur at concerning levels among adolescents (Patel, Flisher, Hetrick, & McGorry, 2007). Along with evidence that symptoms of mental disorders affect 10–20% of adolescents during a given year, researchers have demonstrated that mental disorders account for 15–30% of disability-adjusted life years lost during the first 30 years of life (Kieling et al., 2011). Considering the prevalence of mental disorders, it is vital to identify activities, interventions, and policies that support adolescent mental health (Patel et al., 2007).

Facing preliminary evidence that youth sport involvement may be protective against mental disorders (Eime, Young, Harvey, Charity, & Payne, 2013), we sought to synthesize the growing evidence base regarding the relationship between adolescent organized sport involvement and symptoms of anxiety or depression. We selected symptoms of anxiety and depression as critical outcomes to examine, considering the strong relations between them (Kessler, Berglund, & Demler, 2003) and because of the impact on other dimensions of health such as life satisfaction (Headey, Kelley, & Wearing, 1993) and physical health–related quality of life (Jaycox et al., 2009). In addition to revealing current evidence regarding how anxiety and depression symptoms are associated with organized sport involvement, we also sought to advance the quality of evidence by characterizing approaches used to study this relationship.

Sport Participation and Symptoms of Anxiety and Depression

During the crucial developmental period of adolescence, symptoms of both anxiety and depression are widespread (Teubert & Pinquart, 2011). Anxiety disorders entail excessive perceptions of fear or threat, evident, for instance, in social and generalized anxiety disorders (American Psychiatric Association, 2013). Depression refers to persistent feelings of sadness and worthlessness and includes mood disorders, such as major depressive disorder and dysthymia (American Psychiatric Association, 2013). Anxiety and depression also range in severity. For instance, whereas chronic suicidal ideation is evident among adolescents with major depressive disorder (Kandel, Raveis, & Davis, 1991), symptoms integrated in depression measures also include features of mood disorders as well as more transient depressive states, including loneliness, pessimism about the future, and feelings of frustration (e.g., Radloff, 1977). Anxiety and depression are thus commonly assessed using measures of the frequency and intensity of *symptoms* reported by adolescents ranging on a spectrum from subclinical to clinical (Brown, Chorpita, Korotitsch, & Barlow, 1997; Radloff, 1977).

Considering organized sport as a widespread community activity, it is important to consider the extent to which sport participation may protect against symptoms of anxiety and depression. This is because sport offers a unique integration of two factors that are *independently* established as inversely associated with anxiety and depression symptoms:

(a) physical activity (Ahn & Fedewa, 2011) and (b) social relationships and community participation (Eime et al., 2013).

Adolescents who engage in recommended levels of 60 min or more of moderate-to-vigorous activity experience fewer anxiety and depression symptoms (Paluska & Schwenk, 2000). For instance, Ahn and Fedawa (2011) conducted a meta-analysis and found that physical activity can significantly reduce depression, anxiety, psychological stress, and emotional disturbances in clinical and nonclinical samples of children and adolescents (i.e., effect size of −0.30 for randomized control trials and −0.57 for nonrandomized control trials). A recent review of reviews ($k = 42$ reviews) conducted by Biddle, Ciaccioni, Thomas, and Vergeer (2018) further reported that regular physical activity is a protective factor pertaining to depression and anxiety symptoms. Nevertheless, Biddle et al. (2018) reported that anxiety symptoms were rarely the focus of recent studies and that evidence was mixed regarding the magnitude of the inverse relationship between anxiety symptoms and physical activity.

A second argument for an association with mental health is that sport can support social relationships that contribute to mental health via psychosocial, behavioral, and physiological pathways laid out by Umberson and Karas Montez (2010). Perhaps most closely aligned with the theorizing of sport researchers, personal relationships within the sport community can be resources to support mental health through psychosocial processes such as social support, personal control, and social identities (Eime et al., 2013). Further aligning with the psychosocial path, sport may satisfy the need to belong and expose adolescents to group memberships that are critical for well-being (e.g., Cruwys et al., 2013). Beyond psychosocial influences, there are behavioral mechanisms such as the responsibility that athletes feel for the mental health of themselves and others (e.g., supporting teammates; Liddle, Deane, Batterham, & Vella, 2019). Social interactions may also generate positive and negative processes within immune, endocrine, and cardiovascular systems. As one example, social support plays a stress-buffering role by reducing cardiovascular reactivity to stress (Uchino, 2006). Adolescent organized sport may thus support mental health to the extent that adolescents experience positive interpersonal relationships.

Critical to the previously mentioned descriptions is the recognition that sport provides exposure to both positive and negative experiences with physical activity and social relationships. Despite the potential for sport as a preventive context, certain sport contexts may produce detrimental effects within physical, emotional, psychological, and social domains (Fraser-Thomas, Côté, & Deakin, 2005). For instance, the mental health of an adolescent athlete may be harmed by experiences with inadequate (e.g., autonomy thwarting) or even abusive relationships with coaches, parents, peers, and others in sport (Macdonald, Côté, Eys, & Deakin, 2012). Even contextual features, such as overtraining or spending a large number of hours involved in sport, may be detrimental to one's psychological well-being (Merglen, Flatz, Bélanger, Michaud, & Suris, 2014). As such, *context* is critical to understanding links between sport and the domain of mental health (e.g., Evans et al., 2017).

Researchers studying the relationship between sport and mental health should therefore be sensitive to variability in the sport context. This is particularly the case because it can

be challenging to define what it means to "participate" in sport. First, there is ambiguity regarding what types of activities constitute sport. Second, there is variability regarding how we evaluate participation; do we consider overall involvement, amount, frequency, type, or other characteristics of sport? Studies of youth sport accordingly lack a universal definition for what "sport involvement" entails—employing measures of involvement frequency, differing types of sport, and different settings (see Evans et al., 2017). In studies examining relationships with anxiety or depression symptoms, measures of sport participation range from whether adolescents report being involved or not (e.g., Jewett et al., 2014) to the amount of sport involvement (e.g., hours per week; Wang, Chow, & Amemiya, 2017). If these different operationalizations represent different "exposures" to sport, the effects of a given study are likely contingent on how sport is assessed. By accounting for these differences across studies, sport researchers can develop a deeper understanding of this relationship.

Previous Scoping and Systematic Reviews

Considering the previously mentioned conceptual arguments, it is perhaps not surprising that several researchers have conducted reviews regarding psychosocial outcomes of organized sport participation. However, key reviews have been narrative or scoping in nature or have focused on psychosocial correlates of organized sport participation that range widely from sport-specific cognitions (e.g., group cohesion, autonomy, sport burnout) to indicators of more general mental health (e.g., self-esteem, well-being). This pattern is evident in two recent reviews of sport literature. Eime et al.'s (2013) scoping review described a predominately positive relationship between sport participation and psychological, psychosocial, and social health domains; many of which were greater in magnitude than other forms of leisure-time physical activity. In a subsequent review, Evans et al. (2017) explored potential psychosocial correlates of youth sport type (e.g., individual or team sport); sport setting (e.g., school-based or community clubs); and individual patterns of involvement (e.g., sampling or specializing in sports). The authors identified trends in published studies that relate to mental health outcomes, including the relationship between the amount of sport involvement and quality of life, but the authors did not report aggregated findings via meta-analysis (Evans et al., 2017).

Although these reviews synthesized evidence, they focus on heterogeneous studies involving an array of psychosocial outcomes. This heterogeneity prevents statistical aggregation, making it challenging to estimate the magnitude of the relationship between adolescent sport participation and symptoms of anxiety or depression. Meta-analysis can aid in producing more precise and powerful estimates of the presence (or absence) of an association that exists in the population of interest, compared with what can be obtained in single empirical studies (Schmidt & Hunter, 2014). Although the usefulness of meta-analysis is limited by key factors such as the rigor and nature of underlying studies, this approach can complement the evidence base. Variability in the nature of studies (e.g., sample size, measures used, contexts) also produces heterogeneity that can be examined through moderation analyses (Schmidt & Hunter, 2014). For example, a meta-analysis by Graupensperger, Jensen, and Evans (2018) examined variability in effect sizes by the age of athlete samples to identify potential patterns in effects related to age—revealing moderation effects that had not been

tested in the original studies. Meta-analysis has the potential to reveal the magnitude of correlations between sport involvement and symptoms of depression and anxiety—while identifying types of studies or contexts where this correlation is strongest.

The Current Review

In response to calls to consider sport as a protective community context for mental health (e.g., Eime et al., 2013), it is critical to aggregate the available evidence regarding the relationship between sport participation and mental health in adolescents. The purpose of the current review was thus to conduct a systematic review of original research regarding the correlation between mental health and organized sport participation among adolescents aged 12–18 years. Focusing on anxiety and depression symptoms as commonly studied mental disorders that are particularly prevalent among adolescents, we systematically searched for aggregated evidence of correlations with sport involvement using meta-analysis. Although definitions vary, we focused on adolescence as a period from 12 to 18 years of age that represents critical developmental transitions (Jaworska & MacQueen, 2015).

Beyond the substantive focus on the magnitude of the correlation between sport involvement and symptoms of anxiety and depression, we also conducted the current review to examine and describe how researchers operationalize sport involvement. Are there different “types” of measures that researchers use to identify whether or how much adolescents are involved in sport, relative to anxiety and depression symptoms? We anticipated that a review would inform this question by identifying common operationalizations of sport involvement and by examining how correlations with anxiety or depression symptoms vary in relation to context and measurement strategy.

We anticipated small-to-moderate inverse effects pertaining to the correlation between sport participation and symptoms of anxiety and depression. A notable factor that prevented us from forming a priori hypotheses is that we anticipated that (a) studies used varying operationalizations of sport involvement and measures of anxiety and/or depression symptoms and (b) there would be heterogeneity in these effects across operationalizations. Of note, we subsequently aimed to test moderating variables that would partially explain this variance. We explored whether the correlation between sport participation and symptoms of anxiety and depression varied as a function of sex and age. Moderation analyses were also conducted to test whether effects varied when comparing studies where data were collected primarily to study this relationship or studies that involved secondary analysis of existing datasets.

Method

This systematic review and meta-analysis involved original, published studies that examined the correlation between adolescent organized sport participation and symptoms of mental disorders, with a focus on self-reported anxiety and depression symptoms. We sought quantitative studies employing both correlational and experimental designs. This review was preregistered using the International Prospective Register of Systematic Reviews

(registration: CRD42019116549) and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Moher, Liberati, Tetzlaff, & Altman, 2009).

Search Process

A systematic search was conducted in October 2018 (updated in April 2019) using queries developed for several databases, including: Web of Science (Clarivate Analytics), SPORTDiscus (EBSCO-host), MEDLINE (PubMed), as well as ERIC and PsycINFO (ProQuest). Searches extended to the earliest date for each database (e.g., Web of Science: 1900).

Search strategies constructed uniquely for each database are provided in the Supplementary Materials (available online) in their entirety. All searches were focused on three groups of terms: Group 1 included terms relating to adolescence (e.g., youth, teenager, boy, girl); Group 2 included terms relating to "organized sport" (e.g., athlete, training, athletic); specific sports (e.g., basketball, football, soccer); and Group 3 included terms relating to anxiety and depression, along with comprehensive terms related to mental health (e.g., internalizing problems, mental health, emotional disturbances). Although some of these terms extended beyond the goal to study anxiety and depression, they were included to capture studies in which subscales or added items that reflected anxiety or depression indirectly could be drawn in during the search. Alongside the extensive systematic search strategy, two supplemental steps included: (a) an adapted search through the Google Scholar search engine, with the first 500 results screened at the title and abstract level, and (b) hand searches of reference lists of included studies and previous reviews of the literature (e.g., Eime et al., 2013; Evans et al., 2017).

Study Selection

Following the database and supplemental searches, the first step included aggregating records within a database manager (i.e., EndNote) and removing duplicates using an online software deduplication program (Rathbone, Carter, Hoffmann, & Glasziou, 2015). The lead author and an experienced research assistant screened remaining article records at the level of title and abstract to identify articles that did not focus on sport or mental health constructs and to exclude ineligible article types (see PRISMA flowchart in Supplementary Materials [available online]). The screening process was managed through the web application Rayyan QCRI (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016). From a sample of 313 doubly coded articles, the screeners agreed on 94% of decisions. After discussing discrepancies, both reviewers progressed toward reviewing full texts for eligibility.

Article selection was guided by the inclusion and exclusion criteria listed in Table 1. In addition to several criteria based on paper characteristics (e.g., publication date, language), key criteria were generated through established definitions of the concepts "adolescence," "organized sport," and "mental health." Due to the ambiguity of the term "adolescence," it was essential to operationalize the intended age range. To be included, study samples had to include participants for whom the mean age was between 12 and 18 years, since these years are generally referred to as adolescence (U.S. Department of Health and Human Services, 2017) and align with developmental contexts of sport (e.g., sport clubs high school sport).

Although we only included studies where the mean age was within 12–18 years of age when sport participation was measured, study samples occasionally included participants above or below this range. As such, we included only studies with a mean between 12 and 18 years and with *all* participants older than 8 and younger than 20 years of age. A single study did not meet these age criteria as a whole, but an effect size was, nevertheless, obtained because statistical results could be drawn from a subsample of the study that fit within our age criteria.

Critically, studies had to include both an indicator of organized sport participation and a measure of anxiety and/or depression symptoms, with a quantitative estimate of the correlation between them. Studies included in this review had to include depression or anxiety variables that were self-reported by adolescent participants as a strategy to reduce potential variability in the operationalization of these constructs. Meanwhile, the definition applied to sport participation was a type of organized and competitive physical activity that is played on a team or as an individual (Eime et al., 2013) and shaped by facilities, policies, and normative beliefs that the activity is seen as sport (Evans et al., 2017). Whereas this definition included varying settings, including school-based, community-based, and competitive sport, we excluded physical activity settings that did not fit this definition (e.g., physical education, active transportation).

Data Extraction and Risk of Bias Assessment

Data extraction was completed by the lead author, with goals of extracting pertinent information and to assess the risk of bias for each identified article. Coding sheets included descriptive features of studies such as citation details, participant characteristics, study design, anxiety and/or depression symptoms measures, and the approach to measure sport involvement, as well as study findings and analyses. Quantitative details were extracted to estimate effect sizes, both in relation to correlation or regression analyses (e.g., correlation coefficient, sample size) and in relation to analyses involving between-group differences (e.g., mean differences, standard deviation, group sizes). The lead author e-mailed corresponding authors for additional information in cases where required statistical information was not published (e.g., *b* reported instead of *r*). Eight authors were contacted, and 88% provided the required information within 3 weeks of the request.

Articles were also reviewed to address risk of bias in relation to study methods, analyses, and reporting using an adapted coding tool. The 14-item tool is available in the Supplementary Materials (available online) for this manuscript and was developed based on previous reviews (i.e., Eime et al., 2013; Evans et al., 2017). The coding tool integrated items for reporting, design, and measurement as well as results and analyses. In addition to 12 items regarding study design and analysis from existing tools, the authorship team created two items regarding the sport participation operationalization that were unique to this review; these items assessed the clarity of the measurement approach. All items were coded in a binary yes/no fashion and total scores for each article calculated, with greater scores indicating a lower risk for bias. Interrater reliability for the tool was demonstrated when three authors (M.J. Panza, S. Graupensperger, and M.B. Evans) independently coded four articles. Using the average Cohen's κ (1960) among reviewers, the coders failed to

attain acceptable reliability on an initial sample of four articles (κ = .45; 90% agreement). The coding instructions were amended, and a review of another four articles produced acceptable reliability (κ = .66; 92% agreement). The lead author coded remaining articles.

Synthesizing Results

Although all studies involved the relation between sport participation and anxiety and/or depressive symptoms, there was considerable variability in the way that sport participation was measured. Thus, a preliminary step was to organize studies within groups based on the method used to measure sport participation. For example, studies that examined how *frequently* adolescents engage in sport were unable to be synthesized with studies that examined how long an adolescent had been playing sport. The classification of studies is described below, and this clustering resulted in four subgroups that were meta-analyzed separately. Importantly, meta-analyses were only carried out when a subgroup included a sufficient amount of effect sizes from distinct studies.

Meta-Analytical Procedures—Effect sizes were quantitatively synthesized using meta-analytic methods developed by Schmidt and Hunter (2014) using the *psychmeta* package in R (Dahlke & Wiernik, 2019). These procedures entail random-effects modeling, which assumes that the sample from each individual study does not come from one single population, and thus, effects are allowed to deviate from the true population-level effect (see Borenstein, Hedges, & Rothstein, 2007). The random-effects modeling is recommended by Schmidt, Oh, and Hayes (2009) as it is conservative in nature, providing more accurate results. Beginning by converting effect sizes to correlation coefficients, we computed an estimate of the mean population effect (i.e., ρ) that is weighted based on study sample size and is corrected for unreliability in measurement (i.e., Cronbach's α). That is, analyses corrected for attenuation due to measurement error anxiety and depression symptoms measures. We calculated 95% confidence intervals (CIs) to determine statistical significance of ρ, whereby intervals that did not include zero were deemed to be "real."

An important step to examining moderation in meta-analysis is to consider heterogeneity, regarding the extent that reported effect sizes vary within each meta-analysis. When heterogeneity was present, we tested whether the correlation between sport participation and mental health was moderated by age or sex—and whether Q effect sizes differed significantly by the design type of the study (i.e., primary data vs. secondary data use). Heterogeneity was probed by considering Q values indicating the presence of heterogeneity, alongside I^2 values that estimate the magnitude of heterogeneity that was not caused by sampling error, calculated as: $I^2 = 100\% \times (Q - df)/Q$. I^2 thus represents the proportion of observed variance that reflects variance in true effect sizes rather than sampling error (Borenstein, Higgins, Hedges, & Rothstein, 2017). I^2 values can range from 0% to 100%, where values of 25%, 50%, and 75% reflect low, medium, and high levels of heterogeneity, respectively. We conducted moderation analyses when effect sizes were heterogeneous (i.e., significant Q value and I^2 of at least 25%) using meta-regression analyses and subgroup moderation analysis. Specifically, meta-regressions were computed by regressing the correlation coefficient of each study on the mean age and percentage of

female participants (Huizenga, Visser, & Dolan, 2011). Subgroup moderation analyses were conducted to contrast effect sizes across studies using primary or secondary data.

In a final set of analyses, we examined the potential for publication bias by inspecting a contour-enhanced funnel plot of *SE*s with a quantitative estimate of bias (i.e., Egger's regression test; Egger, Davey Smith, Schneider, & Minder, 1997). Determination of publication bias is based on both visual inspection (i.e., symmetry of effect sizes around the estimated ρ value indicate that bias is unlikely) and the statistical significance of the Egger's test (i.e., significant Z values indicate that bias may be present).

Results

The initial search query retrieved 9,995 articles, which were evaluated for suitability in the current review (see PRISMA flowchart in Supplementary Materials [available online]). An additional 50 articles were found through a supplemental search. Specifically, 1,913 articles were screened at the level of title and abstract, followed by the full review of 60 full-text articles against the inclusion and exclusion criteria. Ultimately, 29 studies were identified and key details from each article are presented in the study summary table (Table 2). Whereas there was substantial variability in sample sizes—ranging from 62 to 32,456 participants with a median of 1,036—13 studies reported on what were considered large-scale samples (i.e., over 1,000 participants), most of which were conducted as secondary analysis of data sets acquired across numerous school contexts. As examples, four studies (i.e., Ashdown-Frank, Sabiston, Solomon-Krakus, & O'Loughlin, 2017; Brunet et al., 2013; Jewett et al., 2014; Sabiston et al., 2016) drew data from the Nicotine Dependence in Teens Study and two studies (i.e., Agans & Geldhof, 2012; Zarrett et al., 2009) drew data from the 4-H Study of Positive Youth Development. The majority of studies were published in the past 10 years, with the year of publication distribution in 5-year increments included 4% of studies published from 1996 to 2000, 7% from 2001 to 2005, 24% from 2006 to 2010, 24% from 2011 to 2015, and 41% of studies from 2016 to 2019. In terms of study design, longitudinal designs were common (55%). Longitudinal studies employed designs where the time between data collection was usually 1 to 3 years; 34% of longitudinal studies measured sport participation during adolescence and symptoms of mental disorders later in adolescence or during emerging adulthood. The remaining 45% of studies were cross-sectional in nature.

The majority of studies came from the United States ($k = 10$), Canada ($k = 9$), Australia ($k = 3$), and Spain ($k = 2$). Several countries had one study included in the review (i.e., Iceland, Japan, Nigeria, and Slovenia) and one study included participants from various European countries. All of the participants involved in the studies were adolescents between the ages of 10 and 20 years at the time when sport participation was measured. Regarding quality, 83% of studies received a score between 11 and 14, indicating a relatively low risk of bias (see scores in Table 2). Nevertheless, items within the risk of bias coding sheet that were least likely to be evident within studies included the inclusion of a researcher-defined operationalization of sport involvement (72% unreported) and the reporting of actual p values (59% unreported).

Recall that only self-reported measures of depression and anxiety symptoms were included in this review. The majority of studies measured exclusively depression symptoms (k = 18). Two studies assessed anxiety symptoms exclusively, and nine studies assessed both anxiety and depression symptoms. The Center for Epidemiological Studies Depression Scale (Radloff, 1977) was the most common measure; being included in 10 studies. There was, nevertheless, substantial variability in the tools used, with no other measure being used more than three times. Additional validated depression tools included the Major Depressive Inventory (used by Brunet et al., 2013) and the Beck Depression Inventory (used by Boone & Leadbeater, 2006). Meanwhile, anxiety scales included the Zung Self-Rating Anxiety Scale (used by McMahon et al., 2017), Hospital Anxiety and Depressive Scale (used by Doré et al., 2018), and State-Trait Anxiety Inventory (used by Dolenc, 2015). Across the 15 measures of anxiety and depression symptoms that were adequately reported on, most scales were validated within adolescent populations (97%), with many validated for use as screening tools in clinical contexts (76%).

We also coded tools regarding scale length, design of items, and severity of symptoms. With the exception of one multiple-choice option measure, all tools involved Likert-type items. Whereas 53% of measures included items asking participants to rate how frequently given symptoms were experienced (e.g., never to every day), remaining tools included items asking participants to indicate the extent that item statements reflected them (e.g., strongly agree to strongly disagree). Whereas 47% of measures assessed at least one item that directly reflected both the severity and frequency of symptoms that reflect anxiety or depression disorder criteria in the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (American Psychiatric Association, 2013), remaining tools incorporated exclusively generalized and subclinical symptoms of depression.

Operationalization of Sport

A goal of this review was to characterize operationalizations of sport involvement—both as a necessary step for conducting meta-analysis and to identify the status of the evidence base. The resulting operationalization is provided in Table 3. By contrasting studies, we identified four types that signify the approach used to define sport involvement. These include one type reflecting a dichotomous index classifying adolescents as sport involved or not and three interval or ratio-level classes: (a) frequency of sport involvement using a scale-scored value, such as hours per week; (b) number of teams or times an individual participates over a period of time (e.g., number of organized sport teams in the past 12 months); and (c) duration of sport involvement, as the number of years in which a participant reported sport involvement over time.

Meta-Analyses

The results of separate meta-analyses are reported in Figure 1. Although there were eight possible meta-analyses, three core analyses were conducted because (a) studies assessing sport frequency and volume employed similar measures, so analyses could be collapsed; (b) no studies reported the extent that frequency/volume of involvement was associated with anxiety; and (c) there were insufficient studies to justify meta-analyzing subgroups where duration of involvement was measured (although these studies were examined descriptively).

A total of 52 relevant effect sizes were included. Across the meta-analyses, we consistently found a small inverse correlation between sport participation and symptoms of anxiety and depression.

Dichotomous Index of Sport Involvement.—This operationalization of sport participation as a binary variable (i.e., involved or not) resulted in 30 relevant effect sizes, 10 relating to anxiety and 20 relating to depression. The 10 effect sizes that measured the correlation between symptoms of anxiety and sport participation revealed a small negative mean correlation ($\rho = -0.12$, 95% CI [−0.15, −0.10]). There was significant heterogeneity across these 10 effect sizes ($Q = 31.20$, $p < .001$; $I^2 = 71.15$). Meta-regression revealed that sex significantly moderated this correlation ($R^2 = .50$; see Supplementary Material S.3.1 [available online]). Specifically, for studies with relatively more male participants, there was a stronger inverse (i.e., negative) correlation between sport involvement and anxiety symptoms.

The 20 effect sizes that measured the correlation between symptoms of depression and sport involvement also revealed a small negative mean correlation ($\rho = -0.08$, 95% CI [−0.10, −0.06]). There was significant heterogeneity among these 20 effect sizes ($Q = 98.41$, $p < .001$; $I^2 = 80.69$). We found that age significantly moderated this correlation such that the inverse correlation between sport involvement and depression symptoms was stronger in samples with a relatively older mean age ($R^2 = .39$; see Supplementary Material S.3.2 [available online]). As such, sport involvement may be more protective for depression symptoms among older adolescents.

Subgroup analyses revealed that the type of data also moderated this correlation—identifying differences between studies that collected data with the primary intent of studying the correlation between sport and depression symptom, relative to secondary analysis of existing data. Specifically, the inverse correlation between sport involvement and depression symptoms was stronger in primary studies ($\rho = -0.14$, 95% CI [−0.15, −0.12]) compared with secondary analyses ($\rho = -0.07$, 95% CI [−0.09, −0.05]).

Frequency and Volume of Sport Involvement.—There were 22 effect sizes from studies that operationalized sport participation as the frequency or volume of sport involvement—all of which examined correlations with depression symptoms. In this domain, meta-analysis revealed a small negative mean correlation between frequency of sport participation involvement and depression symptoms ($\rho = -0.09$, 95% CI [−0.11, −0.06]). Although there was significant heterogeneity across these 22 effect sizes ($Q = 189.74$, $p < .001$; $I^2 = 88.93$), neither the sex nor mean age of study participants moderated this correlation. Similarly, subgroup analyses indicated that the effect sizes did not significantly differ between studies that analyzed primary and secondary data.

Duration of Sport Involvement.—The final operationalization for sport involvement related to the duration that adolescents had been participating in sport. Although these effect sizes are listed in Figure 1, the number of effect sizes using this operationalization did not meet the designated threshold (i.e., at least 10 effect sizes from at least five original studies), so meta-analysis was not conducted. One study (i.e., Ashdown-Franks et al., 2017) provided

effect sizes for the correlation between duration of sport participation and symptoms of anxiety for adolescents involved in team sport ($r = -.11$) and for those involved in individual sport ($r = .02$), although both were nonsignificant. In addition, we identified nine effect sizes from four original studies that examined the correlation between duration of sport participation and symptoms of depression. For instance, Jewett et al. (2014) provided an effect size of −0.12 for the correlation between school sport participation throughout the 5 years of secondary school and symptoms of depression in young adulthood. Across the available evidence, there is an indication that duration of sport participation may have a small inverse correlation with depression symptoms; however, meta-analysis of these existing effect sizes could not be conducted.

Scale Design Meta-Regression

After identifying variability in measures of anxiety and depression symptoms, we conducted exploratory moderation analyses regarding whether effects differed in relation to (a) the Likert-type scaling approach as items assessing symptom frequency, or the degree of support or endorsement for each item, and (b) severity of symptoms. Meta-regressions were collapsed to aggregate effects across both anxiety and depression symptom measures for each of the three sport operationalization types. These analyses were conducted as recommended by one of the peer-reviewers to examine if variation in scales impacted the results. Six exploratory analyses were conducted (anxiety and depression across three different operationalizations), but none were significant.

Publication Bias

We conducted follow-up analyses to assess the likelihood of publication bias impacting the current meta-analytic findings. Upon inspecting the contour-enhanced funnel plot of *SE*s, it was determined that the effect sizes did not deviate from symmetry enough to warrant apparent concern for publication bias (Figure 2). Across all studies that comprise this literature, a nonsignificant Egger's regression test indicated that publication bias was indeed unlikely ($Z = -1.18$, $p = .24$, $b_{\text{intercept}} = 0.04$, 95% CI [−0.21, 0.29]). This conclusion was further supported by conducting Egger's tests on all three core meta-analyses separately —none were significant (i.e., Depression—Involvement: $Z = -.52$, $p = .60$, $b_{\text{intercept}} = -0.25$, 95% CI [−0.72, 0.22]; Depression—Frequency/Volume: $Z = -1.61$, $p = .10$, $b_{\text{intercept}} = 0.47$, 95% CI [−0.28, 0.53]; Anxiety—Involvement: $Z = 0.27$, $p = .79$, $b_{\text{intercept}} = 0.47$, 95% CI [−0.21, 1.14]).

Discussion

Research spanning decades provides evidence that self-reported anxiety and depression symptoms are lower in adolescents who engage in greater daily physical activity or who participate in physical activity interventions (Ahn & Fedewa, 2011). However, this evidence has been slower to crystallize in relation to sport. The current systematic review and meta-analysis of peer-reviewed literature examined correlations between organized sport involvement and self-reported anxiety and depression symptoms. We observed a growing evidence base of 29 primary and secondary empirical studies to examine correlations between anxiety or depression symptoms and participation in sport. Sixteen

of these investigations were published within the past 5 years. Meta-analysis revealed that sport participation held a negative—albeit small—correlation with anxiety and depression symptoms. These effects were evident within studies assessing whether or not adolescents were involved in sport, as well as studies employing continuous measures of frequency, volume, or duration of sport participation. This discussion incorporates insights regarding how we may advance research alongside implications that can be drawn from these findings regarding correlations between sport involvement and mental health.

Perhaps most notably, the meta-analysis revealed that sport involvement was significantly and inversely associated with anxiety and depression symptoms. Significant effects were evident in the three analyses where enough studies had been published to permit meta-analysis: (a) anxiety associated with binary sport involvement, (b) depression associated with binary sport involvement, and (c) depression associated with either the frequency or volume of sport involvement. These findings align with expectations for the role of organized sport within youth development (Eime et al., 2013). Although effects were relatively weak in magnitude and emerged from survey-based studies, the majority of studies used prospective designs with large samples that provide evidence that sport-involved adolescents report relatively lower levels of anxiety and depression symptoms.

Whereas the inverse correlation between sport and symptoms of mental disorders is small, the magnitude aligns with recent reviews involving the relationship between physical activity and mental disorders. For instance, a review of survey studies reported comparably small effect sizes for the relationships between physical activity behavior and depression symptoms, both when considering longitudinal studies ($\rho = -0.07$) and cross-sectional studies ($\rho = -0.17$; Korczak, Madigan, & Colasanto, 2017). It is, nevertheless, notable that a review of reviews conducted by Biddle et al. (2018) reported comparably stronger effect sizes for the relationship between depression symptoms and physical activity, particularly for reviews that aggregated experimental evidence. We anticipate that researchers may have more power to estimate correlations between sport and anxiety or depression symptoms by (a) using more detailed measures of sport involvement or (b) experimental studies manipulating sport involvement. One further possibility is that sport may have a strong benefit for many, but also a detrimental effect for others who experience ostracism from peers or other detrimental social or physical experiences (e.g., MacDonald et al., 2012). As these positive and negative effects would constrain effect sizes, an avenue for future research would be to examine potential moderators (e.g., program quality, social context) that predict variability in the outcomes resulting from sport involvement. Nevertheless, even weak effect sizes can denote meaningful and salient effects, especially when they are consistently evident.

Although these effects are consistent, few studies have tested how or why sport involvement is inversely associated with anxiety and depression. Researchers tend to align theoretically with expectations that sport delivers opportunities for physical activity and social interactions that, independently, are protective factors (e.g., Eime et al., 2013; Fraser-Thomas et al., 2005; Paluska & Schwenk, 2000). However, we could not test the mediating role of physical activity or social interactions because mediation was neither directly tested within the studies reviewed, nor were these constructs measured frequently enough to use

meta-regression models to test associations indirectly. An exception is a study conducted by Doré et al. (2018) that investigated whether social connectedness mediated the relationship between team sport and anxiety and depressive symptoms. In addition, some investigations (e.g., Ashdown-Franks et al., 2017; Sabiston et al., 2016) contrasted team and individual sport participation as a proxy for social interaction, finding early evidence that depressive symptoms were less frequent for adolescents involved in team sport. However, studies have employed varying operationalizations of "team sport" and overlooked evidence that individual sport activities commonly integrate social or group contexts (Evans, Eys, & Bruner, 2012).

In addition to clearer and more consistent measures of sport environments, it is also feasible to directly study mechanisms. For instance, one recent investigation revealed that childhood (i.e., 9–11 years old) involvement in increasingly social sport contexts was a significant predictor of hippocampal volume, a brain region that has been found to show a reduction in symptoms of depression as assessed using functional magnetic resonance imaging (Gorham, Jernigan, Hudziak, & Barch, 2019). The correlation between sport involvement and mental health could also be explained by additional processes, beyond social interaction and physical activity. For example, involvement in sport may be linked to other health behaviors that influence mental disorders (e.g., diet, sleep, and lifestyle choices) or may develop self-regulation skills for managing daily stressors (Fraser-Thomas et al., 2005). Despite these pathways, further mechanistic research must examine third variables that may account for relationships between sport involvement and mental health.

A further observation is that effects were heterogeneous and varied across study design and sample features, with moderation analyses revealing noteworthy trends related to age and sex. As it pertains to the correlation between depression symptoms and the binary indicator of sport involvement, meta-regressions revealed that the inverse effects were stronger in samples that were relatively older. Although the prevalence of depressive symptoms increases throughout adolescence (Merikangas et al., 2010), this finding highlights the importance of keeping adolescents in sport reaching into later adolescence, which is a period when particularly high levels of sport dropout have been reported (Balish, McLaren, Rainham, & Blanchard, 2014). A second moderation was that studies including a greater proportion of male participants reported a stronger inverse correlation between sport involvement and anxiety symptoms. Whereas it is important to consider that adolescent females have a higher prevalence of anxiety symptoms than males (Merikangas et al., 2010), this significant moderation provides early stage evidence that sport involvement may have unique benefits for adolescent males. Alternatively, adolescent males with fewer symptoms of mental disorders may also be those who are more likely to participate in sport, given that boys participate in sport at a higher rate than girls (Slater & Tiggemann, 2011). Slater and Tiggemann (2011) also found that adolescent females experience more adverse social experiences in sport, which could hinder potential protective effects on mental health. Additional research is thus needed to test mediators or additional variables that explain potential sex differences within relationships between sport and mental health.

Exploratory moderation analysis conducted on scale design revealed that neither component (i.e., Likert-type scale design and severity of symptoms) moderated the association between

sport participation and symptoms of anxiety and depression. Nevertheless, similar to our discussion relating to the operationalization of sport participation, sport researchers should employ consistent measures to eliminate potential interference on effect sizes. As such, we call upon the leaders in this domain to form a consensus on measurement approaches used within large scale government-funded studies.

As the final notable moderation, we observed that studies involving secondary analyses on existing data sets found a smaller inverse correlation between binary sport participation and depression symptoms, compared with studies in which the primary study aim was to examine the correlation between sport and depression symptoms. Several studies used existing data sets, such as the National Longitudinal Study of Adolescent Health (United States; Babiss & Gangwisch, 2009), the Nicotine Dependence in Teens Study (Canada; Sabiston et al., 2016), or the Healthy Neighborhoods Study (Australia; Kremer et al., 2014). Meanwhile, the 41% of studies using primary data tended to be smaller studies including data collected by the authorship team. Of course, the use of secondary data entails benefits such as the opportunity to capture data from large samples that are often representative of their respective populations and substantial power for testing relationships. Nevertheless, researchers using existing data sets for secondary analyses must rely on measures that may have been selected to address alternative study aims and provide few opportunities to examine potential mechanisms.

Another novel observation within this review related to the diverse sport operationalizations that we identified: Researchers have focused on sport involvement as a binary value, as well as the frequency, volume, or duration of sport involvement. Along with this diversity comes a threat to generalizability when comparing studies using different operationalizations and approaches. For instance, a scale distinguishing time spent in sport as “no sport participation,” “weekly participation,” or “more-than-weekly participation” (e.g., Brière et al., 2018) would presumably hold a relationship that differs in slope and composition from a scale measuring hours involved per week (e.g., Wang et al., 2017). In addition to diversity in operationalizations, there were threats to validity for approaches to represent sport involvement. Authors commonly employed assessments of sport involvement that (a) were vague in how sport was defined to participants (e.g., “do you participate in sporting activities?”; Fatiregun & Kumapayi, 2014), (b) may be challenging to respond to (e.g., “indicate the number of sports teams on which you participated in the past year”; Duncan et al., 2015), or (c) entail researcher-imposed categories that may not fully represent the contexts involved (e.g., classifying sports as “team” or “individual” based on the name of the sport; Ashdown-Franks et al., 2017).

These issues seemed especially evident for studies using secondary data. Using secondary data amplifies the challenge of accurately and consistently measuring sport involvement because large-scale studies tend to include limited detail regarding the sport contexts or involvement patterns of participants. We argue that richer description of sport involvement could be critical to factor out possible confounds and to reduce measurement error. These concerns were highlighted by Robertson, Hague, Evans, and Martin (2019) who advocated that researchers assess and report richer information regarding sport contexts and samples. More complete contextual descriptions within studies may even enable opportunities to

aggregate findings across studies. For instance, our current analysis could have entailed a more complete assessment of effect-size heterogeneity had authors consistently reported sport types, competitive levels, sport contexts, or additional demographic aspects more comprehensively.

Even though we did not pursue other dependent variables, the process of conducting this review identified a broader spectrum of mental health indices that are increasingly being applied (e.g., internalizing or externalizing behaviors; well-being) as well as broader approaches to assessing these constructs (e.g., parent, peer, or teacher report). It may be of special interest to use a positive mental health indicator as the dependent variable such as subjective well-being (e.g., Merglen et al., 2014). Studying variability in the degree to which adolescents fully actualize positive mental states could help determine if sport participation has the ability to optimize mental health, beyond the reduction of mental disorders indicators.

Limitations and Future Directions

It is important to consider the boundaries of this review, including sample age and mental disorder measures. Our study was designed to capture adolescent sport participants, which left numerous studies involving children excluded from analyses. Only original peer-reviewed studies that were published in English were considered for inclusion in this review. This is a limitation, considering that unpublished research and work in differing languages were overlooked. This review was also constrained to anxiety and depression symptoms. As such, this review is not a complete description of the relationship between sport involvement and mental health across the trajectory of development.

Compared with sample age or measurement, a further constraint to this research is that sport is often only one of several adolescent extracurricular activities. Researchers have made numerous calls to integrate disparate lines of investigation regarding extracurricular activities (Fredricks & Eccles, 2006), but our review only located five studies that contrasted sport participation to other forms of participation in relation to anxiety and depression symptoms. Given that sport participation can only be understood in the broader context of adolescents' lives, further investigation of additional activities is essential.

Further research is critical to fully realize the theoretical and practical significance of this research. Even though numerous theoretical frameworks contribute to understanding of how sport may be a protective context, frameworks of positive youth development (e.g., Côté, Turnnidge, & Evans, 2014) are closely aligned to the goals of this review. This review provides support for frameworks identifying positive outcomes of sport involvement, while also calling on the need for models to balance positive and negative outcomes. While positive youth development models emphasize a strength-based approach (e.g., Larson, 2000), it is important for youth sport researchers to remember that focusing on strengths does not mean disregarding adversity faced by youth or harm-reduction initiatives. Rather, the positive youth development approach is based on the developmental systems theories that recognize the interrelatedness of influences contributing to both strengths and challenges (Masten, 2014), highlighting the need for research that focuses on positive

developmental outcomes of sport alongside the potential to reduce symptoms of anxiety and depression to achieve the overall aim of optimal functioning.

Based on the design of underlying studies, this review also provides little guidance regarding the mechanisms that are central to positive youth development frameworks (e.g., personal assets, life skills, behaviors). For example, the personal assets framework (Côté et al., 2014) describes how optimal sport activities, environments, and relationships foster developmental assets like perceptions of connection, character, confidence, and competence. Côté et al. (2014) posit that these assets are often critical for youth to gain behavioral, social, and cognitive outcomes through sport. These contextual features and mediators are critical to advancing theoretical and practical implications.

Finally, this systematic review and meta-analysis provided evidence that sport participation during adolescence is inversely correlated with symptoms of anxiety and depression. The recommendations we have made for future research are important for advancing these perspectives of youth development. We especially identify a need for researchers to collect primary data in studies that are designed to describe the ways that youth are involved in sport. If researchers can better characterize sport contexts while reporting on psychosocial mechanisms that predict lowered anxiety and depression symptoms, we can make more precise theoretical claims. As researchers develop a better understanding of how and why sport involvement is inversely associated with symptoms of anxiety and depression, youth sport can be designed to maintain or strengthen this association.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

References

Agans JP, & Geldhof GJ (2012). Trajectories of participation in athletics and positive youth development: The influence of sport type. Applied Developmental Science, 16, 151–165. doi:10.1080/10888691.2012.697792

Ahn S, & Fedewa AL (2011). A meta-analysis of the relationship between children's physical activity and mental health. Journal of Pediatric Psychology, 36, 385–397. doi:10.1093/jpepsy/jsq107 [PubMed: 21227908]

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Arlington, VA: Author. doi:10.1176/appi.books.9780890425596

Ashdown-Franks G, Sabiston CM, Solomon-Krakus S, & O'Loughlin JL (2017). Sport participation in high school and anxiety symptoms in young adulthood. Mental Health and Physical Activity, 12, 19–24. doi:10.1016/j.mhpa.2016.12.001

Asmundson GJ, Fetzner MG, DeBoer LB, Powers MB, Otto MW, & Smits JA (2013). Let's get physical: A contemporary review of the anxiolytic effects of exercise for anxiety and its disorders. Depression & Anxiety, 30, 362–373. doi:10.1002/da.22043 [PubMed: 23300122]

Babiss LA, & Gangwisch JE (2009). Sports participation as a protective factor against depression and suicidal ideation in adolescents as mediated by self-esteem and social support. Journal of Developmental & Behavioral Pediatrics, 30, 376–384. doi:10.1097/DBP.0b013e3181b33659 [PubMed: 19692930]

Balish SM, McLaren C, Rainham D, & Blanchard C (2014). Correlates of youth sport attrition: A review and future directions. Psychology of Sport and Exercise, 15, 429–439. doi:10.1016/j.psychsport.2014.04.003

Biddle SJ, Ciaccioni S, Thomas G, & Vergeer I (2018). Physical activity and mental health in children and adolescents: An updated review of reviews and an analysis of causality. Psychology of Sport and Exercise, 42, 146–155. doi:10.1016/j.psychsport.2018.08.011

Boone EM, & Leadbeater BJ (2006). Game on: Diminishing risks for depressive symptoms in early adolescence through positive involvement in team sports. Journal of Research on Adolescence, 16, 79–90. doi:10.1111/j.1532-7795.2006.00122.x

Borenstein M, Hedges L, & Rothstein H (2007). Meta-analysis: Fixed effect vs. random effects. Published online by the authors at https://www.meta-analysis.com/downloads/M-a_f_e_v_r_e_sv.pdf

Borenstein M, Higgins JPT, Hedges LV, & Rothstein HR (2017). Basics of meta-analysis: I2 is not an absolute measure of heterogeneity. Research Synthesis Methods, 8, 5–18. doi:10.1002/jrsm.1230 [PubMed: 28058794]

Brière FN, Yale-Souliere G, Gonzalez-Sicilia D, Harbec MJ, Morizot M, & Pagani LS (2018). Prospective associations between sport participation and psychological adjustment in adolescents. Journal of Epidemiology & Community Health, 72, 575–581. doi:10.1136/jech-2017-209656 [PubMed: 29540466]

Brown TA, Chorpita BF, Korotitsch W, & Barlow DH (1997). Psychometric properties of the Depression Anxiety Stress Scales (DASS) in clinical samples. Behaviour Research and Therapy, 35, 79–89. doi:10.1016/S0005-7967(96)00068-X [PubMed: 9009048]

Brunet J, Sabiston CM, Chaiton M, Barnett TA, O'Loughlin E, Low NCP, & O'Loughlin JL (2013). The association between past and current physical activity and depressive symptoms in young adults: A 10 year prospective study. Annals of Epidemiology, 23, 25–30. doi:10.1016/j.annepidem.2012.10.006 [PubMed: 23176784]

Cohen J (1960). A coefficient of agreement for nominal scales. Educational and Psychological Measurement, 20, 37–46. doi:10.1177/001316446002000104

Côté J, Turnnidge J, & Evans MB (2014). The dynamic process of development through sport. Kinesiologia Slovenica, 20, 14–26.

Cruwys T, Dingle GA, Haslam C, Haslam SA, Jetten J, & Morton TA (2013). Social group memberships protect against future depressions, alleviate depression symptoms and prevent depression relapse. Social Science & Medicine, 98, 179–186. doi:10.1016/j.socscimed.2013.09.013 [PubMed: 24331897]

Dahlke JA, & Wiernik BM (2019). psychmeta: An R package for psychometric meta-analysis. Applied Psychological Measurement, 43, 415–416. doi:10.1177/0146621618795933 [PubMed: 31235986]

Dolenc P (2015). Anxiety, self-esteem and coping with stress in secondary school students in relation to involvement in organized sports. Slovenian Journal of Public Health, 54, 222–229. doi:10.1515/sjph-2015-0031 [PubMed: 27646730]

Doré I, O'Loughlin JL, Schnitzer ME, Datta GD, & Fournier L (2018). The longitudinal association between the context of physical activity and mental health in early adulthood. Mental Health and Physical Activity, 14, 121–130. doi:10.1016/j.mhpa.2018.04.001

Duncan SC, Strycker LA, & Chaumeton NR (2015). Sports participation and positive correlates in African American, Latino, and White girls. Applied Developmental Science, 19, 206–216. doi:10.1080/10888691.2015.1020156 [PubMed: 26692758]

Eccles J (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. Educational Psychologist, 44, 78–89. doi:10.1080/00461520902832368

Egger M, Davey Smith GD, Schneider M, & Minder C (1997). Bias in meta-analysis detected by a simple, graphical test. British Medical Journal, 315, 629–634. doi:10.1136/bmj.315.7109.629 [PubMed: 9310563]

Eime RM, Young JA, Harvey JT, Charity MJ, & Payne WR (2013). A systematic review of the psychological and social benefits of participation in sport for children and adolescents: Informing development of a conceptual model of health through sport. International Journal of Behavioral Nutrition and Physical Activity, 10, 98. doi:10.1186/1479-5868-10-98 [PubMed: 23945179]

Evans MB, Allan V, Erickson K, Martin LJ, Budziszewski R, & Côté J (2017). Are all sport activities equal? A systematic review of how youth psychosocial experiences vary across differing sport

activities. British Journal of Sports Medicine, 51, 169–176. doi:10.1136/bjsports-2016-096725 [PubMed: 27986759]

Evans MB, Eys MA, & Bruner MW (2012). Seeing the “we” in “me” sports: The need to consider individual sport team environments. Canadian Psychology/Psychologie Canadienne, 53, 301. doi:10.1037/a0030202

Fatiregun AA, & Kumapayi TE (2014). Prevalence and correlates of depressive symptoms among in-school adolescents in a rural district in southwest Nigeria. Journal of Adolescence, 37, 197–203. doi:10.1016/j.adolescence.2013.12.003 [PubMed: 24439625]

Fraser-Thomas JL, Côté J, & Deakin J (2005). Youth sport programs: An avenue to foster positive youth development. Physical Education and Sport Pedagogy, 10, 19–40. doi:10.1080/1740898042000334890

Fredricks JA, & Eccles JS (2006). Extracurricular involvement and adolescent adjustment: Impact of duration, number of activities, and breadth of participation. Applied Developmental Science, 10, 132–146. doi:10.1207/s1532480xads1003_3

Fredrickson BL, & Roberts TA (1997). Objectification theory: Toward understanding women’s lived experiences and mental health risks. Psychology of Women Quarterly, 21, 173–206. doi:10.1111/j.1471-6402.1997.tb00108.x

Galderisi S, Heinz A, Kastrup M, Beezhold J, & Sartorius N (2015). Toward a new definition of mental health. World Psychiatry, 14, 231–233. doi:10.1002/wps.20231 [PubMed: 26043341]

Gorham LS, Jernigan T, Hudziak J, & Barch DM (2019). Involvement in sports, hippocampal volume, and depressive symptoms in children. Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 4, 484–492. doi:10.1016/j.bpsc.2019.01.011 [PubMed: 30905689]

Graupensperger SA, Jensen CJ, & Evans MB (2018). A meta-analytic review of studies using the prosocial and antisocial behavior in sport scale: Associations among intergroup moral behaviors. Sport, Exercise, and Performance Psychology, 7, 186. doi:10.1037/spy0000121

Headey B, Kelley J, Wearing A (1993). Dimensions of mental health: Life satisfaction, positive affect, anxiety and depression. Social Indicators Research, 29, 63–82. doi:10.1007/BF01136197

Huizenga HM, Visser I, & Dolan CV (2011). Testing overall and moderator effects in random effects meta-regression. British Journal of Mathematical and Statistical Psychology, 64, 1–19. doi:10.1348/000711010X522687 [PubMed: 21506942]

Jaworska N, & MacQueen G (2015). Adolescence as a unique developmental period. Journal of Psychiatry & Neuroscience, 40, 291–293. doi:10.1503/jpn.150268 [PubMed: 26290063]

Jaycox LH, Stein BD, Paddock S, Miles JN, Chandra A, Meredith LS, … Burnam MA (2009). Impact of teen depression on academic, social, and physical functioning. Pediatrics, 124, 596–605. doi:10.1542/peds.2008-3348 [PubMed: 19596733]

Jewett R, Sabiston CM, Brunet J, O’Loughlin EK, Scarapicchia T, & O’Loughlin J (2014). School sport participation during adolescence and mental health in early adulthood. Journal of Adolescent Health, 55, 640–644. doi:10.1016/S0140-6736(96)91616-5

Kandel DB, Raveis VH, & Davies M (1991). Suicidal ideation in adolescence: Depression, substance use, and other risk factors. Journal of Youth and Adolescence, 20, 289–309. doi:10.1007/BF01537613 [PubMed: 24265011]

Kessler RC, Berglund P, & Demler O (2003). Mood disorders: Bipolar and major depressive disorders. JAMA, 289, 3095–3105. doi:10.1001/jama.289.23.3095 [PubMed: 12813115]

Kieling C, Baker-Henningham H, Belfer M, Conti G, Ertem I, Omigbodun O, & Rahman A (2011). Child and adolescent mental health worldwide: Evidence for action. The Lancet, 392, 1515–1525. doi:10.1016/S0140-6736(11)60827-1

Korczak DJ, Madigan S, & Colasanto M (2017). Children’s physical activity and depression: A meta-analysis. Pediatrics, 139(4), e20162266. doi:10.1542/peds.2016-2266 [PubMed: 28314824]

Kremer P, Elshaug C, Leslie E, Toumbourou JW, Patton GC, & Williams J (2014). Physical activity, leisure-time screen use and depression among children and young adolescents. Journal of Science and Medicine in Sport, 17, 183–187. doi:10.1016/j.jsams.2013.03.012 [PubMed: 23648221]

Larson RW (2000). Toward a psychology of positive youth development. American Psychologist, 55, 170. doi:10.1037/0003-066X.55.1.170 [PubMed: 11392861]

Lerner RM (2007). Developmental science, developmental systems, and contemporary theories of human development. In Lerner RM& Damon W (Eds.), Handbook of child psychology: Theoretical models of human development (pp. 1–17). New York, NY: John Wiley & Sons.

Lerner RM, Lerner JV, Almerigi JB, Theokas C, Phelps E, Gestsdottir S, … Smith LM (2005). Positive youth development, participation in community youth development programs, and community contributions of fifth-grade adolescents: Findings from the first wave of the 4-H study of positive youth development. Journal of Early Adolescence, 25, 17–71. doi:10.1177/0272431604272461

Liddle SK, Deane FP, Batterham M, & Vella SA (2019). A brief sports-based mental health literacy program for adolescent males: A cluster-randomized controlled trial. Journal of Applied Sport Psychology. Advance online publication. doi:10.1080/10413200.2019.1653404

Lim CL, Byrne C, & Lee JK (2008). Human thermoregulation and measurement of body temperature in exercise and clinical settings. Annals Academy of Medicine Singapore, 37, 347.

MacDonald DJ, Côté J, Eys M, & Deakin J (2012). Psychometric properties of the youth experience survey with young athletes. Psychology of Sport and Exercise, 13, 332–340. doi:10.1016/j.psychsport.2011.09.001

Masten AS (2014). Invited commentary: Resilience and positive youth development frameworks in developmental science. Journal of Youth and Adolescence, 43, 1018–1024. doi:10.1007/s10964-014-0118-7 [PubMed: 24723048]

McMahon EM, Corcoran P, O'Regan G, Keeley H, Cannon M, Carli V, … Wasserman D (2017). Physical activity in European adolescents and associations with anxiety, depression and well-being. European Child & Adolescent Psychiatry, 26, 111–122. doi:10.1007/s00787-016-0875-9 [PubMed: 27277894]

Merglen A, Flatz A, Bélanger RE, Michaud PA, & Suris JC (2014). Weekly sport practice and adolescent well-being. Archives of Disease in Childhood, 99, 208–210. doi:10.1136/archdischild-2013-303729

Merikangas KR, He JP, Burstein M, Swanson SA, Avenevoli S, Cui L, … Swendsen J (2010). Lifetime prevalence of mental disorders in U.S. adolescents: Results from the national comorbidity survey replication-adolescent supplement (NCS-A). Journal of the American Academy of Child &Adolescent Psychiatry, 49, 980–989. doi:10.1016/j.jaac.2010.05.017 [PubMed: 20855043]

Moher D, Liberati A, Tetzlaff J, & Altman DG (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Annals of Internal Medicine, 151, 264–269. doi:10.7326/0003-4819-151-4-200908180-00135 [PubMed: 19622511]

Ouzzani M, Hammady H, Fedorowicz Z, & Elmagarmid A (2016). Rayyan—A web and mobile app for systematic reviews. Systematic Reviews, 5, 210. doi:10.1186/s13643-016-0384-4 [PubMed: 27919275]

Paluska SA, & Schwenk TL (2000). Physical activity and mental health. Sports Medicine, 29, 167–180. doi:10.2165/00007256-200029030-00003 [PubMed: 10739267]

Patel V, Flisher AJ, Hetrick S, & McGorry P (2007). Mental health of young people: A global public-health challenge. The Lancet, 369, 1302–1313. doi:10.1016/S0140-6736(07)60368-7

Radloff LS (1977). The CES-D scale: A self-report depression scale for research in the general population. Applied Psychological Measurement, 1, 385–401. doi:10.1177/014662167700100306

Rathbone J, Carter M, Hoffmann T, & Glasziou P (2015). Better duplicate detection for systematic reviewers: Evaluation of systematic review assistant-deduplication module. Systematic Reviews, 4, 6. doi:10.1186/2046-4053-4-6 [PubMed: 25588387]

Robertson M, Hague C, Evans MB, & Martin LJ (2019). Do participant reporting practices in youth sport research adequately represent the diversity of sport contexts? Psychology of Sport and Exercise, 45. doi:10.1016/j.psychsport.2019.101559

Sabiston CM, Jewett R, Ashdown-Franks G, Belanger M, Brunet J, O'Loughlin E, & O'Loughlin J (2016). Number of years of team and individual sport participation during adolescence and depressive symptoms in early adulthood. Journal of Sport & Exercise Psychology, 38, 105–110. doi:10.1123/jsep.2015-0175 [PubMed: 27018562]

Schmidt FL, & Hunter JE (2014). Methods of meta-analysis: Correcting error and bias in research findings (3rd ed.). Thousand Oaks, CA: Sage.

Schmidt FL, Oh IS, & Hayes TL (2009). Fixed- versus random-effects models in meta-analysis: Model properties and an empirical comparison of differences in results. British Journal of Mathematical and Statistical Psychology, 62, 97–128. doi:10.1348/000711007X255327 [PubMed: 18001516]

Slater A, & Tiggemann M (2011). Gender differences in adolescent sport participation, teasing, self-objectification and body image concerns. Journal of Adolescence, 34, 455–463. doi:10.1016/j.adolescence.2010.06.007 [PubMed: 20643477]

Teubert D, & Pinquart M (2011). A meta-analytic review on the prevention of symptoms of anxiety in children and adolescents. Journal of Anxiety Disorders, 25, 1046–1059. doi:10.1016/j.janxdis.2011.07.001

Uchino BN (2006). Social support and health: A review of physiological processes potentially underlying links to disease outcomes. Journal of Behavioral Medicine, 29, 377–387. doi:10.1007/s10865-006-9056-5 [PubMed: 16758315]

Umberson D, & Karas Montez J (2010). Social relationships and health: A flashpoint for health policy. Journal of Health and Social Behavior, 51, 54–66. doi:10.1177/0022146510383501

United States Department of Health and Human Services. (2017, January 25) United States Adolescent Mental Health Facts. HHS. Retrieved from https://www.hhs.gov/ash/oah/facts-and-stats/national-and-state-data-sheets/adolescent-mental-health-fact-sheets/united-states/index.html

Wang MT, Chow A, & Amemiya J (2017). Who wants to play? Sport motivation trajectories, sport participation, and the development of depressive symptoms. Journal of Youth and Adolescence, 46, 1982–1998. doi:10.1007/s10964-017-0649-9 [PubMed: 28299495]

World Health Organization. (2014, August). Mental health: A state of well-being. WHO. Retrieved from http://www.who.int/features/factfiles/mental_health/en/

Zarrett N, Fay K, Li Y, Carrano J, Phelps E, & Lerner RM (2009). More than child's play: Variable-and pattern-centered approaches for examining effects of sports participation on youth development. Developmental Psychology, 45, 368. doi:10.1037/a0014577 [PubMed: 19271825]

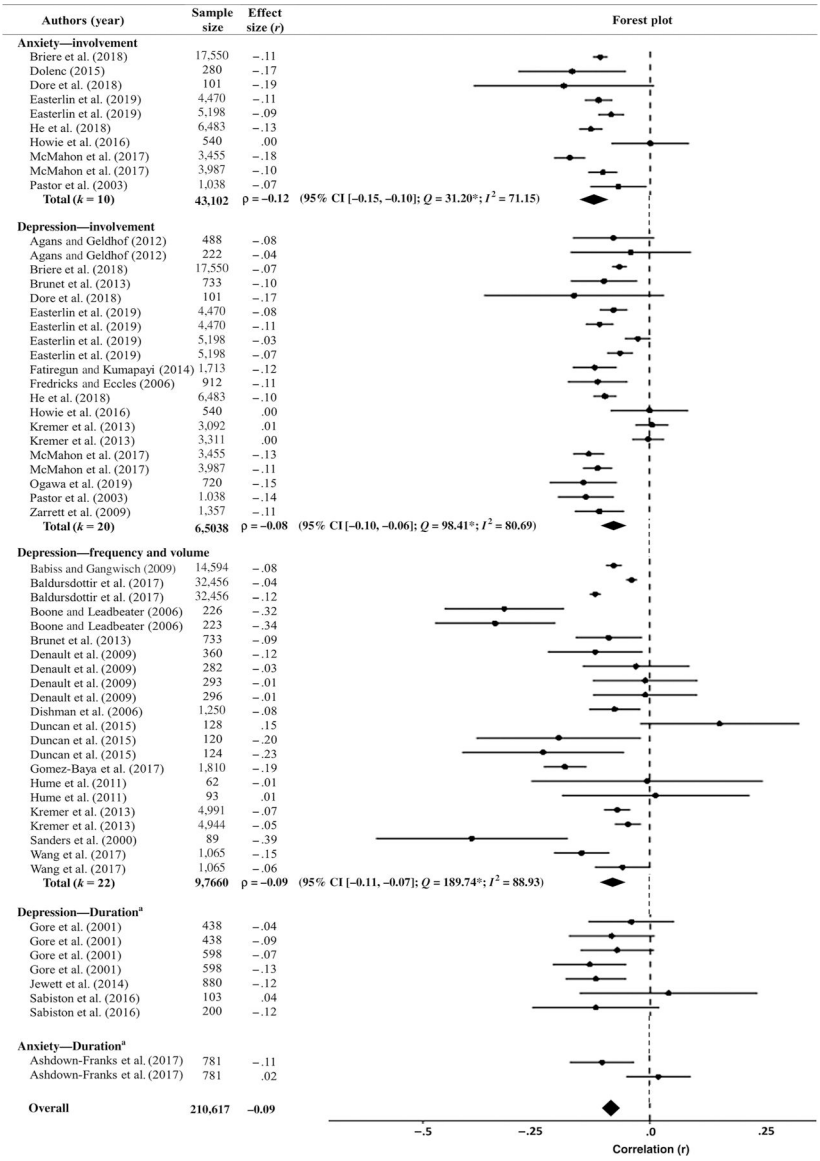

Figure 1 —.

Results of meta-analyses. ρ = meta-analyzed mean population effect estimate corrected for measurement invariance and weighted by study sample size; Q = indicator of heterogeneity (i.e., *$p < .001$); I^2 = percentage of the total variability in a set of effect sizes due to true heterogeneity. aIncluded in table for descriptive purposes only; meta-analyses were not conducted on these effect sizes because there was an insufficient number of unique studies (i.e., <5).

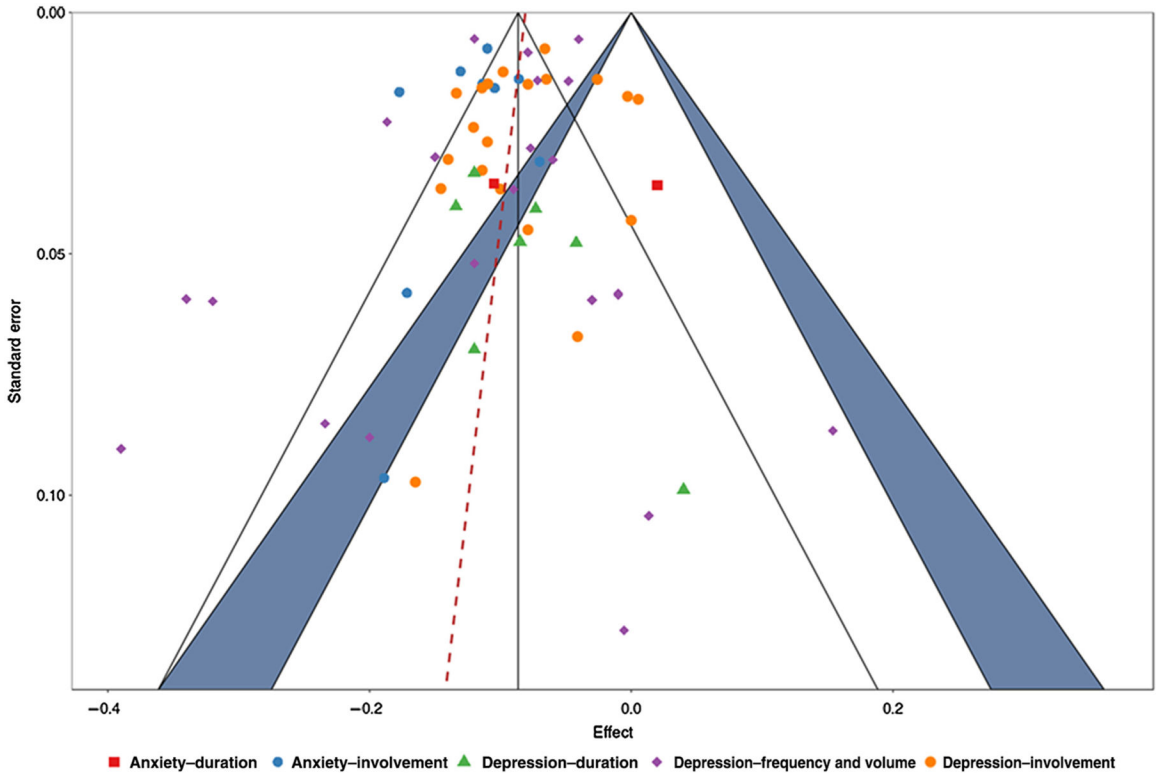

Figure 2 —.
Contour-enhanced funnel plot with Egger's regression line to assess likelihood of publication bias.

Table 1

Inclusion and Exclusion Criteria

Component	Inclusion	Exclusion
Date range	From inception of database to October 2018	
Language	English	
Sample	Youth-sport participants with mean ages of 12–18 years	Participants younger than 8 or older than 20 years
Mental-health outcome measure (i.e., anxiety or depression)	Studies measuring self-reported symptoms of anxiety and depression	
Sport-participation measure	Studies contrasting youth in relation to whether or not they were involved, sport volume, sport frequency, etc.	Nonsport forms of physical activity, vigorous exercise, and recreational activity
Organized sport (setting)	Participants completing sport-participation measures in relation to organized sport in the school or community	Any nonorganized sport participation (e.g., recess, free play, physical education)
Study design	Quantitative studies comparing sport participation to a different activity, to no sport participation, or to other level of sport participation; study designs including correlational (i.e., cross-sectional and prospective) cohort and experimental designs	Qualitative research, case studies, literature reviews

Table 2

Study Details

Study (country), article ID	Sample size, sex, age, and context	Study design and primary analysis [quality/14]	Sport participation operationalization and measure of sport participation	Guiding theory or argument	Mental health variable(s), *measures*
Agans and Geldhof (2012) (United States), 1	N = 710 68.7% female M_{age} = 15.8 years Individual sports, integrative team sports, and dance-like sports	Longitudinal Cluster analysis and ANOVA [12]	Presence/absence: To be included as an athlete, youth needed to participate at least a couple of times a month.	Relational developmental systems theory (Lerner, 2007) and positive youth development (Lerner et al., 2005)	Depressive symptoms *CES-D*
			Core findings: Years of involvement simultaneously in team and individual sport were inversely associated with depression, within a regression model controlling for numerous variables.		
Ashdown-Franks et al. (2017) (Canada), 2	N = 781 55.2% female M_{age} = 14.5 years 18 organized sport teams in or outside of school, classified as team or individual	Longitudinal Multinomial and binomial logistic regression [12]	Amount—duration: Total sport participation was coded as 0 (no sports) to 5 (at least one sport in every year of high school).	Thermogenic hypothesis (Lim, Byrne, & Lee, 2008) and mastery hypothesis (Asmundson et al., 2013)	Anxiety symptoms *CCHS*
			Core findings: Number of years of sport participation in high school was not protective of symptoms of generalized anxiety disorder in young adulthood.		
Babiss and Gangwisch (2009) (Canada), 3	N = 14,594 47.8% female M_{age} = 15.5 years Active sports, such as baseball, softball, basketball, soccer, swimming, or football	Longitudinal Bivariate analyses and t tests, and hierarchical logistic regression analyses [11]	Amount—frequency: Frequency of sport involvement in the past week measured on a Likert-style scale from not at all to 1 or 2 times, 3 or 4 times, and 5 times or more	No guiding theory	Depressive symptoms *CES-D*
			Core findings: As sport participation (i.e., times per week) increased, the odds of suffering from depression decreased by 25% among adolescents. This association was mediated by self-esteem and social support.		
Baldursdottir, Valdimarsdottir, Krettek, Gylfason, and Sigfusdottir (2017) (Iceland), 4	N = 32,456 49.4% female M_{age} = 14.5 years Organized sports with a club or a team	Cross-sectional Multiple linear regression [13]	Amount—number of times: Participants completed two questions about sport involvement. Based on the responses, three categories were created: almost never, 1–3 times per week, and >4 times per week.	No guiding theory	Depressive symptoms *SCL-90*
			Core findings: As age increased, depressive symptoms increased. Organized sport participation was associated with lower levels of depressive symptoms, with stronger effects among girls.		
Boone and Leadbeater (2006) (Canada), 5	N = 449 49.7% female M_{age} = 14 years Team sports	Cross-sectional Structural equation modeling [11]	Amount—frequency: Participants reported hours per week of team sport involvement (“team sports” not defined).	No guiding theory	Depressive symptoms *BDI*
			Core findings: Positive team sport involvement partially mediated risks for depressive symptoms for both boys and girls. Positive team sport involvement was measured using a questionnaire that contained 16 items regarding how often positive and negative experiences occur during team sports. Supplemental analyses focused on hours per week of sport involvement, and revealed that benefits of team sports may be the result of positive experiences such as peer support, coaching, and skill development.		
Briere et al. (2018) (Canada), 6	N = 17,550 54% female M_{age} = 14.4 years (SD = 1.3) Numerous sports, reported through in-school survey	Longitudinal Linear regression and Wald tests [13]	Presence/absence: Measured as “no involvement, once a week, twice a week, three times a week, four or more times a week,” answers were dichotomized as sport participation and no sport participation. (Assessment did not specifically delineate	Positive youth development (Lerner et al., 2005)	Depressive symptoms *CES-D* Social anxiety symptoms *SCAS*

Study (country), article ID	Sample size, sex, age, and context	Study design and primary analysis [quality/14]	Sport participation operationalization and measure of sport participation	Guiding theory or argument	Mental health variable(s), *measures*
			organized sport from PA and exercise in the survey)		
			Core findings: Sport participation predicted small reductions in depressive symptoms and social anxiety symptoms in adolescents who had higher baseline scores on each outcome. Adolescent sport participation predicted small reductions in social anxiety 1 year later.		
Brunet et al. (2013) (Canada), 7	*N* = 1,293 52% female M_{age} = 12.7 years (*SD* = 0.5) Organized team sports	Longitudinal Latent growth curve modeling, and multiple hierarchical linear regression models [13]	Presence/absence*:* Sport involvement was dichotomized as "not involved" or "involved." Amount—number of teams: Number of organized sports involved during the past 12 months	No guiding theory	Depressive symptoms *MDI*
			Core findings: PA within team sport contexts resulted in less depressive symptoms in young adulthood. Both current and past involvement in team sports were significantly negatively related to depressive symptoms.		
Denault, Poulin, and Pedersen (2009) (Canada), 8	*N* = 362 59% female M_{age} = 13.4 years (*SD* = 0.42) 30 different activities were categorized as "sports."	Longitudinal Cross-lagged correlation and LGC models [13]	Amount—frequency: Participation was operationalized as the total number of hours spent in sport (number of hours × number of months).	No guiding theory	Depressive symptoms *CDI*
			Core findings: Involvement in sport and in youth clubs was inversely associated with depressive symptoms.		
Dishman et al. (2006) (United States), 9	*N* = 1,250 100% female M_{age} = 17.7 years (*SD* = 0.61) Sport teams run by school and by organizations outside of school.	Cross-sectional Confirmatory factor analysis and SEM [13]	Amount—number of teams: Participants reported how many sports teams they were involved in during the past 12 months.	No guiding theory	Depressive symptoms *CES-D*
			Core findings: Sport participation might reduce depression risk among adolescent girls mediated by unique, positive physical self-concept.		
Dolenc (2015) (Slovenia), 10	*N* = 280 50% female M_{age} = 16.6 years Organized sports within a club from a list of team sports (e.g., basketball, volleyball, soccer) and individual sports (e.g., athletics, swimming, gymnastics)	Cross-sectional Multiple regression analysis and Mann–Whitney test [11]	Presence/absence: Two groups were created: athletes and nonathletes. The group of athletes was defined as regularly engaged in organized sports over the past 12 months.	No guiding theory	Anxiety symptoms *STAI*
			Core findings: Participants engaged in organized sports reported lower anxiety compared with nonsport participants. Female athletes showed higher levels of anxiety than male athletes.		
Doré, O'Loughlin, Schnitzer, Datta, and Fournier (2018) (Canada), 11	*N* = 460 62.4% female M_{age} = 16.5 years (*SD* = 2.6) Involvement in team sports since the beginning of the semester (Fall)	Longitudinal Multivariate linear regression, mediation analyses, and ANOVA [12]	Presence/absence: Participants were asked how many team sports they had been involved in (0, 1, 2, or 3). Participants were classified as sport involved (1 or more) or not.	No guiding theory	Anxiety symptoms and depressive symptoms *HADS*
			Core findings: The context of team sports (i.e., more social interactions) was inversely associated with depressive symptoms.		
Duncan, Strycker, and Chaumeton (2015) (United States), 12	*N* = 372 100% female M_{age} = 12 years Involvement in organized sports from a list of 18 possible sports (e.g., basketball, soccer, volleyball)	Cross-sectional Multiple-sample structural equation models [12]	Amount—number of times and number of teams: Responses ranged from 1 (not at all) to 6 (at least twice a week). In addition, girls indicated the number of sport teams they participated on in the past year.	No guiding theory	Depressive symptoms *CES-D*
			Core findings: Greater sports participation was related to less depression for Latino and European American girls, but not African American girls.		

Study (country), article ID	Sample size, sex, age, and context	Study design and primary analysis [quality/14]	Sport participation operationalization and measure of sport participation	Guiding theory or argument	Mental health variable(s), *measures*
Easterlin, Chung, Leng, and Dudovitz (2019) (United States), 13	*N* = 372 100% female M_{age} = 12 years Team sports (e.g., basketball, ice hockey). Participants identified as experiencing adverse childhood experiences.	Longitudinal Univariate and bivariate analysis and multivariable logistic regression [12]	Presence/absence: Adolescents were designated as participating in team sports if they selected one or more sports from a list.	No guiding theory	Depressive symptoms *CES-D*
			Core findings: Among those with adverse childhood experiences, team sports participation during adolescence was significantly associated with lower odds of receiving a diagnosis of depression.		
Fatiregun and Kumapayi (2014) (Nigeria), 14	*N* = 1,713 55.3% female M_{age} = 14 years Participation in sporting activities	Cross-sectional Bivariate and multivariate analysis [10]	Presence/absence: Participants were categorized as participating in sport activities or not.	No guiding theory	Depressive symptoms *PHQ-9*
			Core findings: Respondents who did not participate in sporting activities had a higher proportion of depressive symptoms when compared with those who did participate. Those who participated in sport were less likely to develop depression.		
Fredricks and Eccles (2006) (United States), 15	*N* = 912 51% female M_{age} = 16.5 years Participation in school sports and in any organized summer or after-school sports	Longitudinal ANCOVA [12]	Presence/absence: Organized sport involvement was assessed with two yes/no questions (i.e., sport involved at school and outside of school).	No guiding theory	Anxiety and depressive symptoms *CDI*
			Core findings: Breadth of participation, or number of activity contexts, was associated with positive academic, psychological, and behavioral outcomes.		
Gomez-Baya, Mendoza, Matos, and Tomico (2017) (Spain), 16	*N* = 1,810 50.9% female M_{age} = 14.6 years Sports outside out-of-school time	Cross-sectional Partial mediation analysis and moderation analysis [11]	Amount—frequency: Participants reported how often they participate in sports with five Likert-type response options (never, rarely, one day a week, several days a week, and every day).	Objectification theory (Fredrickson & Roberts, 1997)	Depressive symptoms *CDI*
			Core findings: A higher frequency of sport participation was associated with a lower presence of depressive symptoms, both directly and through its effect on body satisfaction.		
Gore, Farrell, and Gordon (2001) (United States), 17	*N* = 1,036 57.7% female M_{age} = 15.6 years (*SD* = 1.00) Team sports involvement	Longitudinal Linear regression [10]	Amount—duration: A Likert-type scale assessing amount of time spent in team sports in the past 12 months ranging across 5 points from “a lot of time” to “no time.”	No guiding theory	Depressive symptoms *CES-D*
			Core findings: Significant association between team sports involvement and depressed mood among both males and females.		
He, Paksarian, and Merikangas (2018) (United States), 18	*N* = 6,483 57% female M_{age} = 15.1 years Sport team involvement, other than gym class, that involved adult coaching or instruction	Cross-sectional Logistic regression [11]	Presence/absence: Participants were asked how many years they played sport. Responses were dichotomized to distinguish those never reporting sport with those reporting at least some involvement.	No guiding theory	Anxiety and depression *CIDI*
			Core findings: Youth who reported at least some involvement in sport were less likely to experience psychological distress and mood disorders.		
Howie, McVeigh, Smith, and Straker (2016) (Australia), 19	*N* = 1,679 49% female M_{age} = 14 years Organized sport, in school and outside of school hours	Longitudinal Chi square, paired Spearman correlations, repeated-measures	Presence/absence: A single-item question with a binary yes/no response regarding sport involvement in or out of school.	No guiding theory	Depressive and anxiety symptoms *DASS*
			Core findings: Consistent participation in organized sport was associated with the greatest health benefits for both sexes as opposed to those who dropped out or joined later in adolescence.		

Study (country), article ID	Sample size, sex, age, and context	Study design and primary analysis [quality/14]	Sport participation operationalization and measure of sport participation	Guiding theory or argument	Mental health variable(s), *measures*
		latent class analysis, and generalized linear models [13]			
Hume, Veitch, Salmon, and Ball (2011) (Australia), 20	N = 155 60% female M_{age} = 14.5 years (SD = 0.64) Various organized sports (e.g., cricket, netball, tennis)	Longitudinal Logistic regression models and linear regression [12]	Amount—frequency: Frequency and duration of organized sports were reported for a typical week and total time (minutes per week) was calculated.	No guiding theory	Depressive symptoms *CES-DC*
			Core findings: There were no cross-sectional or longitudinal associations between MVPA, VPA, organized sport, sedentary time, and symptoms of depression among boys or girls.		
Jewett et al. (2014) (Canada), 21	N = 880 54% female M_{age} = 15 years (SD = 0.75) Involvement in school sport (e.g., 11 common sports, such as basketball, soccer, rugby, hockey, and volleyball)	Longitudinal MANOVA and linear regression models [14]	Amount—duration: Participants were asked if they belonged to common sports. Responses across a single school year were collapsed in yearly participation (yes or no). School sport participation ranged from 0 (no involvement) to 5 (involved in school sport throughout the 5 years of secondary school).	No guiding theory	Depressive symptoms *MDI*
			Core findings: Involvement in school sport during adolescence was a statistically significant predictor of lower depression symptoms in young adulthood.		
Kremer et al. (2014) (Australia), 22	N = 8,256 52% female M_{age} = 11.5 years (SD = 0.8) Organized sports at school and outside of school	Cross-sectional Chi-square analyses and multivariate logistic regression [10]	Presence/absence: Involved in school sport more than five times in the past 12 months (>5 considered as sport involved and <5 considered as not involved) Amount—number of teams: Participants were asked how many sport teams they played on at school and outside of school in the past 12 months.	No guiding theory	Generalized tool *SMFQ*
			Core findings: Greater involvement in sport (in and out of school) was associated with lower odds for depressive symptoms.		
McMahon et al. (2017) (European countries), 23	N = 11,072 59% female M_{age} = 14.8 years (SD = 0.84) Team and individual sports	Cross-sectional t test, ANOVA, and multilevel mixed effects linear regression [12]	Presence/absence: Participants were asked if they played sports in the past 6 months, with response of yes or no. Sport involvement vs. no sport involvement categories created.	No guiding theory	Depressive symptoms *BDI-II Anxiety Symptoms Zung SAS*
			Core findings: Participation in sport (team or individual/fitness) was associated with significantly lower levels of anxiety and depressive symptoms.		
Ogawa et al. (2019) (Japan), 24	N = 720 50% female M_{age} = 14.5 years Sport club activities at school (e.g., football, basketball, tennis)	Cross-sectional Multiple regression [12]	Presence/absence: Participants were asked how often they took part in sport, with five responses. Participants who answered “always,” “often,” and “about half the time” were categorized as being adequate PA; those who answered “rarely” or “never” were without adequate PA.	No guiding theory	Anxiety and depressive symptoms *GHQ-12*
			Core findings: GHQ-12 score was significantly better in adolescents with adequate PA than those with inadequate PA.		
Pastor, Balaguer, Pons, and García-Merita (2003) (Spain), 25	N = 1,038 50.9% female	Cross-sectional Structural equation modeling [6]	Presence/absence: Sport participation was measured by asking the subjects how often they participated in sports, ranging from 6	No guiding theory	Anxiety and depressive symptoms *Unvalidated tool*

Study (country), article ID	Sample size, sex, age, and context	Study design and primary analysis [quality/14]	Sport participation operationalization and measure of sport participation	Guiding theory or argument	Mental health variable(s), *measures*
	M_{age} = 16.3 years Sports excluding athletics at school		(6–7 times per week) to 1 (never). Sport participation was categorized as involved or not.		
			Core findings: Sport participation affected perceived health directly and indirectly by decreasing feelings of depression.		
Sabiston et al. (2016) (Canada), 26	*N* = 860 54% female M_{age} = 17.4 years Numerous sports organized into team vs. individual and school vs. outside of school.	Longitudinal Multivariate linear regression [13]	Amount—duration: Participants were asked if they belonged to school sports and sports outside of school. Responses across a single school year were collapsed in yearly participation (yes or no). School sport participation ranged from 0 (no involvement) to 5 (involved in school sport throughout the 5 years of secondary school).	No guiding theory	Depressive symptoms *MDI*
			Core findings: Years of involvement in team sport was inversely associated with depression, within a regression model controlling for numerous variables. Number of years of individual sport involvement was not associated with depression.		
Sanders, Field, Diego, & Kaplan et al. (2000) (United States), 27	*N* = 89 58% female M_{age} = 17 years Sports involvement	Cross-sectional Chi-square analyses and MANOVA [8]	Amount—frequency: Sports involvement was divided into three categories: low (2 hr per week), moderate (3–6 hr per week), and high (≥7 hr per week).	No guiding theory	Depressive symptoms *CES-D*
			Core findings: Youth reporting moderate sports involvement had significantly lower depression scores than did the low sports involvement group; the high sport involvement group did not differ from either group.		
Wang et al. (2017) (United States), 28	*N* = 1,065 51% female M_{age} = 15.5 years Different types of sport, which were coded into team-based sports (e.g., soccer, basketball, baseball) vs. individual sports (e.g., boxing, skiing)	Cross-sequential longitudinal LGC analyses and growth mixture models [13]	Amount—frequency: Participants reported their participation in different sports and the number of hours spent on these activities per week, ranging from 1 (none) to 8 (≥21 hours per week).	Expectancy-value theory (Eccles, 2009)	Depressive symptoms *SCL-90-R*
			Core findings: Higher levels of team-sport participation were associated with faster declines in depressive symptoms.		
Zarrett et al. (2009) (United States), 29	*N* = 1,357 57.9% female M_{age} = 13.2 years Various community- and school-based sports, separated into team (e.g., soccer) and individual sports (e.g., martial arts)	Longitudinal Cluster analysis, logistic regression, and ANCOVA [12]	Presence/absence: Participants were asked if they participated in community- and school-based sports. The authors also asked about other organized activities. Comparisons were between those having only reported sport activity involvement in a given year compared with those reporting no sport involvement.	Positive youth development (Lerner et al., 2005)	Depressive symptoms *CES-D*
			Core findings: High-engaged youths (i.e., participating in sports, clubs, performing arts, religious activities, and volunteer activities) and nonsport youths had the highest depression levels. The sport-only cluster reported lower symptoms of depression than the nonsport cluster.		

Note. Full article citations can be found in the Supplementary Materials (S.5; available online). CES-D = Center for Epidemiologic Studies—Depression Scale; CCHS = Canadian Community Health Survey; SCL-90-R = Symptom Checklist-90; BDI = Beck Depression Inventory; SCAS = Spence Children's Anxiety Scale; MDI = Major Depression Inventory; STAI = State-Trait Anxiety Inventory; CDI = Children's Depression Inventory; HADS = Hospital Anxiety and Depression Scale; PHQ-9 = Patient Health Questionnaire; DASS = Depression Anxiety and Stress Scales; CES-DC = Center for Epidemiologic Studies—Depression Scale for Children; SMFQ = Short Mood and Feelings Questionnaire; Zung SAS = Zung Self-Rating Anxiety Scale; GHQ-12 = General Health Questionnaire; LGC =

latent growth curve; SEM = structural equation modeling; ANOVA = analysis of variance; ANCOVA = analysis of covariance; MANOVA = multivariate analysis of variance; MVPA = moderate to vigorous physical activity; VPA = vigorous physical activity; PA = physical activity; CIDI, World Health Organization Composite International Diagnostic Interview.

Table 3

Operationalization of Sport Involvement

Type and operationalization	Example	Article IDs[a]
Presence or absence of sport involvement		
(a) Involvement: Dichotomous index classifying youth as sport involved or not	Answers were dichotomized into any sport participation (1) and no sport participation (0; Brière et al., 2018).	1, 6, 7, 10, 11, 13, 14, 15, 18, 19, 22, 23, 24, 25, and 29
Amount of sport involvement		
(b) Frequency: Frequency of sport involvement	Participants reported their frequency of involvement, using one of three options: (a) low, representing ≤ 2 hr/week; (b) moderate, representing 3–6 hr/week; and (c) high, representing ≥7 hr/week (Sanders et al., 2000).	5, 8, 20, 27, and 28
(c) Volume: Number of teams or number of times an individual participates across a period of time	Participants were asked to report the number of sport teams (both in and out of school setting) that they had been involved in during the previous 12 months. Scores ranged from 0 to 3 teams (Dishman et al., 2006).	3, 4, 7, 9, 12, 16, and 22
(d) Duration: Duration of sport involvement, originating from a dichotomous indicator but aggregated	Focusing on the number of years a youth had been involved in sport throughout high school, each participant was assigned a score from 0 (*no involvement*) to 5 (*sport involved throughout high school*; Sabiston et al., 2016).[b]	2, 17, 21, and 26

[a] Studies employing the stated operationalization, with identifiers located in table.

[b] Note that this study was conducted in a school system where students often complete 5 years of secondary school.