Towards an integrated model of supportive peer relationships in early adolescence: A systematic review and exploratory meta-analysis

Marija Mitic^{1*}, Kate A. Woodcock^{2,¶}, Michaela Amering³, Ina Stacher¹, Katharina A.M. Stiehl¹, Sonja Zehetmayer⁴, Beate Schrank^{1,5,¶}, on behalf of the D.O.T. Co-I team[^]

Published: Mitic M, Woodcock KA, Amering M, Krammer I, Stiehl KAM, Zehetmayer S and Schrank B (2021) Toward an Integrated Model of Supportive Peer Relationships in Early Adolescence: A Systematic Review and Exploratory Meta-Analysis. Front. Psychol. 12:589403. doi: 10.3389/fpsyg.2021.589403

¹ D.O.T. Research Group for Mental Health of Children and Adolescents, Ludwig Boltzmann Society at Karl Landsteiner University of Health Sciences, Krems on the Danube, Austria

² Centre for Applied Psychology, School of Psychology, University of Birmingham, Birmingham, United Kingdom

³ Department of Psychiatry and Psychotherapy, Clinical Division of Social Psychiatry, Medical University of Vienna, Vienna, Austria

⁴ Centre for Medical Statistics, Informatics and Intelligent Systems, Medical University of Vienna, Vienna, Austria

⁵ Department of Psychiatry and Psychotherapy, University Hospital Tulln, Karl Landsteiner University of Health Sciences, Tulln, Austria

* Corresponding author

E-Mail: marija.mitic@kl.ac.at; marija.mitic@gmx.net (MM)

[¶]KW and BS are joint senior authors.

[^]Membership of the D.O.T. team of co-investigators (Co-I) is provided in the acknowledgments.

Funding: This research was supported in part by a dissertation grant (SC17-009) from Lower Austrian Research and Education Association (NÖ Forschungs- und Bildungsges.m.b.H.-NFB).

Disclosure: This is a non-peer-reviewed manuscript and its content might not fully match a final peer-reviewed publication.

Abstract

Supportive peer relationships (SPR) are crucial for mental and physical health. Early adolescence is an especially important period in which peer influence and school environment strongly shape psychological development and maturation of core social-emotional regulatory functions. Yet, there is no integrated evidence based model of SPR in this age group to inform future research and practice. The current meta-analysis (PROSPERO protocol reference: CRD42018107945) synthesizes evidence from 364 studies into an integrated model of potential determinants of SPR in early adolescence. The model encompasses links with 93 variables referring to individual (identity, skills/strengths, affect/wellbeing and behavior/health) and environmental (peer group, school, family, community and internet/technology) influences on SPR. Findings suggest the central importance of identity and social–emotional skills in SPR. School environment stands out as a compelling setting for future prevention programs. Finally, we underscore an alarming gap of research on the influence of the virtual and online environment on youth’s social realm given its unquestionable importance as a globally expanding social interaction setting. Hence, we propose an integrated model that can serve as organizational framework, which may ultimately lead to the adoption of a more structured and integrated approach to understanding peer relationship processes in youth and contribute to overcoming marked fragmentation in the field.

Keywords: *peer relationships, loneliness, friendship, peer support, social wellbeing, emotional wellbeing, mental health, integrated model, ecological model, holistic approach, determinants, early adolescence, youth, systematic review, meta-analysis, mixed methods*

Introduction

A role of supportive peer relationships in early adolescence

Adolescents' social realm encompasses relationships with family members, peers, school staff and people in any other physical (e.g., neighborhood; 1) or virtual community (2, 3) to which an individual belongs. Some of these relationships reflect the norms of the adult world (conventional types - e.g., relationships with parents and teachers). Importantly however, peer relationships are linked to unsupervised activities and norms of the adolescent world (4) and thus possess a specific character that must be understood independently from the other social contexts.

From a developmental perspective, the family plays a central role in the life of a child. However, in middle childhood and early adolescence the influence of peer relationships on social and emotional outcomes intensifies (5) and these relationships become one of the key factors in shaping and directing young people's psychological development (6). Evidence from cognitive neuroscience suggests that this period may be critical for the maturation of complex socio-emotional and cognitive skills that influence later mental health outcomes (i.e., development of the so-called "social brain"- 7, 8). Indeed, in line with an important role of peer relationships in these aspects of social emotional development, supportive peer relationships (SPR) contribute to the sense of self (9, 10), social competence (11) and academic performance (12, 13). Furthermore, a lack of SPR is linked to a range of negative outcomes, including social withdrawal (14), risk-taking behavior such as early commencement of smoking, drinking and sexual relationships (15), increased risk of juvenile delinquency (16) and long-term mental health consequences (17).

In light of the fact that SPR pervade healthy functioning, an integrative understanding of early adolescent's SPR is necessary to enable effective and sustainable preventive and

therapeutic strategies relevant for the aforementioned outcomes. This requires SPR to be defined in a manner meaningful and informative for future research and practice as there is somewhat conflicting evidence on the relative importance of different aspects of peer relationships – quality, popularity and stability (18, 19) that contributes to the existing fragmentation in the field of peer relationships (20). However, we believe that these conflicts can be reconciled by recognizing that whilst early social relationships tend to be instable – giving meaning to popularity (21) – friendships (quality) represent a constant, universal aspect of the peer environment for children of any age (18). Indeed, even just one stable mutual friendship can be protective against the feeling of loneliness (22). Furthermore, early changes in status and/or in the number or nature of friendships can be viewed as indicators of the development of a more complex understanding of the social realm, individual bonding needs and preferences, which are enacted via specific friendships (18, 19). Thus, the quality of early adolescents’ peer relationships reflects age specific social goals as well as personal needs and preferences (23). As such, we offer peer relationship quality (PRQ) as the most appropriate integrative and quantifiable concept for studying SPR and these two terms will be used interchangeably in further text depending on a context (i.e., as psychological or statistical concept). Further, we will refer to our work as integrative (Merriam Webster - having different parts working together as a unit) as we aspire to overcome the existing fragmentation (Merriam Webster - separation into distinct parts) in the field of peer relationships.

In summary, SPR in early adolescence are one of the crucial factors for health and wellbeing both in the short- and in the long-term. However – as we will demonstrate below – there is currently no integrative evidence based model of SPR in this age group to inform intervention strategies (20). The current review aims to address this need and to initiate the development of such model by drawing on evidence of the diverse influences on peer relationships from the scientific literature.

Theoretical models of human development in interpersonal contexts

Numerous established theories have studied the process of human development in diverse interpersonal contexts. Attachment theory examined the complex paths of human development in relationships with caregivers (24); whereas, interpersonal theory studied how relationships with “significant others” - especially peers (25) complement each other in developmental processes. Indeed, the cumulative interpersonal risk model (26) stipulates the complementary roles these relationships have in the genesis of affective disorders. Yet, this complementarity also enables a mutual buffering effect (resilience theory; 27); thus, peer relationships can buffer against adversity in the family and vice versa. However, all relationships are inherently embedded into specific environmental contexts and they need to be understood in relation to these contexts.

Bronfenbrenner’s bioecological model (28) puts relationships in the context of ecological systems, stipulates the environmental context as a powerful determinant of human development and considers the reciprocal interactions between different systems connected via social interactions. Yet, the model fails to account for precise relationships between the systems and focuses more on spatial than on interpersonal dimensions of ecological systems (29).

Magnusson’s holistic-interactionistic model (30) draws on the bioecological model and focuses on the person in the context and introduces an idea of an individual as an organism and its physical environment as a system that functions as an organized whole. Psychological events reflect two interdependent levels of continuously ongoing individual processes: (a) those that interact between individual and environmental factors, and (b) those among psychobiological and behavioral components in the individual (31). Hence, the integrated holistic nature of developmental processes implies that they cannot be decomposed into or understood as independent components. The model challenges traditional, variable-

oriented unidirectional psychological research models and proposes a functional interaction model based on principles of reciprocity, interdependence and nonlinearity of interactions between and within the individual and its environment.

By applying the functional interaction principles to peer relationships it becomes obvious that the current developmental context and aspect of the self that emerge from it determine the quality of the current and future relationships in a given environmental context and short- and long-term mental health outcomes. Whereas, the developmental mechanisms in the context of relationships with caregivers are frequently studied and relatively integrated (e.g., 32), the integrative understanding of the peer relationships is missing. Further, research on peer relationships is fragmented and grounded in traditional socialization theories based on unidirectional models that fail to capture the reciprocal, translational nature of influences *in* and *on* peer relationships (20) and their the role in promoting wellbeing remains mainly unknown. The complex interplay of individual, interpersonal and sociopolitical factors models a dynamic system that imposes great challenges for empirical research on peer relationships (31). Further, the qualitative evidence that enables us to capture these aspects is often omitted or lost during the theory building.

We aim to develop of a flexible framework based on the principles of holistic functional interactionism that allows integrated understanding of SPR and surrounding environmental systems. The integrated model is a critical step towards overcoming existing fragmentation in the field of peer relationships.

Integrative approach towards advancing interventions that foster supportive peer relationships and wellbeing

The above described fragmentation is mirrored in the interventions in the field. Although experts agree that complex ecological strategies are necessary to deliver the expected impact in the field of youth mental health (33, 34), complex interventions usually comprise multiple components, which may act independently or interdependently, with the ‘active ingredient(s)’ often being difficult to specify (35). Such interventions challenge current approaches to conceptualization, assessment and implementation.

The realist approach suggests a framework adaptation towards top-down understanding of active ingredients, their interactions with the delivery context and the resultant development of ecologically valid models (36) during the evaluation of complex interventions. However, many of the widespread intervention strategies have not been empirically validated or rooted in comprehensive evidence based theoretical models (e.g., 37, 38, 39). Indeed, during the development of complex interventions a comprehensive (bottom-up) understanding of the role SPR have in promoting wellbeing, in addition to mapping potential determinants and their mechanisms from empirical studies, is another missing link crucial for overcoming fragmentation in and between theoretical and interventional research.

In summary, given the interdependence between the SPR and wellbeing, integrated bottom-up understanding of SPR may help to advance interventions in the field of youth mental health. The current model is a first step towards such integration, aiming to inform the design, implementation, and interpretation of empirical studies on SPR in early adolescence. It aims to spark further (qualitative and quantitative) research towards integrated understanding of individual, interpersonal and sociopolitical developmental contexts, and to inform the theory driven development of new and refinement of existing interventions.

Materials and methods

The systematic review was conducted according to a structured protocol (reference: CRD42018107945) registered on the PROSPERO repository. The law in our country does not require an Ethics Board approval for secondary research. The systematic search included five databases (Education Resources Information Centre - ERIC, PsycINFO, MEDLINE, EMBASE, and Cochrane Collection Library) and grey literature sources (OSF Preprints and OpenGrey). All databases were searched from inception until end of December 2017 using widely defined terms for the adolescent population ('child*', 'adoles*', 'teenage*', 'youth*', 'young*') combined with a set of terms for the quality of peer relations ('peer support', 'emotional support', 'emotional connection', 'social network(s)', 'social relation(s)', 'social relationship(s)', 'social connection(s)', 'social connectivity', 'social connectedness', 'belongingness', 'loneliness', 'social isolation', 'social acceptance', 'social withdrawal', 'friendship(s)', 'friend(s)', 'peer relation(s)', 'peer relationship(s)', 'peer connection(s)', 'peer connectedness', 'well-being'). Studies in English, German, Portuguese, Spanish, Italian, Serbian, Croatian and Hebrew were considered for inclusion. An additional hand search included the first 200 references identified via Google Scholar, as well as reference lists and cited reference searches of included studies and relevant literature reviews (40-44) retrieved during the database search. The detailed search strategy, including search terms and number of hits for the individual databases, is available online as part of the PROSPERO protocol.

Here, SPR are operationalized as any aspect of quality, such as intimacy, value, supportive function or closeness, of social relationships with at least one specific peer or with peers in general. Potential determinants of SPR in early adolescents are considered as factors that may influence PRQ. Hence, any variable (e.g., psychological or environmental) correlated with PRQ in this population was considered as a potential determinant. Initially, we placed no restrictions on measurement instruments for potential determinants.

Inclusion criteria. Cross-sectional and longitudinal correlational studies that measured some aspect of PRQ in early adolescents (aged 8 to 14 years) were included. Studies must include a full- or subscale on PRQ as defined by the authors of the measure (i.e., PRQ factor measured as a part of e.g., social connectedness or social support scale), with available reliability and/or validity information and its correlation with at least one psychological, social or environmental factor. Due to the large number of eligible studies and questionable translatability of dated publications to the current societal context, we only included articles published after 1999.

Exclusion criteria. We excluded studies with the following populations: delinquent and homeless; emigrational backgrounds including refugees; sexual, religious and ethnic minorities; intellectual, physical or sensory disabilities; acute or chronic physical illness; psychiatric clinical samples with diagnosed affective disorders, bipolar disorder, psychotic disorders, eating disorders, attention deficit hyperactivity disorder or conduct disorder. Characteristics of such special populations create specific developmental contexts for SPR during early adolescence (e.g., 45, 46-48). The influence of these contexts on SPR is critical to understand, particularly when considering how to help the most vulnerable members of society. However, to understand such influence in a systematic way that will be productive for future research and intervention development, we need a framework that comprehensively describes potential determinants of SPR in early adolescents on which to build. We therefore excluded such populations from the present review.

During the data analysis, in which we conducted a meta-analysis, additional exclusion criteria were established to enable meaningful statistical analysis of the identified studies and to obtain results pertinent to early adolescence. Initially, we placed no restrictions on the mean age of participants as long as the age range showed an overlap with our target range of 8 to 14 years. However, due to the wide age range in some studies, which may have limited the

relevance to the early adolescent period, we excluded studies in which the mean age exceeded 15 years, this upper age limit was established based on the highest age limit used to describe early adolescence identified in the literature (49). Six studies with a mean age of 16 were included to enable meaningful quantitative analysis for certain variables. However, the mean age of the analysed sample was 12.5 years. Furthermore, on the variable level only 18.3% of variables had samples with the mean age over 14 years. Information on the applicability to the context of early adolescence for each variable is available in the results tables.

Our aim was to bring together all potential determinants of early adolescent SPR in a single model, to act as a basis for further research. A minority of studies eligible for meta-analyses 10.9% (33 of 303) included longitudinal data. Longitudinal data can provide stronger evidence that a potential determinant of SPR is a true determinant. However, such data set is limited by the greater pragmatic demands on longitudinal research. For the present goal to develop an integrated model, longitudinal correlations were therefore excluded. An additional challenge was the marked heterogeneity in the measurement instruments for potential determinants. Our aim to develop an integrated framework and our focus on adolescents' experiences demanded a coherent quantitative analysis and comparable measurements, hence for variables that were assessed with diverse procedures (e.g., victimization assessed via self-report and peer nominations) we prioritized psychometric self-reported measures for inclusion in the meta-analysis, and this led to the exclusion of studies that used only sociometric and/or observational instruments. Finally, studies that reported only correlations controlled for confounders or aggregated correlations for multiple assessment points were excluded if authors were unreachable or nonresponsive to our requests for additional information. Again, such data would not allow meaningful quantitative analysis if analyzed together with the cross-sectional uncontrolled time points. Information on exclusion from the meta-analysis with reasons can be found in the data supplement (S1 Table).

Study selection and data extraction

The identification, screening and data extraction of eligible studies was conducted in accordance with the PRISMA statement (50). Two reviewers independently screened the identified references. Disagreements over the eligibility of particular studies were resolved through discussion with a third reviewer. A standardized form was used to extract data for the assessment of study quality and evidence synthesis. Due to the large number of eligible studies, data were extracted by multiple trained reviewers and controlled by an experienced researcher. To establish consistency between multiple reviewers, supervised training was provided. During the training period reviewers extracted data independently, compared extractions and resolved discrepancies through discussion. This process was continued until concordance of extractions was adequate.

Quality appraisal

The methodological quality of included studies was assessed in accordance with recommendations from the recent systematic review by Zeng and colleagues (51), which informed our choice of the assessment instruments. The Newcastle-Ottawa Scale (NOS; 52) was used to rate quality of longitudinal studies. Cross-sectional studies were rated using the checklist recommended by Agency for Healthcare Research and Quality (AHRQ; 51). Given both instruments were designed to assess methodological quality of clinical studies; scales were adapted for the purpose of our research for the panel studies design. The adapted instruments comprised 10 (ARHQ) and 7 (NOS) distinct criteria. To enable meaningful interpretation of the results numeric scores (higher score indicates higher risk of bias) were defined and studies were judged as having low (≤ 1), moderate (≤ 2) or high ($\geq 2,5$) risk of bias. The adapted instruments and assessment criteria are available in the study supplement (S1 Doc).

The methodological quality of included studies was assessed independently, by two reviewers in 213 (59%) studies, the rest of the included studies were assessed by a single trained reviewer. Disagreement between the assessors was resolved in discussion with involvement of a third experienced researcher where necessary. The level of reliability between the reviewers was fair (53) - Cohen's kappa (k) .44.

Qualitative analysis

The extracted data were imported to QSR NVivo (54) for the initial qualitative analysis. For every study, a unique case was created along with assigned attributes including authors' names, study design, year of publication, country, methodological quality and mean age of study participants. Next, two independent reviewers coded potential determinants measurements and measures of PRQ in parallel. Reviewers consulted and discussed the coding procedures on a daily basis including an experienced supervisor when needed.

Measures of PRQ were examined on the dimensional level to guide the development of the analysis strategy. However, the heterogeneity among instruments was marked. Furthermore, reporting was not consistent: whereas some authors provided results on a subscale level, others reported aggregated scores for multiple subscales. Hence, to be able to perform meaningful statistical analysis, we decided not to differentiate between the different measures of PRQ and their sub-dimensions or between positive and negative dimensions. This decision was based on the assumption supported by the prevailing literature that positive and negative quality aspects of peer relationships are the opposite polarities of the same continuum (20). Therefore, we analyzed positive dimensions (such as peer attachment and positive friendship qualities) and negative dimensions (such as loneliness and negative friendship qualities) together. To enable the quantitative analysis, correlations relating to negative dimensions of PRQ were reversed so that constructs could be considered in positive

terms. For example, reported positive correlates of loneliness were considered as negative correlates of absence of loneliness, which is comprised in our definition of PRQ. The same method was applied in cases where correlates were judged to be the opposite polarities of the same construct (e.g., hope and hopelessness). All decisions were made based on the consensus between leading and supervising author.

Based on the identified potential determinants constructs, a coding hierarchy (Fig 1) was inductively developed. The data were then hierarchically clustered into first-order concepts that include clusters (C), themes (T), groups (G) and variables (V), as depicted in Fig 1. Finally, for each of the variables, the quantitative data were extracted into a pre-structured table to enable the statistical analysis. The extraction process was performed by trained reviewers and controlled throughout by an experienced reviewer. Missing data from included studies were requested from corresponding authors with limited success (10%).

Fig 1. Coding hierarchy and model development process. A&W – Affect and wellbeing; B&H – behavior and health; C – community; F- family; I&T – internet and technology; PG – peer group; S – school; S&S – skills and strengths.

☐ Qualitative analysis; ▤ Meta-analysis; ▦ Mixed methods; ↓ Types of evidence used for the model development (see Table 1).

Meta-analysis

Meta-analyses based on bivariate correlation coefficients were performed by a statistician. For the effect size estimation the Fisher z transformation (55) was applied to obtain approximately normal distributions of the test statistics, for the presentation of the results the effect sizes were reconverted to correlation coefficients. For the analyses, repeated correlation coefficients within the publications have to be considered because the assumption of independence may be violated. Two different approaches were applied – conservative and mixed effects approach (56). First, for all publications, the Fisher transformed correlation coefficients as well as the sample sizes were averaged. Second, a mixed effects model was calculated, where random effects were introduced. For both approaches the estimated correlation coefficient (β) of the meta-analysis, the corresponding 95% confidence intervals and a p -value, which tests the null hypothesis ($\beta=0$), were computed. Both approaches yielded equivalent results and thus we report the results of the mixed effects model. Forest plots showing the correlation coefficients of the single studies together with the 95% confidence intervals and the corresponding resulting meta-analysis estimators were generated and are available in the study supplement along with a histogram of the conducted meta-analysis correlation coefficients (S1 – 95 Fig). Finally, the statistical heterogeneity index (I^2) that quantifies the degree of inconsistency across the studies' results was calculated (56). For the analyses, the R programming language (57) and the “metafor package” (56) were applied, with aim to answer the following research questions: What are potential determinants of SPR in early adolescence?

To facilitate the mapping of salient findings we defined 5 types of evidence (Table 1) following recommendations from Cohen, J. (58). The evidence types were defined based on estimated correlation coefficient (β) and p -value. The variables showing small to strong

estimated correlation coefficients (i.e., evidence type A and B) were included in the model development, which employed a mixed-methods synthesis.

Table1. Types of evidence

Strong	Type A+	$\beta \geq +/- .40 $; $p\text{-value} \leq .05$
Moderate	Type A	$\beta \geq +/- .30 $; $p\text{-value} \leq .05$
Small	Type B	$\beta \geq +/- .20 $; $p\text{-value} \leq .05$
Very small	Type C	$\beta \geq +/- .10 $; $p\text{-value} \leq .05$
Negligible	Type D	$\beta \leq +/- .10 $; $p\text{-value} \leq .05$

Legend. β = estimated correlation coefficient; $| +/- x|$ = the absolute value.

Mixed methods approach to model development

The mixed methods synthesis was informed by techniques described in Popay and colleagues' guidelines (59) that were adapted for the purpose of the current study. The methodology was based on the concept mapping method (60) which involves linking multiple pieces of evidence from across individual studies (variables in the current context) to a model that highlights key concepts or issues relevant to the research question and represents relationships between these. This approach uses diagrams and flow charts to visually represent studied concepts and relationships between them and we used it to develop the hierarchical maps of potential determinants. Further, the conceptual triangulation method (61) was adapted (Fig 2) to inform the model development by combining our qualitative and quantitative findings with recognized theoretical models that serve as a base for the definition

of the second-order concepts. This allowed us to generate the integrated model through which the SPR may be better understood on the basis of the diverse sources of synthesized evidence.

Fig 2. Conceptual triangulation. First-order concepts (psychological) are based on qualitative synthesis of evidence; Variables are quantified (statistical) first-order concepts i.e., estimated correlation coefficients derived via meta-analysis. Second-order concepts are integrative concepts that include qualitative and quantitative results embedded in existing theoretical models.

First, the quantitative data (tabulated variables) were examined with respect to strength and direction of association with PRQ. The variables showing salient findings (see Table 1) were embedded in the existing qualitatively derived coding hierarchy of first-order concepts (see Fig 1) and named to reflect positive association with PRQ (i.e., high emotion regulation ability and low depression show moderate positive association with PRQ) to develop the hierarchical maps of evidence (see Fig 4 & 5) and explore relationships between the concepts. Second, the hierarchical maps were examined in parallel with the recognized theoretical models to develop the integrative second-order concepts that embed the salient findings in the

recognized theoretical models with respect to identified relationships between the concepts. Hence, the first-order concepts individual factors were transformed in the second-order concepts – self-building-blocks based on Magnusson’s holistic-interactionistic model (30, 31, 62) and the environmental factors (first-order) were transformed in the environmental planes (second-order) based on Bronfenbrenner’s ecological model (28, 63). Finally, the evidence based integrated model of SPR was developed and graphically presented.

Publication bias

There is evidence on the pervasive publication bias in the entire field of psychology (64) that may arise due to non-publication of negative findings, selective reporting or misinterpretation of results (65). Hence, in order to minimize the publication bias we followed the recommendations from DeVito & Goldacre (65) and (a) conducted an extensive literature search including grey literature sources, (b) included primary, secondary and exploratory endpoints in our analyses, (c) requested missing data from authors, and (d) performed three different sensitivity analyses. First, two funnel plots (scatter plot of the standard error and the effect size i.e., the Fisher transformed correlation coefficients) for each meta-analysis were generated, one for the mixed model approach and one for the conservative mean approach. In these analyses, an asymmetrical funnel plot would indicate the presence of publication bias. Second, for the conservative approach we applied the trim and fill method - a nonparametric, rank-based data augmentation technique proposed by (66, 67) that estimates the number of studies missing from a meta-analysis due to the suppression of the most extreme results on one side of the funnel plot and recomputes effect sizes and p-values. Third, for the conservative and the mixed data a rank correlation test for funnel plot asymmetry as described by Begg and Mazumdar (68) was performed. The test is used to examine the association

between the observed outcomes and the corresponding sampling variances. A high correlation indicates that the funnel plot is asymmetric, which may be a result of publication bias.

Results

Characteristics of included studies

We identified 364 studies from 361 publications eligible for inclusion in the narrative synthesis: 260 studies from systematic database search, 99 studies from reference search and 4 studies from hand-search in Google scholar (Fig 2). Included articles were published between 2000 and 2018. With respect to geographical region, 50.1% (183) of eligible studies had samples from North America (including USA and Canada), 25.2% (92) from Western Europe, 17.3% (63) from Asian countries, 5.8% (21) from Australia and New Zealand and 1.6% (6) from Central or South America. The majority (97%) of the included studies had samples comprised of typically developing school-aged populations. A few studies included participants from vulnerable populations such as children of parents with a mental illness (69, 70), foster care populations (71, 72) or socio-economically disadvantaged populations (73-79). With respect to study design, 36.4% (133) had a longitudinal and 63.6% (232) a cross-sectional design. We included 303 studies in the meta-analyses. The mean age of the analyzed sample was 12.5 (age range 8.09 – 16.41; SD = 1.8). The Supplemental Table 1 contains information on study characteristics including: first author information, year of publication, design, country in which the study was conducted, age of participants, risk of bias, PRQ measure type, data on in/exclusion from the quantitative analysis with reasons. The reference list of included studies is also available in the online supplement – S2 Doc.

Fig 3. PRISMA flow diagram. Diagram of the study inclusion process adapted from Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group (50).

Methodological quality of included studies. The methodological quality was generally low: 17 studies (4.7%) had a moderate risk of bias and 348 (95.3%) had a high risk of bias. Out

of 17 studies with moderate risk of bias, 10 had longitudinal and 7 had cross-sectional designs. Given this is an exploratory analysis that aims to obtain a comprehensive picture of potential determinants of SPR, we decided not to exclude papers based on their methodological quality. However, we consider the general low methodological quality in our interpretation of the derived evidence. The detailed information on methodological quality for individual studies is available in the S1 Table.

Publication bias. Except dissertations, we failed to identify additional unpublished studies. The missing data were requested from corresponding authors for 141 and received for 16 studies. Visual and quantitative evaluation of the sensitivity analyses' results showed consistent small to irrelevant publication bias in the 303 studies included in the meta-analyses. During the visual evaluation of funnel plots (S96 – 219 Fig), no significant asymmetry was observed. Trim and fill and rank correlation tests yielded small/irrelevant adjustments in values across all variables after controlling for publication bias. Hence, there is no evidence of publication bias being a major issue for the present meta-analyses.

Measures of peer relationship quality

We identified 87 distinct self-reported measures of PRQ. Detailed information on measurement instruments from individual studies is available in the supplement (see S1 Table). The identified quality dimensions are intimacy, closeness, relatedness, support, attachment, belonging and loneliness – and these are measured in relation to best friend, close friends (same or opposite sex), peers or classmates. With respect to the structure of used measures, some studies employed instruments with mixed sub-dimensions referring to positive and negative qualities e.g., the Friendship Quality Questionnaire (FQQ; 80), Network of Relationships Inventory (NRI; 81), Inventory of Parent and Peer Attachment (IPPA; 82) and the Loneliness and Social Dissatisfaction Questionnaire (LSDQ; 83). Other authors

employed measures exclusively referring to positive qualities such as the Child and Adolescent Social Support Scale (CASSS; 84). Finally, measures with negative qualities such as the Peer Network and Dyadic Loneliness scale (PNDL; 85) and the University of California Los Angeles Loneliness Scale (UCLA; 86) were used in some studies. Many authors failed to provide detailed information regarding employed instruments and/or their modifications; hence, in many cases it was not possible to draw conclusions about the exact structure of employed instruments.

Potential determinants of peer relationship quality

We identified two clusters of potential determinants of PRQ in early adolescence - individual and environmental (see Fig 1). Within each of the two clusters, we defined specific themes referring to (a) individual skills and strengths, (b) identity aspects, (c) behavior and health, (d) affect and wellbeing, (f) family, (g) peer group, (h) school, (i) internet and technology and (j) community. Within the themes, we defined specific topics – groups. Each group comprised multiple quantifiable data units – variables. In total, we computed 93 variables (55 in the individual and 38 in the environmental cluster), resulting in total of 2097 correlation coefficients used for statistical analysis. The minimum number of correlation coefficients per variable was 2, the maximum 193 (mean 22). Some publications appear several times as different scores were used for the analysis; however, none of these scores were included more than once. The minimum number of studies per variable was 2, the maximum number was 73. The variables showing A or B type of evidence (i.e., $\beta \geq .20$; 45.5% of all analyzed variables) informed the development of our integrated model of possible determinants of SPR in early adolescence (see Fig 1,3,4 and 5). The model and its implications for research and practice will be described in more detail in the discussion

section; here we focus on individual variables to obtain a comprehensive overview of identified factors.

Individual cluster

Skills and strengths. This theme contains 7 distinct groups: (a) emotion regulation, (b) social cognition, (c) social skills, (d) cognitive and language skills, (e) academic skills, (f) emotional intelligence and (g) autonomy in decision making; and 12 different variables referring to individual skills and strengths (Table 2). Amongst skills variables, five variables displayed type A evidence: emotion regulation ability, co-rumination, affective component of social cognition and social skills; 4 variables showed type B: general coping, constructive coping, cognitive component of social cognition and emotional intelligence; and 3 variables type C: language skills, academic competence and autonomy in decision making.

Table 2. Skills and strengths variables

Variable	No. of studies (total No. of r)	Total sample size	β [CI]	Heterogeneity (I ²)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
Emotion regulation							
Emotion regulation ability	7 (41)	2680	.30** [.14 – .43]	91.34	6 PQ 1 NQ	12.75^a (8 – 17)	A
Co-rumination	10 (19)	3890	.33* [.13 – .51]	97.76	10 PQ 1 NQ	12.89^a (9 – 18)	A
<i>Constructive coping & attributions</i>	<i>14 (43)</i>	<i>6807</i>	<i>.25**</i> [.17 – .33]	<i>91.09</i>	<i>13 PQ</i> <i>2 NQ</i>	<i>12.94^a</i> <i>(9 – 19)</i>	<i>B</i>
<i>General coping & attributions</i>	<i>3 (6)</i>	<i>1384</i>	<i>.24*</i> [.04 – .42]	<i>91.16</i>	<i>1 PQ</i> <i>2 NQ</i>	<i>11.49^a</i> <i>(8 – 15)</i>	<i>B</i>
Social cognition							
Affective social cognition	5 (10)	1843	.36** [.10 – .57]	97.16	5 PQ -	14.26 (11 – 18)	A

Prosocial motivation and sympathy	3 (5)	1397	.31** [.24 – .38]	67.88	3 PQ -	13.22^a (11-18)	A
<i>Cognitive social cognition</i>	<i>6 (15)</i>	<i>2197</i>	<i>.27**</i> [.06 – .46]	<i>96.31</i>	<i>5 PQ</i> <i>1 NQ</i>	<i>10.53^a</i> (9 – 18)	<i>B</i>
Social skills							
Social competence	26 (64)	11167	.36** [.29 – .44]	95.51	17 PQ 9 NQ	12.8^a (8 – 18)	A
Cognitive and language skills							
Language skills	2 (2)	419	.18** [.09 – .27]	0.00	1 PQ 1 NQ	12.73 ^a (11 – 16)	C
Academic skills							
Academic competence	7 (12)	7756	.15* [.02 – .28]	93.74	7 PQ -	13.29 ^a (8 – 18)	C
Emotional intelligence							
<i>Emotional intelligence</i>	<i>3 (8)</i>	<i>814</i>	<i>.22**</i> [.09 – 0.34]	<i>14.59</i>	<i>1 PQ</i> <i>2 NQ</i>	<i>14.37</i> (11 – 19)	<i>B</i>

Autonomous decision making							
ADM	2 (3)	2167	.12*	60.33	2 PQ	13.78 ^a	C
			[.00 – .24]		-	(10 – 18)	

Legend. ADM = Autonomy in decision-making; NQ = Negative quality dimension (i.e., loneliness); PQ = positive quality dimension; PRQ = peer relationship quality; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

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

Identity. Within this theme, we identified three groups with 19 variables referring to (a) temperament, (b) relational dispositions and (c) self-concepts (Table 3). Type A evidence in a positive direction was demonstrated for the following variables: hope and optimism (A^+), sense of coherence (A^+), adaptability, emotional stability, extraversion and self-esteem; and in a negative direction for the shyness and rejection sensitivity variables. Type B was present for 7 variables (agreeableness, interpersonal goals, preference for solitude, trust beliefs, academic self-efficacy, social self-efficacy and body image), D type for 4 variables (psychopathic traits, openness to experience, conscientiousness and general self-efficacy). No C type evidence was present within this theme.

Table 3. Identity variables

Variable	No. of studies (total No. of r)	Total sample size	β [CI]	Heterogeneity (I ²)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
Temperamental dispositions							
Adaptability	2 (6)	2293	.30**	0	1 PQ	15.42	A
			[.22 – .38]		2 NQ	(13 – 19)	
Emotional stability	2 (2)	1816	.34**	49.87	-	15.82	A
			[.27 – .40]		2 NQ	(13 – 19)	
Extraversion	2 (2)	1816	.46**	60.62	-	15.91	A
			[.39 – .53]		2 NQ	(12 – 19)	
<i>Agreeableness</i>	<i>3 (3)</i>	<i>244</i>	<i>.22**</i>	<i>7.02</i>	<i>1 PQ</i>	<i>12.07^a</i>	<i>B</i>
			[.18 – .26]		<i>1 NQ</i>	<i>(10 – 14)</i>	
Openness to experience	2 (2)	1816	.06	38.01	-	15.82	D
			[-.00 – .13]		2 NQ	(13 – 19)	
Conscientiousness	2 (2)	1816	-.05	37.45	-	15.91	D

			[-.11 – .02]		2 NQ	(12 – 19)	
Absence of	3 (11)	960	.02	88.96	2 PQ	14.13	D
psychopathic traits			[-.16 – .20]		1 NQ	(10 – 18)	
Relational dispositions							
Shyness	8 (10)	5735	-.35**	96.32	2 PQ	12.91^a	A
			[-.46 – -.22]		6 NQ	(9 – 15)	
Rejection	8 (15)	2783	-.34**	81.66	4 PQ	12.46^a	A
sensitivity			[-.42 – -.25]		6 NQ	(9 – 17)	
<i>Preference for</i>	6 (9)	5545	-.22**	96.40	1 PQ	13.34 ^a	B
<i>solitude</i>			[-.35 – -.08]		5 NQ	(9 – 20)	
<i>Connection-oriented</i>	6 (13)	1485	.23**	71.42	5 PQ	12.25 ^a	B
<i>interpersonal goals</i>			[.13 – .32]		1 NQ	(9 – 17)	
Self-concepts							
Beliefs and self-perceived abilities							
Hope & optimism	8 (10)	6029	.43**	97.49	4 PQ	12.39 ^a	A⁺
			[.29 – .56]		5 NQ	(9 – 16)	

Sense of coherence	4 (8)	2539	.49** [.33 – .63]	94.23	1 PQ 3 NQ	11.21 ^a (9 – 15)	A⁺
<i>Trust beliefs</i>	3 (4)	593	.26* [-.00 – .49]	86.041	- 3 NQ	11.36 ^a (9 – 11,97)	B
<i>Social self-efficacy</i>	5 (8)	2037	.28** [.10 – .45]	91.51	5 PQ -	12.61 ^a (9 – 16)	B
<i>Academic self- efficacy</i>	5 (5)	2652	.22** [.11 – .32]	86.40	5 PQ -	12.20 ^a (8 – 17)	B
General self-efficacy	2 (6)	534	.12 [-.01 – .25]	43.43	3 PQ -	13.64 ^a (11 – 19)	D
Multidimensional self-concepts							
Self-esteem	44 (73)	31905	.35** [.30 – .39]	95.40	27 PQ 23 NQ	12.90^a (7 – 19)	A
<i>Body image</i>	2 (5)	308	.23* [.02 – .43]	70.40	3 PQ -	15.05 (14 – 16)	B

Legend. NQ = Negative quality dimension (i.e., loneliness); PQ = positive quality dimension; PRQ = peer relationship quality; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

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

Behavior and health. This large theme contains clinical and nonclinical health related variables referring to mental and physical health divided into 5 groups: (a) general clinical spectrum, (b) clinical spectrum in relational context, (c) multidimensional behavioral and emotional issues, (d) nonclinical behavioral spectrum and (e) physical health (Table 4). Amongst the 19 distinct variables, 3 showed type A evidence i.e., depression, social anxiety and self-disclosure. Type B was present for 2 variables (prosocial behavior and social withdrawal), type C for 9 variables (internalizing symptoms, anxiety, externalizing symptoms, risky and delinquent behavior, hyperactivity, aggression, multidimensional issues, problematic relational behavior and sport participation) and type D for 3 (emotional symptoms, substance use, antisocial behavior).

Table 4. Behavior and health variables

Variable	No. of studies (total No. of r)	Total sample size	β [CI]	Heterogeneity (I ²)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
General clinical spectrum							
Internalizing spectrum							
Depression	71 (141)	34077	-.30** [-.35 – -.25]	95.90	54 PQ 30 NQ	12.56^a 8 - 19	A
<i>Somatic symptoms</i>	<i>5 (11)</i>	<i>738</i>	<i>-.20**</i> <i>[-.31 – -.07]</i>	<i>86.50</i>	<i>4 PQ</i> <i>2 NQ</i>	<i>12.13^a</i> <i>(10 – 15)</i>	<i>B</i>
Anxiety	18 (33)	5723	-.13* [-.23 – -.03]	92.97	29 PQ 4 NQ	12.61 ^a (8 – 18)	C
Internalizing symptoms (AS)	24 (47)	10005	-.17** [-.23 – -.12]	87.15	19 PQ 4 NQ	12.86 ^a (8 – 18)	C
Emotional Symptoms	6 (9)	2412	-.13 [-.25 – .01]	71.50	3 PQ 2 NQ	12.70 ^a (9 – 18)	D

Externalizing spectrum							
Externalizing symptoms	20 (44)	8864	-.17**	79.84	18 PQ	12.76 ^a	C
(AS)			[-.22 – -.12]		3 NQ	(8 – 18)	
Risky/delinquent	9 (17)	2377	-.12**	83.48	8 PQ	13.00 ^a	C
behavior			[-.20 – -.03]		3 NQ	(10 – 18)	
Hyperactivity	2 (5)	790	.14**	0	3 PQ	12.84 ^a	C
			[.10 – .20]		1 NQ	(10 – 18)	
Substance use	4 (4)	615	.02	79.25	5 PQ	14.21	D
			[-.19 – .22]		-	(12 – 18)	
Relational clinical spectrum							
Internalizing spectrum							
Social Anxiety	33 (73)	16394	-.34**	95.40	22 PQ	12.10^a	A
			[-.41 – -.27]		20 NQ	7 - 18	
<i>Social withdrawal</i>	6 (8)	1029	-.24**	15.01	4 PQ	11.27 ^a	B
			[-.31 – -.17]		3 NQ	(9 – 17)	
Externalizing spectrum							

Aggression	27 (73)	17726	-.13** [-.18 – -.08]	86.04	19 PQ 9 NQ	12.04 ^a (6 – 18)	C
Antisocial behavior	8 (8)	2885	-.01 [-.20 – .19]	96.10	6 PQ 2 NQ	12.11 ^a (9 – 18)	D
Multidimensional behavioral & emotional issues							
AS of internalizing/externalizing symptoms	9 (17)	6912	-.19** [-.25 – -.13]	81.95	5 PQ 4 NQ	12.35 ^a (7 – 18)	C
Nonclinical spectrum							
Self – disclosure	7 (37)	1985	.40** [.23 – .54]	94.05	5 PQ 2 NQ	12.70^a (9 – 18)	A⁺
<i>Prosocial behavior</i>	<i>14 (19)</i>	<i>6576</i>	<i>.27**</i> <i> [.15 – .38]</i>	<i>96.00</i>	<i>12 PQ</i> <i>3 NQ</i>	<i>12.40^a</i> <i>(7 – 17)</i>	<i>B</i>
Problematic relational behavior	7 (26)	2876	-.16** [-.24 – -.09]	64.50	6 PQ 3 NQ	12.63 ^a (9 – 16)	C
Physical health							

Sport participation	5 (10)	5854	.12*	89.00	4 PQ	12.19 ^a	C
			[.00 – .22]		1 NQ	(8 - 18)	

Legend. AS= aggregated scores; NQ = Negative quality dimension (i.e., loneliness); PQ = positive quality dimension; PRQ = peer relationship quality; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

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

Affect and wellbeing. Within this theme, we distinguish between the three groups: (a) feelings and emotions specific for the relational context, (b) feelings and emotions that constitute general affective states and (c) general wellbeing (Table 5). Amongst 6 variables, happiness (A^+), positive affect and self-perceived quality of life demonstrated the A type of evidence. The remaining three variables displayed B (negative affect and multidimensional perceived stress) and D type (jealousy).

Table 5. Affect and wellbeing variables

Variable	No. of studies (total No. of r)	Total sample size	β [CI]	Heterogeneity (I^2)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
General affective states							
Happiness	6 (8)	5299	.40** [.34 – .47]	85.02	4 PQ 4 NQ	12.29^a (8.3 – 18)	A⁺
Positive affect	5 (6)	3212	.31** [.23 – .39]	76.33	2 PQ 3 NQ	12.26^a (8 – 17)	A
<i>Negative affect</i>	<i>8 (9)</i>	<i>7189</i>	<i>-.26**</i> [-.37 – -.15]	<i>93.75</i>	<i>4 PQ</i> <i>4 NQ</i>	<i>13.05^a</i> <i>(8 – 18)</i>	<i>B</i>
F&E in relational context							
Jealousy	3 (8)	603	-.10 [-.39 – .21]	83.81	3 PQ -	11.51 ^a (9 – 15)	D
General wellbeing							

Perceived QoL	23 (34)	27395	.39**	93.424	15 PQ	13.32^a	A
& satisfaction			[.35 – .43]		11 NQ	(7 – 19)	
<i>Multidimensional</i>	<i>8 (11)</i>	<i>4644</i>	<i>-.20**</i>	<i>94.656</i>	<i>8 PQ</i>	<i>14.27</i>	<i>B</i>
<i>perceived stress</i>			<i>[-.33 – -.08]</i>		<i>1 NQ</i>	<i>(10 – 19)</i>	

Legend. F&E = feelings and emotions; NQ = Negative quality dimension (i.e., loneliness); PQ = positive quality dimension; PRQ = peer relationship quality; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

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

Environmental cluster

Family. The family theme included 14 variables constituting 4 groups: (a) family unit, (b) relationships between family members, (c) parental factors and (d) childhood maltreatment (Table 6). Amongst these 14 variables, only parental support showed type A evidence, secure attachment to parents showed type B. Most variables demonstrated type C (family climate, parent child communication, child perception of interparental conflict, sibling relationship quality, parenting variables, parental interpersonal skills and childhood abuse and neglect) and type D evidence (economic factors, parental perceptions of interparental conflict, parental mental illness and exposure to family violence).

Table 6. Family variables

Variable	No. of studies (Total No. of r)	Total sample size	β [CI]	Heterogeneity (I ²)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
Family unit functioning							
Family climate	5 (10)	4520	.19** [.08 – .29]	92.00	3 PQ 3 NQ	12.14 ^a (9.5 – 18)	C
Economic factors	6 (6)	10950	.09 [.03 – .15]	87.30	3PQ 3 NQ	11.01 ^a (7 – 14)	D
Relationships between family members							
<i>Parental Support</i>	25 (43)	9923	.29** [.23 – .36]	93.01	23 PQ 2 NQ	12.69 ^a (8 – 19)	B
<i>Secure attachment to parents</i>	38 (174)	27862	.24** [.21 – .28]	88.35	42 PQ 1 NQ	13.09 ^a (8 – 18)	B

Functional parent child communication	3 (21)	1388	.18 [-.04 – .38]	91.46	2 PQ 2 NQ	13.72 ^a (10 – 18)	C
Inter-parental conflict – CP	5 (41)	1026	-.14** [-.21 – -.08]	40.37	5 PQ 1 NQ	12.43 ^a (8 – 16)	C
Sibling relationship	4 (17)	1520	.17** [.14 – .20]	0	5 PQ 1 NQ	11.83 ^a (8 – 17)	C
Inter-parental conflict – PP	4 (67)	957	-.04 [-.07 – .00]	0	3 PQ 1 NQ	11.89 ^a (8 – 15)	D
Parental factors							
<i>Positive parenting</i>	<i>16 (39)</i>	<i>12282</i>	<i>.20** [.10 – .30]</i>	<i>96.38</i>	<i>15 PQ 7 PQ</i>	<i>11.73^a (6 – 18)</i>	<i>B</i>
Negative parenting	18 (52)	11733	-.13** [-.07 – -.19]	88.30	14 PQ 5 NQ	11.90 ^a (6 – 18)	C

Parental interpersonal skills	2 (6)	241	.19 [-.10 – -.45]	76.80	2 PQ -	14.37 (12 – 16)	C
Parental mental illness	3 (7)	337	-.09* [-.17 – -.02]	0	2 PQ 1 NQ	11.38 ^a (7 – 17)	D
Childhood maltreatment							
Childhood abuse and neglect	3 (10)	3557	-.14* [-.27 – .01]	92.45	3 PQ -	12.25 ^a (8 – 17.5)	C
Exposure to family violence	2 (2)	1284	-.08** [-.13 – -.02]	0	2 PQ -	12.5 ^a (11 – 15)	D

Legend. CP = child perception; NQ = Negative quality dimension (i.e., loneliness); PP = parental perception; PQ = positive quality dimension; PRQ = peer relationship quality; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

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

Peer group. This small theme contained 4 variables referring to (a) peer group characteristics and (b) experiences of an individual within the peer group (Table 7). Peer group inclusion shows type A evidence, victimization and peer problems type B, and peer deviance type C.

Table 7. Peer group variables

Variable	No. of studies (total No. of r)	Total sample size	β [CI]	Heterogeneity (I ²)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
Experiences in the peer group							
Inclusion	17 (25)	13819	.38** [.27 – .48]	97.42	11 PQ 7 NQ	12.49^a (7 – 18)	A
<i>Victimization</i>	<i>41 (105)</i>	<i>23228</i>	<i>-.26**</i> [-.32 – -.21]	<i>94.61</i>	<i>26 PQ</i> <i>13 NQ</i>	<i>12.40^a</i> <i>(8 – 17)</i>	<i>B</i>
<i>Peer related stress</i>	<i>6 (7)</i>	<i>3182</i>	<i>-.27**</i> [-.36 – -.18]	<i>71.60</i>	<i>4 PQ</i> <i>2 NQ</i>	<i>11.82^a</i> <i>(9 – 18)</i>	<i>B</i>
Peer group characteristics							
Peers' deviant behavior	6 (14)	4936	-.12* [-.23 – -.01]	92.62	6 PQ -	13.73 ^a (10 – 18)	C

Legend. NQ = Negative quality dimension (i.e., loneliness); PQ = positive quality dimension; PRQ = peer relationship quality; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

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

School. The school theme contained 9 variables in three groups, related to (a) academic performance, (b) experiences in the school setting and (c) relationship with the teacher (Table 8). Our results show: type A evidence for positive attitudes towards school and school belonging; type B for student-teacher relationship and academic engagement; type C for academic performance, mastery motivation and school adjustment; and type D for the classroom autonomy variable.

Table 8. School variables

Variable	No. of studies (total No. of r)	Total sample size	β [CI]	Heterogeneity (I ²)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
Individual academic related factors							
Positive attitudes toward school	5 (9)	3840	.34** [.16 – .49]	96.10	5 PQ -	13.04^a (10 – 19)	A
<i>Academic engagement</i>	<i>15 (30)</i>	<i>12304</i>	<i>.23**</i> [.18 – .27]	<i>75.49</i>	<i>13 PQ</i> <i>7 NQ</i>	<i>12.00^a</i> (8 – 18)	B
Academic performance	16 (29)	7770	.10** [.06 – .15]	71.44	15 PQ 5 NQ	11.18 ^a (7 – 16)	C
Mastery motivation	7 (17)	3531	.15** [.10 – .19]	46.52	9 PQ -	13.33 ^a (11 -17)	C
School adjustment	3 (10)	2508	.16** [.05 – .27]	0.01	2 PQ 2 NQ	12.29 ^a (10 – 16)	C
Experiences in the school setting							

School belonging	14 (20)	9662	.31**	88.13	10 PQ	12.68^a	A
			[.26 – .37]		4 NQ	(8 – 18)	
PE for academic engagement	3 (5)	1009	.33**	48.05	3 PQ	12.34^a	A
			[.25 – .41]		-	(10 – 16)	
Autonomy in classroom	2 (2)	1586	.55	99.72	2 PQ	12.41 ^a	D
			[-.32 – .92]		-	(11 – 17)	
Relationship with teacher							
<i>Relationship with Teacher</i>	<i>19 (47)</i>	<i>15028</i>	<i>.27**</i>	<i>93.38</i>	<i>17 PQ</i>	<i>12.23^a</i>	<i>B</i>
			[.21 – .33]		<i>3 NQ</i>	<i>8 – 17.5</i>	

Legend. NQ = Negative quality dimension (i.e., loneliness); PQ = positive quality dimension; PRQ = peer relationship quality; PE= peers' expectations; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

Internet and technology. We identified 7 variables in four groups referring to (a) usage tendencies, (b) cyberbullying, (c) online communication and (d) online activities (Table 9). Problematic technology use showed type A; quality of online communication and online victimization showed type C; time spent online, online aggression, communication with strangers and online information seeking displayed type D.

Table 9. Internet and technology variables

Variable	No. of studies (total No. of r)	Total sample size	β [CI]	Heterogene ity (I^2)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
General usage tendencies							
Problematic/addictive I&T use	7 (12)	10541	-.32** [-.44 – -.19]	97.33	3 PQ 5 NQ	15.05 (10 – 19)	A
Time spent online	7 (11)	5506	-.07 [-.16 – .01]	89.28	4 PQ 4 NQ	14.14 (12 – 19)	D
Cyberbullying							
Online victimization	8 (12)	4231	-.14** [-.20 – -.93]	59.95	4 PQ 4 NQ	14.2 (10 – 18)	C
Online aggression	4 (6)	1777	-.12 [-.32 – .09]	93.32	2 PQ 2 NQ	14.4 (11 – 18)	D
Online communication							

Quality of communication	3 (7)	2159	.18** [.07 – .28]	76.36	3 PQ 1 NQ	13.04 ^a (10 – 17)	C
Communication with strangers	2 (3)	1782	-.15 [-.32 – .03]	93.02	2 PQ 1 NQ	13.1 ^a (10 – 17)	D
Type of online activities							
Information seeking	2 (3)	2038	.02 [-.20 – -.25]	95.73	2 NQ 1 PQ	11.27 ^a (8 – 16)	D

Legend. I&T = Internet and technology; NQ = Negative quality dimension (i.e., loneliness); PQ = positive quality dimension; PRQ = peer relationship quality; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

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

Community. This theme comprises 4 variables clustered into two groups, referring to (a) socio-demographic factors and (b) experiences of community setting (Table 10). Our results showed the A type of evidence for the variable relationships with non-parental adults (A+), B type for community connectedness and D type for exposure to community violence and economic factors.

Table 10. Community variables

Variable	No. of studies (total No. of r)	Total sample size	β [CI]	Heterogeneity (I ²)	PRQ Measure Type ⁱ	Mean age (age range)	Type of evidence ^e
Experiences in the community setting							
Relationships with significant others	3 (3)	2114	.66** [.46 – .79]	96.44	3 PQ -	14.93 (14.1 – 15.9)	A⁺
<i>Community connectedness</i>	<i>5 (8)</i>	<i>11137</i>	<i>.24**</i> [.19 – .29]	<i>84.43</i>	<i>5 PQ</i> -	<i>12.89^a</i> (9 - 19)	<i>B</i>
Exposure to community violence	4 (9)	2148	-.10* [-.16 – -.03]	13.23	4 PQ -	13.00 ^a (10 -17)	D
Socio-demographic factors							
Economic factors	2 (3)	2194	-.07** [-.11 – -.03]	0	2 PQ -	13.88 ^a (10 – 19)	D

Legend. NQ = Negative quality dimension (i.e., loneliness); PQ = positive quality dimension; PRQ = peer relationship quality; r = correlation coefficient; β = estimated correlation coefficient; A evidence type = **Bold**; B evidence type = *Italic*.

^a mean age/age range suggest fair translatability to the context of early adolescence. ⁱ numbers do not fully correspond to the total numbers of studies due to multiple measures used in some studies. The ratio PQ/NQ depicts general patterns in data, however all coefficients were adapted and analyzed as positive dimensions. ^e see Table 1 for detailed description of evidence types.

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

Hierarchical maps of main findings

As described in the methods section, salient findings were used to form the hierarchical maps of evidence and to facilitate the development of the integrated model in the mixed methods synthesis. The two maps were created based on the two clusters of potential determinants i.e. individual (Fig 4) and environmental (Fig 5) cluster.

Fig 4. Hierarchical map of individual factors. The variables were named to reflect the positive association with the high PRQ.

- - - qualitatively derived constructs; — quantitative evidence; **bold** – A/A⁽⁺⁾ evidence type; BLOCK CAPTALS – clusters and themes.

Fig 5. Hierarchical map of environmental factors. The variables were named to reflect the positive association with the high PRQ.

- - - qualitatively derived constructs; — quantitative evidence; **bold** – A/A⁽⁺⁾ evidence type; BLOCK CAPTALS – clusters and themes.

Discussion

This is the first review to systematically examine and quantify the existing evidence on potential determinants of SPR in early adolescents, where SPR are defined in terms of peer relationship quality. Following a comprehensive systematic literature review, data were analyzed in three stages, i.e., first, qualitative clustering of factors into meaningful and internally comparable groups of potential determinants, second, exploratory meta-analysis to inform on the relative strength of associations with peer relationship quality, and third, mixed methods synthesis where we apply established psychological theory to our findings to propose an integrated model of potential determinants of early adolescent SPR, which can serve as a foundation for future research.

Integrated Model of Supportive Peer Relationships

Our model (Fig 6) encompasses key individual and environmental factors, as determined based on the strength of the associations identified in our meta-analyses. Our main findings underscore individual factors related to identity and social-emotional skills as the most potent targets for future empirical research in the field. Next, we emphasize the significance of the school environment for peer interactions in this age group. Finally, we

identify an alarming gap in research on the influence of the virtual or online environment on SPR given its undeniable importance as a globally expanding social interaction setting. The model can serve as an organizational framework for integration of diverse findings on SPR, including those based on quantitative and qualitative data.

Fig 6. Integrated model of supportive peer relationships in early adolescence.

Black letters/rectangles – environmental planes; white letters/circles – self-building-blocks.

Identity and social-emotional skills – core self-building blocks; affect and wellbeing –

bridging self-building-block; behavior and health – peripheral self-building-block. Intensity of

shading/patterning indicates higher relevance of a block/plane for the SPR. Transparent colored circle represents a self-perceived circle of SPR as an intersection between the self and the peer environmental plane.

The model depicts individual factors as self-building-blocks, which interact with environmental factors represented as planes as part of an integrated system. Supportive peer relationships are constituted by continuous reciprocal interactions between the self and the peer environment and modified by continuous influences from the surrounding environmental planes (school, community and family; 31).

Self-building-blocks. Here, the self can be defined as a set of psychological processes that allow self-reflection, affect the nature of conscious experience, underlie all perceptions, beliefs, and feelings about oneself and allow deliberate regulation of one's own behavior (87). Hence, self-building-blocks are specific internal functions that constitute an individual's sense of self and agency within the environment. And the interaction between self-building blocks and environmental planes can be conscious and/or subconscious.

The self-building-blocks are only abstractions covering different aspects of an organism (self) that functions as an organized whole (31), so they cannot be fully represented in a linear fashion. However, for didactical reasons, we propose that the inner structure of the self originates from the core self-building-blocks (identity and social-emotional skills), which interact with an individual's affective response (i.e., bridging self-building-block) that further shapes the experience of the surrounding environment and the behavioral response (i.e., peripheral self-building-block). Hence, within the proposed inner structure the core self-building-blocks have a processing and regulatory function. The bridging self-building-block allows internal communication (defined as a means of sending and/or receiving information) between the core and peripheral block. Whereas, the peripheral self-building-block represents

the self, interacting with a specific environmental plane (e.g., interaction with a best friend in school context or with a younger sibling in family context) and as such has a communicative function between the self and the environment.

Our results show a constant moderate to strong association between PRQ and all aspects of identity, social-emotional skills set, general affect, wellbeing, internalizing and prosocial behaviors and provide initial evidence for the interdependence between the developmental pathways of self-building-blocks and SPR and for the reciprocal interactions between the self and the peer environment. This association is especially convincing for the core self-building-blocks. Yet, the specific functions of each self-building-block and dynamic interaction between them that results in a holistic response of the self are yet to be understood. Further, the mechanisms of the interaction between the self and the environmental planes and the intersecting role of SPR in these processes are still mainly unknown. These are all important avenues for future research.

Environmental planes. The concept of environmental planes is based on the alternative ‘networked’ adaption of the Bronfenbrenner’s ecological systems theory model by Neal & Neal (29) that views ecological systems as an overlapping arrangement of structures, each directly or indirectly connected to the others by the direct and indirect social interactions of their participants. We focus on the quality of these interactions (relationships), hence in our model, each environmental plane encompasses setting-specific interpersonal relationships, group dynamics, hierarchy and other sociopolitical factors (e.g., socio-economic status, culture etc.) that influence relationships in the current context. The planes are in constant reciprocal interactions with each other, with elements from other planes and with the self-building blocks via shared social ties. Additionally, environmental planes are influenced by the behavioral response of the self, yet this influence may vary from macroscopically

unnoticeable to extremely noticeable (20) depending on a context, type of interaction, number of interacting elements etc.

The salient associations between SPR and at least one variable related to the setting specific relationships (i.e., parental attachment, teacher relationship, relationships with significant others, peer group inclusion) in each of the environmental planes provides an initial evidence for the socially mediated interdependence and reciprocal interactions between the different environmental planes and their influence on SPR. The salient associations with context specific variables (e.g., school belonging; academic engagement etc.) indicates the significance of sociopolitical factors (e.g., influences of educational policies) within the planes. Yet, elaborated understanding of the interpersonal and sociopolitical factors that influence SPR in each environmental plane is missing and the interpersonally mediated mechanisms of environmental influences on SPR are still unknown. Future research should focus on further exploration of these processes.

A hypothetical example of supportive peer relationship in the school context. The following example illustrates how our framework can be used to integrate diverse factors to understand SPR in a certain environmental context. Early adolescents experience their friendships based on the holistic response of the self in a certain environmental context, where affective states, cognition and corresponding behaviors are defined by initial responses of core self-building-blocks. The core building-blocks themselves are shaped by previous and modified by current relational experiences with family members (family plane), peers (peer plane), and non-parental adults (community and school plane; 8, 88). Every model component is to a certain extent defined by these reciprocal relationships (20), as exemplified by the interaction between the self – e.g., with an empathic but no-nonsense identity – and a friend in the classroom environment. Here, in a direct interaction with a friend the self will display affective and behavioral relational patterns (e.g., variable shyness evidence type A) shaped by

previous relational experiences, which influence the self-interpreted quality of the current dyadic interaction (e.g., 89, 90). Thus, abruptness from the friend may reduce the perceived quality of the interaction if abruptness has been experienced previously in a negative interaction in the classroom (e.g., experienced victimization evidence type B). However, if the current interaction shows a new pattern, previously unknown to the self (e.g., friend apologizing for being abrupt and explaining it was driven by their own anxiety - connection oriented interpersonal goals - type B), that new pattern may be internalized in line with the self-identity (i.e., empathizing with friend's anxiety when they are abrupt - affective social cognition - type A; prosocial motivation and sympathy - type A) and – if reinforced – applied to other relationships or contexts. Alternatively, if it is insufficiently repeated in future interactions, it can be overwritten by a previously established pattern (i.e., abruptness indicates rudeness and is negative - rejection sensitivity - type A). Thus, the integrated self-building-block's response in repeated dyadic interactions may act as a self-reinforcing function with the aim to sustain the known or to establish a new relational pattern (90).

It is not possible to name all factors that determine the direction of the self-reinforcing response, yet we hypothesize an important role of the surrounding environmental planes (interpersonal and sociopolitical factors) in this process. The friendship dyad is a part of the larger peer environmental plane, which is here embedded in the school environmental plane. Hence, the friendship dyadic interaction is further shaped by the surrounding peer environment (e.g., peer group dynamics and hierarchy - peer related stress - type B) and by the school environment (e.g., positive attitudes towards school - type A). The less observable influence in the opposite direction (i.e., the influence of the dyad on the classroom environment) is also part of the system (20), yet we were unable to capture it based on available data. Finally, in addition to the described direct influences on the formation of the core-building blocks, family and community planes may directly influence the friendship

dyad and/or classroom environment (e.g., by providing resources for meaningful and fun interaction - positive parenting - type B; community connectedness - type B).

All described processes over time result in more or less stable routinely displayed interaction patterns (e.g., supporting each other, teasing, sharing secrets etc.) within the friendship dyad. They also determine the hierarchical positioning of each dyad member (e.g., inclusion - type A) and the dyad itself within the classroom system. However, alternative patterns and behaviors (e.g., social anxiety - type A) may emerge due to chronic exposure to adversity, acute extremely stressful experiences or in situations that resemble past traumatic experiences (e.g., family violence, bullying, a new environment during the school transition etc.; 91, 92, 93). The wholeness of all described relational interactions and corresponding responses of the self-building-blocks within the model constitute the “personal lens” through which the self experiences its social environment (94). This personal lens may be operationalized as social-emotional wellbeing (e.g., quality of life - type A). Hence, mechanisms of establishment and malleability of these relational patterns are critical for the long-term wellbeing.

Bellow, we offer empirically based speculations on significance of SPR for wellbeing in early adolescence and vice versa by discussing a role of each model component (i.e., self-building-block and environmental plane) supported by the evidence from our study and from the extant literature. The speculations and the hypothetical example are based on Magnusson’s functional interaction principles (i.e., reciprocity, interdependence and nonlinearity) and on the literature based assumption supported by our empirical evidence (happiness - type A⁺; perceived quality of life - type A) that the lack of SPR is inherently interlinked to low social-emotional wellbeing.

Identity as a core self-building-block

We place identity at the center of our model due to the strength of the associations demonstrated between SPR and identity-related variables. This is in line with previous research (4, 95, 96), which emphasizes the significance of identity for peer relationships and wellbeing. According to our findings, identity encompasses temperamental dispositions, self-concepts and relational dispositions, defined as relatively well-established trait-like functional, emotional and cognitive patterns, developed and reshaped through continuous reciprocal interaction between an individual and the environment (97).

Extant literature suggests that early experiences with caregivers are curial crucial for the development of general identity aspects (such as general self-concepts and temperament), whereas domain specific aspects such as self-efficacy are more influenced by “out of family” social relations (98). Again, this supports the reciprocal interactions we propose in our model between core blocks and environmental planes, which result in a self that is continually shaped and re-shaped by interactions with the environment.

Indeed, supporting the reciprocal nature of a core role of identity in SPR, such relationships might serve to attenuate developmental trajectories of some personality aspects (e.g., 99, 100). Low self-esteem (101), rejection sensitivity (102, 103) shyness and preference for solitude are found to be vulnerability factors for depression in youth and adults (104, 105). On the other hand, hope, optimism, sense of coherence and self-efficacy might be potent resilient factors in humans of all ages (e.g., 106, 107, 108). Hence, identity determines SPR and wellbeing, is simultaneously shaped by the same SPR, and this dynamism may lead to a change in wellbeing and potentially in some identity aspects over time.

Despite such an important role of identity in SPR and vice versa, the research on identity developmental trajectories in children and early adolescents is mainly focused on self-esteem and is fragmented and somewhat conflicting (98). Future research should focus on mapping potential key timings and key contexts in developmental trajectories especially of

under-researched protective traits (i.e., hope, optimism, sense of coherence, self-efficacy). Besides exploring the levels (i.e., high vs. low) of individual identity aspects, other dimensions such as fluctuations over time (98) and interrelatedness between them need to be addressed in order to move towards a comprehensive understanding of human identity and the interdependence between identity and interpersonal relationships (including SPR). Finally, a role of sociopolitical factors within environmental developmental contexts remains mainly unrecognized and hence the influence of such factors on the developmental pathways of human identity remains unknown.

Social-emotional skills as a core self-building-block

Social-emotional (adaptive) skills - defined as abilities that underpin successful self-regulation and establishment of positive and rewarding relationships with others are the second central component of our model. In fact, identity and adaptive skills can be understood as the two sides of the same coin (i.e., core self-building-blocks) that develop and act together in order to orchestrate the holistic response of the self in a certain environmental context (e.g., 109). They comprise multidimensional constructs of emotion regulation, social cognition, social skills and emotional intelligence that showed a consistent salient association with SPR in our analysis. Affective states underpin all aspects of cognition; hence, they are key factors for the sense of self (110) and for understanding and interpreting the environment (111). This association is reciprocal – the affective expression of an individual influences how others perceive them (112) and the core blocks are the main regulator in this process.

In line with the reciprocal interactions that shape shared developmental contexts we are proposing in our model, neuroscientific evidence has suggested the importance of the family (i.e., early experiences with caregiver; 113) and the social environment (i.e., peer group) in the period of early adolescence for the development of these adaptive skills (7, 8).

Yet, this is the first meta-analysis to provide evidence on the relevance of emotion regulation and social skills for SPR in typically developing youth. In previous work, a significant association between SPR and social cognition skills has been demonstrated in preschool and early school populations (2 – 10 years; 114). Yet, our findings suggest a stronger association in early adolescence, which further underscores the significance of this particular developmental stage.

The role of social-emotional skills in SPR highlighted here is consistent with a more general role of such skills for wellbeing, which has been previously linked to their self-regulatory function and impact on mental health outcomes (115-117). Hence, an important task for future research is to examine the associations between the core self-building-blocks (i.e., identity and skills), SPR, and general wellbeing (i.e., bridging and peripheral blocks) together thus we can begin to parcel out the role SPR have in allowing these aspects of self to promote wellbeing and specific mental health outcomes.

Co-rumination is an important constituent of the social-emotional skills set as conceptualized in our model. Given the widely demonstrated maladaptive role of rumination in the context of mental health outcomes (118), the importance of co-rumination (evidence type A) in SPR is particularly interesting due to its positive direction. Our results are consistent with a growing literature demonstrating the heterogeneity of rumination sub-constructs in terms of their roles in psychological wellbeing. For example, Burns and colleagues (119) demonstrate a more adaptive role of reflection than of brooding rumination sub-components in terms of mental health outcomes. Further, observational findings by Rose and colleagues (120) suggest that certain aspects of co-rumination (i.e., extensively talking, rehashing problems and mutual encouragement, which in other research are positively associated with each other; 121) are associated with positive friendship quality, whereas other aspects (i.e., dwelling on negative affect) do not show this association. Hence, the “positive”

aspects of co-rumination can create closeness through sharing, perception of a potential common goal, the prospect of successfully overcoming problems and the experience of mutual support. These findings contribute to a better understanding of early adolescents' social realm and have a therapeutic value, especially for peer support programs. However, the Rose and colleagues (120) also suggested links with depression (peripheral self-building-block) that again indicates the general need for integrated understanding of interactions between the different self-building-blocks, and SPR in different environmental contexts that would allow researchers to understand if/how the positive aspects of co-rumination can be harnessed as a meaningful resource for future interventions.

Affect and wellbeing as a bridging self-building-block

General affectivity (happiness, positive and negative affect) and general wellbeing (quality of life and perceived stress) are important constituents of our integrated model due to their strong association with SPR. Emotions (i.e., physical states arising from the body's responses to external stimuli) and feelings (i.e., mental experiences of bodily cues; 122) - are defined as momentary aspects of affective life. On the other hand, general affectivity is not tied to one specific circumstance, but to a collection of different inputs; hence, it is more stable and shows a certain tendency over time, dependent on numerous intrinsic (physiological and psychological) and extrinsic (interpersonal and sociopolitical) stimuli (123, 124). An individual sees themselves and the world through an "emotional lens" (125); hence, quality of life and perceived stress are directly dependent on physiological and cognitive capacity to recognize the impact of external influences and to regulate emotional response (i.e., social-emotional adaptive skills). This process represents the bridging function of the affect and wellbeing as a self-building-block that further dictates the response of the peripheral self-building-block.

A person's adaptive capacity is developed through early interactions with caregivers and relationships with significant others in schoolchildren (126). Adverse social experiences may hinder the development of adaptive skills (17, 127) or buffer the adverse impact of other environmental planes i.e., of the family (128, 129) and community plane (130).

Future research should examine the developmental pathways and relationships between both – trait and state like aspects of affect and wellbeing, along with their bio-physiological component to be able to understand the bridging role of this self-building-block. This is necessary for comprehensive understanding of individual functioning in SPR and other environmental contexts and could have a vast significance for the youth mental health.

Behavior and health as a peripheral self-building-block

The final category of self-building blocks comprises context specific external behavioral manifestations (clinical and nonclinical) of the self, expressed as a reaction to its interpretation of the environment i.e., peripheral block. In line with previous research (131, 132), we underline an association between SPR and internalizing spectrum behavior (i.e., depression, somatic symptoms, social anxiety and withdrawal). However, we find evidence of only a very small association (type C) between SPR and externalizing spectrum behavior (as a generally defined personal construct, distinct from the more specific and relational peer victimization, discussed below). Furthermore, self-disclosure and prosocial behavior are highly relevant non-clinical behaviors associated with PRQ.

Consistent with the internalizing behaviors as potential determinants of SPR and general interaction principles in our model, such behaviors in youth have been conceptualized as having an interpersonal etiology (26, 133). Further, in line with victimization as an important component of the peer environmental plane as discussed below, longitudinal results

stipulate a role of victimization in both short-lived and persistent internalizing symptoms (134, 135) linked to suicidal ideation and suicide attempts (136, 137). Conversely, SPR have a protective role in the relationship between the negative mental health outcomes of victimization and suicidal ideation (138). Hence, SPR may act as a protective factor against internalizing symptoms via the already discussed influence on core blocks (e.g., 139). Indeed, universal school-based interventions, which target social-emotional skills and peer support are found to be promising especially given their potential wide reach (140, 141).

Future research should commit to exploring the dynamism and interdependence between SPR and peripheral block together with the other self-building-blocks in order to gain more nuanced understanding of clinical and non-clinical behaviors and internalizing and externalizing behaviors. Understanding the mechanisms of environmental influences in these processes and the intersecting roles of the peer and school environments are another important task for researchers.

Peer environmental plane

Peer environment encompasses relationship(s) with at least one peer (i.e., individual related with the person based on any type of similarity with no power or responsibility differential). In our model, experienced inclusion is a key positive correlate of SPR, whilst victimization and peer related stress show the opposite effect. Our results demonstrate only a very small relationship (type C) between deviant behavior in peer group and SPR. However, this construct does not exclusively incorporate deviant behavior towards another peer, which is the case with victimization.

In line with interactions in our model, the negative consequences on long-term wellbeing of deviant behavior towards peers (i.e., bullying or peer aggression) have been well

documented (e.g., 134, 137). Importantly, such behavior is often rooted in parental prohibition of friendships and parental control (142) and appears to be resistant to targeted interventions (141, 143). This emphasizes the need to consider the links between SPR, conventional relationships (school, teacher and community) and the corresponding environmental contexts, due to their potential to balance peer influence, and to positively influence peer outcomes (4).

Thus, there is a need for a more nuanced examination of both the deviant behavior (that causes victimization) and its macro (sociopolitical) level, such as cultural norms, values, beliefs and related policies in order to understand how to buffer the detrimental impact of such behavior within family, school, and peer environmental planes. Furthermore, peer relationships need to be assessed with other conventional relationships in order to capture a comprehensive picture of the social realm and possible causes of externalizing tendencies.

School environmental plane

In line with previous research (144) the school surroundings is a key environmental plane for SPR in our model and for wellbeing in general. As discussed, school belonging and relationship with the teacher (conventional relationships) are protective (145), especially for children faced with adversity in the family (146, 147).

Consistent with socially mediated reciprocal interactions, school environment provides access to mental health services and opportunities for meaningful parental involvement (e.g., 146, 148). Further, individual perception of the school environment (i.e., positive attitudes towards school and academic engagement) may buffer against deviance in the peer group (149) and increase wellbeing (150) via its influence on conventional and unconventional relationships. Finally, the school environment provides one of the most feasible and efficient ways of fostering resilience in children and young people (141, 151,

152). Hence, instead of being on the margins of research agendas, school settings need to be recognized as a potent and cost-effective prevention setting by researchers and policy makers alike.

In terms of advancing research on the school environmental plane, it is important to note that school belonging measures include items on relationships with peers and/or teachers, hampering efforts to measure constituent constructs individually. Hence, future research should make efforts to understand the complementary roles these relationships have within the school environmental plane, advance knowledge on influences of specific sociopolitical factors (e.g., educational and social policies, cultural norms etc.) that shape the dynamics of these relationships, and propose validated and flexible ways of measuring these. Integration of qualitative stakeholder-lead models is crucial for achieving these goals.

Family environmental plane

Family influence weakens during early adolescence. Hence, the relatively peripheral position of the family plane in our model, along with the small percentage of salient results, is not surprising. However, as discussed above - parental attachment, support and positive parenting are crucial for the development of all self-building blocks (98, 133, 153-155) and may even have a direct influence on SPR. This is in line with principles of interdependence between the self as a whole and environment we propose in our model. Yet, the interactions between the different environmental planes are another important research avenue as well as the understanding of the sociopolitical factors that seem to be especially evident in family environment.

Interventional research has shown that different layers of prevention targeting different environmental planes may influence a child's social and emotional development: systemic

interventions focusing on sociopolitical justice and gender equality in schools and communities (e.g., 156, 157) as well as family interventions focusing on interparental relationship, parental mental health and parenting skills (e.g., 158, 159, 160). These are important indicators of the significance of the sociopolitical factors for the family environmental plane and the potential interpersonal mechanisms of influences on SPR and wellbeing that present potent targets for future research.

Community environmental plane

The community environment also yields large relationships with SPR in our model. This encompasses relationships with significant others and the community, which are a meaningful resource for youth (147, 161). Via these relationships, youths gain access to otherwise unavailable informal resources (e.g., social networks, experiences and knowledge - 161) and formal opportunities for meaningful engagement and participation (e.g., in youth organizations) that may increase a sense of personal value, hopefulness, and agency (162).

The notable strength of the association between SPR and quality of relationships with significant others (type A⁺) is consistent with the proposed key role of the core self-building-blocks for youth relationships and wellbeing, shared developmental pathways and the socially mediated environmental factors on SPR. This is especially important for children from socially disadvantaged families affected by poverty (163) or parental physical and mental illness (164), who might be in need for additional adult support and/or role models. Hence, examining interactions between the community and family plane (including interpersonal and sociopolitical factors) and their role in SPR and wellbeing might be of specific importance for socially disadvantaged early adolescents.

In order to recognize and address complex needs of these young people, researchers need to involve them directly in the research process. This may increase feasibility, youth-friendliness and ecological validity of work and improve the value and impact of the research results (165-167). Hence, we underline the necessity of the direct stakeholder involvement for in depth understanding of a role community environmental plane has in SPR and wellbeing and for the development of acceptable, effective and sustainable interventions.

Emerging virtual environmental plane

We found insufficient evidence to include the virtual environment in our model. The only salient finding was a negative association (type A) between PRQ and addictive technology use. However, we were unable to differentiate between usage types (i.e., social media, gaming and other online contents). The association with the quality of online communication was highly significant but very small (type C).

Indeed, use of social media and television in adolescents may enhance symptoms of depression, whereas the association with gaming is non-significant (168). Further, important models of online victimization stipulate a role of internalizing behaviors in increased cyber-victimization (169); linked to suicidal ideation (170). Yet, these effects can be explained by the upward social comparison hypothesis (171; i.e., people compare themselves with others who they believe are in a more favourable position, of which more are readily accessible in social media contexts) and the reinforcing spirals hypothesis (172, 173; i.e., people seek out and select information consistent with their cognitions).

On the other hand, virtual domains (especially instant messaging and social networking sites) can provide an important forum for building social connections in youth (174). They can increase the ability to initiate offline friendships (175) and social cognition

skills (176). Hence, the virtual environment has been linked to all youth's relationships (177), yet it remains unacknowledged as a formal dimension of multidimensional social relationship constructs. Further, little is known about the preventive potential of the online setting (178) and complex interventions stretching between the two settings to address on- and offline SPR are completely unaddressed, in spite of the demonstrated overlap between the two relational settings (179).

One of the main tasks for future research is to deepen the understanding of the virtual environmental plane as potential determinant of SPR and its interactions with the self-building-blocks and physical environmental planes. This may lead towards development of integrative research informed measures of peer relationships that incorporate virtual environment in a way meaningful for future research on SPR and youth mental health.

Strengths and Limitations

One of the main strengths of this review is the widely defined search terms and broad inclusion criteria that allowed us to identify a large number of studies and diverse groups of potential determinants. Due to the exclusion of dissertations and failure to identify other unpublished literature, our findings may be prone to a "non-publication bias" (180). However, we addressed this possibility by requesting missing correlations from authors and included secondary and exploratory endpoints that were not crucial for the publication. Furthermore, multiple sensitivity analyses confirmed consistently small to irrelevant publication bias pertinent to our findings. Inclusion of only papers published after 1999 may also introduce bias and result in missing factors or de/increased scores for some variables. However, we decided to focus on a time span with roughly comparable and consistent conditions for youth in order to develop a model pertinent today rather than a historical picture. For example, more than 20 years ago, the communication technologies such as instant messaging, email and

social media that transformed social worlds of adolescents (3, 181), would not have been a significant aspect of young people's lives and the global sociopolitical context (e.g., cultural, economic, political climate) also changed significantly during this period .

Another limitation is the presentation of gender-aggregated scores without taking into account gender differences that may introduce significant disparity between early adolescent boys and girls (182). Gender differences might be especially relevant when studying developmental trajectories of the self-building-blocks that need to be examined with respect to relevant sociopolitical context and pertinent gender roles (e.g., 183, 184, 185). Furthermore, we were unable to differentiate between dyadic and peer group relationships, which may influence our results given that the strength of association between certain variables can differ for these two contexts (e.g., 132, 186). Hence, studying dynamics between dyadic and peer group relationships is an important avenue for further research.

The relatively narrow age range in comparison to other similar meta-analyses (108, 132, 187) focusing on early adolescents is a strength of this review. It introduces consistency given the differences in peer relational patterns between early and older adolescent groups (132). We focused on the period between 8 and 14 years because it includes the major stages in the development of SPR during early adolescence, specifically primary school as a key setting in which early peer relationships are established and school transition, which imposes significant challenges for SPR (188, 189). However, due to the inconsistent definition of early adolescence in the extant literature, some studies with an applicable mean age of participants included wide age ranges, which contaminated our findings with data from outside our target age range. However, a minority (18.3%) of variables included in the meta-analyses had samples in which mean age exceeded 14 years.

We consider the use of self-reported measures of PRQ as a strength of the review given the subjective nature of the PRQ construct (177) and children's demonstrated ability to

reliably assess the status of their friendship (190). However, our model was developed primarily from literature relating to typically developing, Caucasian, majority populations in the Western world and therefore has a limited applicability, especially to different cultural contexts and to vulnerable or disadvantaged youth whose perspectives need to be understood in relation to pertinent developmental contexts. Hence, expanding understanding on cultural differences and specific needs of vulnerable young people is imperative for future research.

The employed statistical method also has a few limitations. The Fisher z transformation is mainly derived for Pearson correlation coefficients (55). Based on the data from the original studies, we were unable to distinguish between Pearson and Spearman coefficients. However, as the minimum sample size for the calculation of the correlation coefficients was 33 (the mean sample size was 504 with a standard deviation of 700), we apply the Fisher z transformation for both Spearman and Pearson correlations in an exploratory way. Further, the statistical heterogeneity (I^2) was consistently high for most variables. This is not surprising as we combined studies with cross-sectional and longitudinal design, different sample sizes, measurement instruments and wide age ranges in some studies. Yet, as the purpose of this meta-analysis is to generate hypotheses in an exploratory way and not to confirm one, the high heterogeneity values are not of concern for the interpretation of the results. Indeed, it is important to allow for heterogeneity through the use of random-effects models, especially when interested in parameter estimation rather than hypothesis testing (191).

Given that we included all eligible studies regardless of their methodological quality, which was poor in 95 % of papers, an unavoidable limitation of the present work is the poor quality of the included research. However, the inclusive nature of our review and large number of studies included help to counteract this limitation in the exploratory context of the present review aims. Finally, our findings are based on different numbers of studies - varying

from 2 to 71 per variable; hence future research should establish replicability for certain variables.

Conclusion and Future Vision

The present study is a first step towards an integrated framework for understanding the role of SPR in wellbeing in early adolescence. By synthesizing the last 20 years of research in the field, we provide evidence on the key role of SPR in early adolescence and its interrelatedness with all aspects (internal and external) of early adolescent's lives. We propose an evidence-based model of SPR that may serve as a framework for future harmonization of theoretical and interventional research efforts towards evidence based interventions. The model describes the central importance of identity in peer relationships, which interacts with individual factors including social-emotional skills, affective states, general perceptions of wellbeing and specific behaviors to form an organized self. All such self-building-blocks are further influenced by environmental planes, including peer, school, family and community environments to build an integrated system that functions as an organized whole. In the context of the exhaustive approach to collating evidence examining factors affecting peer relationships, we discuss the general (related to peer relationships aspects, gender, culture etc.) and specific (related to the identified model components) future research avenues that are necessary for refinement and validation of the proposed model for the purpose of overcoming the current fragmentation in the field. To achieve this ambitious goal we advocate use of adequate and validated measurement instruments, mixed – methods techniques, an integrative approach to designing quantitative studies, process models that allow understanding of complex mechanisms of interdependence, and when possible longitudinal designs. The scope of such an endeavor demands interdisciplinary expertise, direct stakeholder involvement in

the research process and the combination of top-down (empirical) and bottom –up (interventional) data. Ultimately, we hope that our approach will allow advancement towards evidence-based integrated ecological prevention programs that stretch across multiple environmental planes in a structured and coordinated manner to provide optimal sociopolitical climate that supports relevant interpersonal relationships (especially SPR) necessary for the holistic development of the resilient self.

Acknowledgments

The D.O.T. (Die Offene Tür - The Open Door) team of co-investigators - Adam Barnard (playwright and theatre director), João Dias (computer scientist), Marija Mitic (medical doctor & researcher), Beate Schrank (practicing & research psychiatrist) and Kate Woodcock (research psychologist) - grew during a sandpit event (Ideas Lab) organized by the Open Innovation Center of Ludwig Boltzmann Society and facilitated by Know Innovation. The team would like to thank these organizations for their role in its formation. D.O.T teamwork is jointly conceived and led by the co-investigators. The team sees this as a fully meaningful interdisciplinary collaboration.

The correspondence about our work should be directed to the D.O.T. team leaders:

adamacbarnard@gmail.com (AB); joao.dias@gaips.inesc-id.pt (JD); marija.mitic@kl.ac.at (MM); Beate.Schrank@kl.ac.at (BS); papers@katewoodcock.com (KW).

The authors would also like to acknowledge Tamara Diendorfer, Sylvia Dörfler, Gloria Mittmann, Sally Reynard, Irina Schmid, Verena Steiner-Hofbauer and Justyna Rauch for supporting screening, data extraction and risk of bias analyses.

References

1. Karcher MJ, Sass D. A multicultural assessment of adolescent connectedness: testing measurement invariance across gender and ethnicity. *J Couns Psychol.* 2010;57(3):274-89.
2. Nesi J, Choukas-Bradley S, Prinstein MJ. Transformation of Adolescent Peer Relations in the Social Media Context: Part 2-Application to Peer Group Processes and Future Directions for Research. *Clin Child Fam Psychol Rev.* 2018;21(3):295-319.
3. Nesi J, Choukas-Bradley S, Prinstein MJ. Transformation of Adolescent Peer Relations in the Social Media Context: Part 1-A Theoretical Framework and Application to Dyadic Peer Relationships. *Clin Child Fam Psychol Rev.* 2018;21(3):267-94.
4. Karcher MJ, Holcomb M, Zambrano E. Measuring adolescent connectedness: A guide for school-based assessment and program evaluation. in H L K Coleman & C Yeh (Eds) *Handbook of school counseling.* Mahwah, NY, US: Lawrence Erlbaum; 2008. p. 649-69.
5. Somerville LH. The Teenage Brain: Sensitivity to Social Evaluation. *Current Directions in Psychological Science.* 2013;22(2):121-7.
6. Barnes GM, Hoffman JH, Welte JW, Farrell MP, Dintcheff BA. Adolescents' time use: Effects on substance use, delinquency and sexual activity. *Journal of Youth and Adolescence.* 2007;36(5):697-710.
7. Lamblin M, Murawski C, Whittle S, Fornito A. Social connectedness, mental health and the adolescent brain. *Neuroscience and Biobehavioral Reviews.* 2017;80:57-68.
8. Wong NML, Yeung PPS, Lee TMC. A developmental social neuroscience model for understanding loneliness in adolescence. *Social Neuroscience.* 2018;13(1):94-103.
9. Harter S. *The construction of the self: A developmental perspective.* New York, NY, US: Guilford Press; 1999 1999.
10. Meeus W, Oosterwegel A, Vollebergh W. Parental and peer attachment and identity development in adolescence. *Journal of Adolescence.* 2002;25(1):93-106.

11. Laible D. Attachment with parents and peers in late adolescence: Links with emotional competence and social behavior. *Personality and Individual Differences* 2007.
12. Vandell DL, Hembree SE. Peer social status and friendship: Independent contributors to children's social and academic adjustment. *Merrill-Palmer Quarterly*. 1994;40(4):461-77.
13. Schwartz D, Gorman AH, Dodge KA, Pettit GS, Bates JE. Friendships with peers who are low or high in aggression as moderators of the link between peer victimization and declines in academic functioning. *Journal of Abnormal Child Psychology*. 2008;36(5):719-30.
14. Bond L, Butler H, Thomas L, Carlin J, Glover S, Bowes G, et al. Social and school connectedness in early secondary school as predictors of late teenage substance use, mental health, and academic outcomes. *Journal of Adolescent Health*. 2007;40(4):357.e9-18.
15. Kipping RR, Campbell RM, MacArthur GJ, Gunnell DJ, Hickman M. Multiple risk behaviour in adolescence. *Journal of Public Health*. 2012;34 Suppl 1:i1-2.
16. Wasserman G. A. KK, Tremblay R. E., Coie J. D. , Herrenkohl T. I., Loeber R., Petechuk D. Risk and Protective Factors of Child Delinquency - NCJRS. U.S. Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention 2003 2003/4.
17. Lereya ST, Copeland WE, Costello EJ, Wolke D. Adult mental health consequences of peer bullying and maltreatment in childhood: two cohorts in two countries. *Lancet Psychiatry*. 2015;2(6):524-31.
18. Gifford-Smith ME, Brownell CA. Childhood peer relationships: Social acceptance, friendships, and peer networks. *Journal of School Psychology*. 2003;41(4):235-84.
19. Flannery KM, Smith RL. Are Peer Status, Friendship Quality, and Friendship Stability Equivalent Markers of Social Competence? *Adolescent Research Review*. 2017;2(4):331-40.
20. Brown BB, Larson J. Peer relationships in adolescence. *Handbook of adolescent psychology: Contextual influences on adolescent development*, Vol 2, 3rd ed. 2009:74-103.

21. LaFontana KM, Cillessen AHN. Developmental Changes in the Priority of Perceived Status in Childhood and Adolescence. *Social Development*. 2010;19(1):130-47.
22. Sanderson JA, Siegal M. Loneliness and stable friendship in rejected and nonrejected preschoolers. *Journal of Applied Developmental Psychology*. 1995;16(4):555-67.
23. Korkiamäki R. Rethinking Loneliness—A Qualitative Study about Adolescents' Experiences of Being an Outsider in Peer Group. 2014.
24. Bowlby J. *Attachment and Loss*: New York: Basic Books; 1969 1969.
25. Sullivan HS. *The interpersonal theory of psychiatry*. London, UK: Routledge; 2013. Available from: <https://www.taylorfrancis.com/books/9781315014029>.
26. Epkins CC, Heckler DR. Integrating etiological models of social anxiety and depression in youth: evidence for a cumulative interpersonal risk model. *Clin Child Fam Psychol Rev*. 2011;14(4):329-76.
27. Zimmerman MA. Resiliency theory: a strengths-based approach to research and practice for adolescent health. *Health Education & Behavior*. 2013;40(4):381-3.
28. Bronfenbrenner U, Morris PA. The Bioecological Model of Human Development. In: Damon W, Lerner RM, editors. *Handbook of Child Psychology*. 3. Hoboken, NJ, USA: John Wiley & Sons, Inc.; 2007. p. 266.
29. Neal JW, Neal ZP. Nested or Networked? Future Directions for Ecological Systems Theory. *Soc Dev*. 2013;53.
30. Magnusson D. The holistic-interactionistic paradigm: Some directions for empirical developmental research. *European Psychologist*. 2001;6(3):153.
31. Magnusson DS, Håkan. The Person in Context: A Holistic-Interactionistic Approach. In: Damon W, Lerner RM, editors. *Handbook of Child Psychology*. 19. Hoboken, NJ, USA: John Wiley & Sons, Inc.; 2007. p. 35.
32. Stormshak EA. *Intervening in children's lives: An ecological, family-centered approach to mental health care*: American Psychological Association; 2009 2009.

33. Tolan P. Positive youth development interventions: Advancing evaluation theory and practice. *Appl Dev Sci.* 2016;20(3):147-9.
34. Ross KM, Tolan P. Social and emotional learning in adolescence: Testing the CASEL model in a normative sample. *J Early Adolesc.* 2018;38(8):1170-99.
35. Pfadenhauer LM, Gerhardus A, Mozygemba K, Lysdahl KB, Booth A, Hofmann B, et al. Making sense of complexity in context and implementation: the Context and Implementation of Complex Interventions (CICI) framework. *Implement Sci.* 2017;12(1):21.
36. Fletcher A, Jamal F, Moore G, Evans RE, Murphy S, Bonell C. Realist complex intervention science: Applying realist principles across all phases of the Medical Research Council framework for developing and evaluating complex interventions. *Evaluation.* 2016;22(3):286-303.
37. Arnold ME, Gagnon RJ. Illuminating the process of youth development: The mediating effect of thriving on youth development program outcomes. *Journal of Human Sciences and Extension.* 2019;7(3):24-51.
38. Arnold ME, Silliman B. From theory to practice: A critical review of positive youth development program frameworks. *J Youth Dev.* 2017.
39. Ciocanel O, Power K, Eriksen A, Gillings K. Effectiveness of Positive Youth Development Interventions: A Meta-Analysis of Randomized Controlled Trials. *J Youth Adolesc.* 2017;46(3):483-504.
40. Laursen B, Hartl AC. Understanding loneliness during adolescence: developmental changes that increase the risk of perceived social isolation. *Journal of Adolescence.* 2013;36(6):1261-8.
41. Li TMH, Wong PWC. Youth social withdrawal behavior (hikikomori): A systematic review of qualitative and quantitative studies. *The Australian and New Zealand Journal of Psychiatry.* 2015;49(7):595-609.

42. Meter DJ, Card NA. Stability of children's and adolescents' friendships: A meta-analytic review. Special Issue: Contexts, Causes, and Consequences New Directions in Peer Victimization Research. 2016;62(3):252-84.
43. Newsom D, Mallow J, Watson J, Miner A, Legg K, Theeke LA. Loneliness in school age children: An integrative review of quantitative studies. Psychology and Education: An Interdisciplinary Journal. 2013;50(3-4):32-41.
44. Pallini S, Baiocco R, Schneider BH, Madigan S, Atkinson L. Early child-parent attachment and peer relations: a meta-analysis of recent research. Journal of family psychology : JFP : journal of the Division of Family Psychology of the American Psychological Association (Division 43). 2014;28(1):118-23.
45. Dunn J. Children's friendships: The beginnings of intimacy. Children's friendships: The beginnings of intimacy. 2004.
46. Korkiamaki R. Support and Control among "Friends" and "Special Friends": Peer Groups' Social Resources as Emotional and Moral Performances amidst Teenagers. Children & Society. 2011;25(2):104-14.
47. Shiffman M, VanderLaan DP, Wood H, Hughes SK, Owen-Anderson A, Lumley MM, et al. Behavioral and emotional problems as a function of peer relationships in adolescents with gender dysphoria: A comparison with clinical and nonclinical controls. Psychology of Sexual Orientation and Gender Diversity. 2016;3(1):27-36.
48. Bos HMW, Sandfort TGM, de Bruyn EH, Hakvoort EM. Same-sex attraction, social relationships, psychosocial functioning, and school performance in early adolescence. Developmental psychology. 2008;44(1):59-68.
49. Sawyer SM, Azzopardi PS, Wickremarathne D, Patton GC. The age of adolescence. Lancet Child Adolesc Health. 2018;2(3):223-8.

50. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *International Journal of Surgery*. 2010;8(5):336-41.
51. Zeng X, Zhang Y, Kwong JSW, Zhang C, Li S, Sun F, et al. The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis, and clinical practice guideline: a systematic review. *Journal of Evidence-Based Medicine*. 2015;8(1):2-10.
52. Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *European Journal of Epidemiology*. 2010;25(9):603-5.
53. McHugh ML. Interrater reliability: the kappa statistic. *Biochemia Medica*. 2012;22(3):276-82.
54. Richards L. Handling qualitative data: a practical guide. London, UK: Sage Publications; 2005 2005.
55. Fisher RA. On the 'probable error' of a coefficient of correlation deduced from a small sample. *Metron*. 1921;1:1-32.
56. Viechtbauer W. Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software*. 2010;36(3):1-48.
57. Team RC. A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2012 2019 [updated 2019. Available from: <https://www.R-project.org>.
58. Cohen J. Statistical power analysis for the behavioral sciences: Routledge; 2013 2013.
59. Popay J, Roberts HM, Sowden A, Petticrew M, Arai L, Rodgers M, et al. Guidance on the conduct of narrative synthesis in sytematic reviews. 2006.
60. Mulrow C, Langhorne P, Grimshaw J. Integrating heterogeneous pieces of evidence in systematic reviews. *Ann Intern Med*. 1997;127(11):989-95.

61. Foster RL. Addressing epistemologic and practical issues in multimethod research: a procedure for conceptual triangulation. *ANS Adv Nurs Sci*. 1997;20(2):1-12.
62. Magnusson D. The person approach: concepts, measurement models, and research strategy. *New Directions for Child and Adolescent Development* 2003(101):3-23.
63. Bronfenbrenner U, Ceci SJ. Nature-nuture reconceptualized in developmental perspective: A bioecological model. *Psychological Review*. 1994;101(4):568-86.
64. Kühberger A, Fritz A, Scherndl T. Publication bias in psychology: a diagnosis based on the correlation between effect size and sample size. *PLoS One*. 2014;9(9):e105825.
65. DeVito NJ, Goldacre B. Catalogue of bias: publication bias. *BMJ Evid Based Med*. 2019;24(2):53-4.
66. Duval S, Tweedie R. Trim and fill: a simple funnel-plot--based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*. 2000;56(2):455-63.
67. Duval S, Tweedie R. A Nonparametric "Trim and Fill" Method of Accounting for Publication Bias in Meta-Analysis. *J Am Stat Assoc*. 2000;95(449):89-98.
68. Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. *Biometrics*. 1994;50(4):1088-101.
69. Fraser E, Pakenham KI. Resilience in children of parents with mental illness: relations between mental health literacy, social connectedness and coping, and both adjustment and caregiving. *Psychology, health & medicine*. 2009;14(5):573-84.
70. Festa CC, Ginsburg GS. Parental and peer predictors of social anxiety in youth. *Child Psychiatry & Human Development*. 2011;42(3):291-306.
71. Merritt DH, Snyder SM. Correlates of optimal behavior among child welfare-involved children: Perceived school peer connectedness, activity participation, social skills, and peer affiliation. *The American Journal of Orthopsychiatry*. 2015;85(5):483-94.

72. Thompson HM, Wojciak AS, Cooley ME. Self-esteem: A mediator between peer relationships and behaviors of adolescents in foster care. *Children and Youth Services Review*. 2016;66:109-16.
73. Goodearl AW, Salzinger S, Rosario M. The association between violence exposure and aggression and anxiety: The role of peer relationships in adaptation for middle school students. *The Journal of Early Adolescence*. 2014;34(3):311-38.
74. Salzinger S, Feldman RS, Rosario M, Ng-Mak DS. Role of parent and peer relationships and individual characteristics in middle school children's behavioral outcomes in the face of community violence. *Journal of Research on Adolescence*. 2011;21(2):395-407.
75. Lamis DA, Wilson CK, King NM, Kaslow NJ. Child Abuse, Social Support, and Social Functioning in African American Children. *Journal of Family Violence*. 2014;29(8):881-91.
76. Wentzel KR, Russell S, Baker S. Emotional support and expectations from parents, teachers, and peers predict adolescent competence at school. *Journal of Educational Psychology*. 2016;108(2):242-55.
77. Guay F, Denault A-S, Renaud S. School attachment and relatedness with parents, friends and teachers as predictors of students' intrinsic and identified regulation. *Contemporary Educational Psychology*. 2017;51:416-28.
78. Oldfield J, Humphrey N, Hebron J. The role of parental and peer attachment relationships and school connectedness in predicting adolescent mental health outcomes. *Child and Adolescent Mental Health*. 2016;21(1):21-9.
79. Tanigawa D, Furlong MJ, Felix ED, Sharkey JD. The Protective Role of Perceived Social Support Against the Manifestation of Depressive Symptoms in Peer Victims. *Journal of School Violence*. 2011;10(4):393-412.

80. Parker JG, Asher SR. Friendship and friendship quality in middle childhood: Links with peer group acceptance and feelings of loneliness and social dissatisfaction. *Developmental Psychology*. 1993;29(4):611-21.
81. Furman W, Buhrmester D. Children's perceptions of the personal relationships in their social networks. *Developmental Psychology*. 1985;21(6):1016-24.
82. Armsden GC, Greenberg MT. The inventory of parent and peer attachment: Individual differences and their relationship to psychological well-being in adolescence. *Journal of Youth and Adolescence*. 1987;16(5):427-54.
83. Asher SR, Hymel S, Renshaw PD. Loneliness in children. *Child Development*. 1984;55(4):1456-64.
84. Malecki CK, Demaray MK. Measuring perceived social support: Development of the child and adolescent social support scale (CASSS). *Psychology in the Schools*. 2002;39(1):1-18.
85. Hoza B, Bukowski WM, Beery S. Assessing peer network and dyadic loneliness. *Journal of Clinical Child Psychology*. 2000;29(1):119-28.
86. Russell DW. UCLA Loneliness Scale (Version 3): reliability, validity, and factor structure. *Journal of Personality Assessment*. 1996;66(1):20-40.
87. Leary MR, Tangney JP. *Handbook of Self and Identity, Second Edition*: Guilford Press; 2011 2011/12/21. 754 p.
88. Davidson RJ, McEwen BS. Social influences on neuroplasticity: stress and interventions to promote well-being. *Nat Neurosci*. 2012;15(5):689-95.
89. DiTommaso E, Brannen-McNulty C, Ross L, Burgess M. Attachment styles, social skills and loneliness in young adults. *Personality and Individual Differences*. 2003;35(2):303-12.
90. Erskine RG. *Relational patterns, therapeutic presence: Concepts and practice of integrative psychotherapy*: Routledge; 2018 2018.

91. Cook A, Spinazzola J, Ford J, Lanktree C, Blaustein M, Cloitre M, et al. Complex trauma in children and adolescents. *Psychiatr Ann.* 2017;35(5):390-8.
92. D'Andrea W, Ford J, Stolbach B, Spinazzola J, van der Kolk BA. Understanding interpersonal trauma in children: why we need a developmentally appropriate trauma diagnosis. *Am J Orthopsychiatry.* 2012;82(2):187-200.
93. Alisic E, Zalta AK, van Wesel F, Larsen SE, Hafstad GS, Hassanpour K, et al. Rates of post-traumatic stress disorder in trauma-exposed children and adolescents: meta-analysis. *Br J Psychiatry.* 2014;204:335-40.
94. Kestly TA. Presence and play: Why mindfulness matters. *International Journal of Play Therapy.* 2016;25(1):14-23.
95. Lee RM, Robbins SB. The relationship between social connectedness and anxiety, self-esteem, and social identity. *Journal of Counseling Psychology.* 1998;45(3):338-45.
96. Stets JE, Burke PJ. Identity Theory and Social Identity Theory. *Social Psychology Quarterly.* 2000;63(3):224-37.
97. Kunnen ES, Bosma HA. Fischer's Skill Theory Applied to Identity Development: A Response to Kroger. *Identity.* 2003;3(3):247-70.
98. Orth U, Robins RW. Development of self-esteem across the lifespan. D P McAdams, R L Shiner, & J L Tackett, *Handbook of personality development.* New York, NY, US: Guilford; 2019. p. 328-44.
99. Chen X, Fu R, Li D, Liu J. Developmental Trajectories of Shyness-Sensitivity from Middle Childhood to Early Adolescence in China: Contributions of Peer Preference and Mutual Friendship. *Journal of Abnormal Child Psychology.* 2019;47(7):1197-209.
100. Reitz AK, Zimmermann J, Hutteman R, Specht J, Neyer FJ. How peers make a difference: The role of peer groups and peer relationships in personality development. *European Journal of Personality.* 2014;28(3):279-88.

101. Sowislo JF, Orth U. Does low self-esteem predict depression and anxiety? A meta-analysis of longitudinal studies. *Psychological Bulletin*. 2013;139(1):213-40.
102. Romero-Canyas R, Downey G, Berenson K, Ayduk O, Kang NJ. Rejection sensitivity and the rejection--hostility link in romantic relationships. *Journal of Personality*. 2010;78(1):119-48.
103. Liu RT, Kraines MA, Massing-Schaffer M, Alloy LB. Rejection sensitivity and depression: mediation by stress generation. *Psychiatry*. 2014;77(1):86-97.
104. Gazelle H, Peter D, Karkavandi MA. Commentary: Bashful Boys and Coy Girls: A Review of Gender Differences in Childhood Shyness. *Sex Roles*. 2014;70(7):285-308.
105. Hay DF, Payne A, Chadwick A. Peer relations in childhood. *Journal of Child Psychology and Psychiatry*. 2004;45(1):84-108.
106. Alimujiang A, Wiensch A, Boss J, Fleischer NL, Mondul AM, McLean K, et al. Association Between Life Purpose and Mortality Among US Adults Older Than 50 Years. *JAMA Netw Open*. 2019;2(5):e194270.
107. Schiavon CC, Marchetti E, Gurgel LG, Busnello FM, Reppold CT. Optimism and Hope in Chronic Disease: A Systematic Review. *Frontiers in Psychology*. 2016;7:2022.
108. Gorrese A, Ruggieri R. Peer attachment and self-esteem: A meta-analytic review. *Personality and Individual Differences*. 2013;55(5):559-68.
109. Calkins SD, Fox NA. Self-regulatory processes in early personality development: a multilevel approach to the study of childhood social withdrawal and aggression. *Development and psychopathology*. 2002;14(3):477-98.
110. Gross JJ. *Handbook of Emotion Regulation*, Second Edition. New York, NY, US: Guilford Publications; 2013a 2013/12/17. 669 p.
111. Immordino-Yang MH. *Emotions, Learning, and the Brain: Exploring the Educational Implications of Affective Neuroscience (The Norton Series on the Social Neuroscience of*

Education): W. W. Norton & Company; 2015. Available from:

<https://play.google.com/store/books/details?id=M5PCgAAQBAJ>.

112. Kim N-G, Son H. How Facial Expressions of Emotion Affect Distance Perception.

Frontiers in Psychology. 2015;6:1825.

113. Shaver PR, Mikulincer M. Adult Attachment Strategies and the Regulation of

Emotion. In: Gross JJ, editor. Handbook of emotion regulation. 654. New York, NY, US: The

Guilford Press, xvii; 2007. p. 446-65.

114. Slaughter V, Imuta K, Peterson CC, Henry JD. Meta-Analysis of Theory of Mind and

Peer Popularity in the Preschool and Early School Years. Child Development.

2015;86(4):1159-74.

115. von Salisch M. Emotional competence and friendship involvement: Spiral effects in

adolescence. European Journal of Developmental Psychology 2018:1-16.

116. Kim P, Evans GW, Angstadt M, Ho SS, Sripada CS, Swain JE, et al. Effects of

childhood poverty and chronic stress on emotion regulatory brain function in adulthood.

Proceedings of the National Academy of Sciences of the United States of America.

2013;110(46):18442-7.

117. Germine L, Dunn EC, McLaughlin KA, Smoller JW. Childhood Adversity Is

Associated with Adult Theory of Mind and Social Affiliation, but Not Face Processing. PLoS

One. 2015;10(6):e0129612.

118. Flett GL, Nepon T, Hewitt PL. Perfectionism, Worry, and Rumination in Health and

Mental Health: A Review and a Conceptual Framework for a Cognitive Theory of

Perfectionism. In: Sirois FM, Molnar DS, editors. Perfectionism, Health, and Well-Being.

Cham, Switzerland: Springer International Publishing; 2016. p. 121-55.

119. Burns A, Irvine M, Woodcock K. Self-Focused Attention and Depressive Symptoms

in Adults with Autistic Spectrum Disorder (ASD). Journal of Autism and Developmental

Disorders. 2019;49(2):692-703.

120. Rose AJ, Schwartz-Mette RA, Glick GC, Smith RL, Luebke AM. An observational study of co-rumination in adolescent friendships. *Developmental Psychology*. 2014;50(9):2199-209.
121. Felton JW, Cole DA, Havewala M, Kurdziel G, Brown V. Talking Together, Thinking Alone: Relations among Co-Rumination, Peer Relationships, and Rumination. *Journal of Youth and Adolescence*. 2019;48(4):731-43.
122. Scherer KR, Moors A. The Emotion Process: Event Appraisal and Component Differentiation. *Annual Review of Psychology*. 2019;70:719-45.
123. Miller DN. Positive Affect. In: Goldstein S, Naglieri JA, editors. *Encyclopedia of Child Behavior and Development*. Boston, MA: Springer US; 2011. p. 1121-2.
124. Stringer DM. Negative Affect. In: Gellman MD, Turner JR, editors. *Encyclopedia of Behavioral Medicine*. New York, NY: Springer New York; 2013. p. 1303-4.
125. Kopsov I. A New Model of Subjective Well-Being. *The Open Psychology Journal*. 2019;12(1).
126. Gross JJ. Emotion regulation: taking stock and moving forward. *Emotion*. 2013b;13(3):359-65.
127. Beutel ME, Tibubos AN, Klein EM, Schmutzer G, Reiner I, Kocalevent R-D, et al. Childhood adversities and distress - The role of resilience in a representative sample. *PLoS One*. 2017;12(3):e0173826.
128. Parra LA, Bell TS, Benibgui M, Helm JL, Hastings PD. The buffering effect of peer support on the links between family rejection and psychosocial adjustment in LGB emerging adults. *Journal of Social and Personal Relationships* 2018;35(6):854-71.
129. Yeung W-JJ, Li H. Educational Resilience Among Asian Children in Challenging Family Environment. *Social Indicators Research*. 2019.
130. Pashang S, Khanlou N, Clarke J. *Today's Youth and Mental Health: Hope, Power, and Resilience*. New York, NY, US: Springer; 2018 2018/3/1. 436 p.

131. Maes M, Nelemans SA, Danneel S, Fernández-Castilla B, Van den Noortgate W, Goossens L, et al. Loneliness and social anxiety across childhood and adolescence: Multilevel meta-analyses of cross-sectional and longitudinal associations. *Developmental Psychology*. 2019.
132. Rueger SY, Malecki CK, Pyun Y, Aycok C, Coyle S. A meta-analytic review of the association between perceived social support and depression in childhood and adolescence. *Psychological Bulletin*. 2016;142(10):1017-67.
133. Madigan S, Atkinson L, Laurin K, Benoit D. Attachment and internalizing behavior in early childhood: a meta-analysis. *Developmental Psychology*. 2013;49(4):672-89.
134. Zwierzyńska K, Wolke D, Lereya TS. Peer victimization in childhood and internalizing problems in adolescence: a prospective longitudinal study. *Journal of Abnormal Child Psychology*. 2013;41(2):309-23.
135. Brendgen M, Poulin F. Continued Bullying Victimization from Childhood to Young Adulthood: a Longitudinal Study of Mediating and Protective Factors. *Journal of Abnormal Child Psychology*. 2018;46(1):27-39.
136. Hinduja S, Patchin JW. Connecting Adolescent Suicide to the Severity of Bullying and Cyberbullying. *Journal of School Violence*. 2019;18(3):333-46.
137. Brunstein Klomek A, Barzilay S, Apter A, Carli V, Hoven CW, Sarchiapone M, et al. Bi-directional longitudinal associations between different types of bullying victimization, suicide ideation/attempts, and depression among a large sample of European adolescents. *Journal of Child Psychology and Psychiatry*. 2019;60(2):209-15.
138. Jenkins LN, Fredrick SS, Wenger J. Peer victimization and social-emotional outcomes: The role of teacher and peer support. *Aggressive Behavior*. 2018;44(2):176-84.
139. Eisenberg N, Sadovsky A, Spinrad TL, Fabes RA, Losoya SH, Valiente C, et al. The relations of problem behavior status to children's negative emotionality, effortful control, and

impulsivity: concurrent relations and prediction of change. *Developmental Psychology*. 2005;41(1):193-211.

140. Caelear AL, Christensen H, Freeman A, Fenton K, Busby Grant J, van Spijker B, et al. A systematic review of psychosocial suicide prevention interventions for youth. *European Child & Adolescent Psychiatry*. 2016;25(5):467-82.

141. Bonell C, Allen E, Warren E, McGowan J, Bevilacqua L, Jamal F, et al. Effects of the Learning Together intervention on bullying and aggression in English secondary schools (INCLUSIVE): a cluster randomised controlled trial. *Lancet*. 2018;392(10163):2452-64.

142. Keijsers L, Branje S, Hawk ST, Schwartz SJ, Frijns T, Koot HM, et al. Forbidden friends as forbidden fruit: parental supervision of friendships, contact with deviant peers, and adolescent delinquency. *Child Development*. 2012;83(2):651-66.

143. Barnes TN, Smith SW, Miller MD. School-based cognitive-behavioral interventions in the treatment of aggression in the United States: A meta-analysis. *Aggression and Violent Behavior*. 2014;19(4):311-21.

144. Witherspoon D, Schotland M, Way N, Hughes D. Connecting the Dots: How Connectedness to Multiple Contexts Influences the Psychological and Academic Adjustment of Urban Youth. *Applied Developmental Science*. 2009;13(4):199-216.

145. Steiner RJ, Sheremenko G, Lesesne C, Dittus PJ, Sieving RE, Ethier KA. Adolescent Connectedness and Adult Health Outcomes. *Pediatrics*. 2019;144(1).

146. Nichols EB, Loper AB, Meyer JP. Promoting Educational Resiliency in Youth with Incarcerated Parents: The Impact of Parental Incarceration, School Characteristics, and Connectedness on School Outcomes. *Journal of Youth and Adolescence*. 2016;45(6):1090-109.

147. Foster CE, Horwitz A, Thomas A, Opperman K, Gipson P, Burnside A, et al. Connectedness to family, school, peers, and community in socially vulnerable adolescents. *Children and Youth Services Review*. 2017;81:321-31.

148. Barger MM, Kim EM, Kuncel NR, Pomerantz EM. The relation between parents' involvement in children's schooling and children's adjustment: A meta-analysis. *Psychological Bulletin*. 2019;145(9):855-90.
149. Honora D, Rolle A. A Discussion of the Incongruence Between Optimism and Academic Performance and Its Influence on School Violence. *Journal of School Violence*. 2002;1(1):67-81.
150. Pietarinen J, Soini T, Pyhältö K. Students' emotional and cognitive engagement as the determinants of well-being and achievement in school. *International Journal of Educational Research*. 2014;67:40-51.
151. Ungar M, Russell P, Connelly G. School-based interventions to enhance the resilience of students. *Journal of Educational and Developmental Psychology*. 2014;4(1):66.
152. Dray J, Bowman J, Campbell E, Freund M, Wolfenden L, Hodder RK, et al. Systematic Review of Universal Resilience-Focused Interventions Targeting Child and Adolescent Mental Health in the School Setting. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2017;56(10):813-24.
153. Groh AM, Roisman GI, van Ijzendoorn MH, Bakermans-Kranenburg MJ, Fearon RP. The significance of insecure and disorganized attachment for children's internalizing symptoms: A meta-analytic study. *Child Development*. 2012;83(2):591-610.
154. Hoeve M, Stams GJJM, van der Put CE, Dubas JS, van der Laan PH, Gerris JRM. A meta-analysis of attachment to parents and delinquency. *Journal of Abnormal Child Psychology*. 2012;40(5):771-85.
155. Groh AM, Fearon RP, Bakermans-Kranenburg MJ, van Ijzendoorn MH, Steele RD, Roisman GI. The significance of attachment security for children's social competence with peers: a meta-analytic study. *Attachment & Human Development*. 2014;16(2):103-36.

156. Murray J, Farrington DP, Sekol I. Children's antisocial behavior, mental health, drug use, and educational performance after parental incarceration: A systematic review and meta-analysis. *Psychological Bulletin*. 2012;138(2):175-210.
157. Repetti RL, Taylor SE, Seeman TE. Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin*. 2002;128(2):330-66.
158. de Graaf I, Speetjens P, Smit F, de Wolff M, Tavecchio L. Effectiveness of the Triple P Positive Parenting Program on behavioral problems in children: a meta-analysis. *Behavior Modification*. 2008.
159. Coatsworth JD, Pantin H, Szapocznik J. Familias Unidas: A Family-Centered Ecodevelopmental Intervention to Reduce Risk for Problem Behavior among Hispanic Adolescents. *Clinical Child and Family Psychology Review*. 2002;5(2):113-32.
160. Bakermans-Kranenburg MJ, van Ijzendoorn MH, Juffer F. Less is more: Meta-analyses of sensitivity and attachment interventions in early childhood. *Psychological Bulletin*. 2003;129(2):195-215.
161. Grossman JB, Bulle MJ. Review of what youth programs do to increase the connectedness of youth with adults. *Journal of Adolescent Health*. 2006;39(6):788-99.
162. McLaughlin MW. Community Counts: How Youth Organizations Matter for Youth Development. Public Education Network, Washington, DC.; 2000 2000.
163. Sieving RE, McRee A-L, McMorris BJ, Shlafer RJ, Gower AL, Kapa HM, et al. Youth-Adult Connectedness:: A Key Protective Factor for Adolescent Health. *American Journal of Preventive Medicine*. 2017;52(3 Suppl 3):S275-S8.
164. Bee P, Berzins K, Calam R, Prymachuk S, Abel KM. Defining Quality of Life in the Children of Parents with Severe Mental Illness: A Preliminary Stakeholder-Led Model. *PLoS One*. 2013;8(9):e73739.

165. Hawke LD, Relihan J, Miller J, McCann E, Rong J, Darnay K, et al. Engaging youth in research planning, design and execution: Practical recommendations for researchers. *Health Expectations*. 2018;21(6):944-9.
166. Dickson-Hoyle S, Kovacevic M, Cherbonnier M, Nicholas KA. Towards meaningful youth participation in science-policy processes: a case study of the Youth in Landscapes Initiative. *Elementa: Science of the Anthropocene*. 2018;13(6(1)).
167. Checkoway B, Richards-Schuster K. Youth Participation in Community Evaluation Research. *American Journal of Evaluation*. 2003;24(1):21-33.
168. Boers E, Afzali MH, Newton N, Conrod P. Association of Screen Time and Depression in Adolescence. *JAMA Pediatrics*. 2019.
169. Van Zalk N, Van Zalk M. Longitudinal Links Between Adolescent Social Anxiety and Depressive Symptoms: Testing the Mediational Effects of Cybervictimization. *Child Psychiatry & Human Development*. 2019;50(2):186-97.
170. Cénat JM, Smith K, Hébert M, Derivois D. Cybervictimization and suicidality among French undergraduate Students: A mediation model. *Journal of Affective Disorders*. 2019;249:90-5.
171. Festinger L. A Theory of Social Comparison Processes. *Human Relations*. 1954;7(2):117-40.
172. Slater MD. Reinforcing Spirals: The Mutual Influence of Media Selectivity and Media Effects and Their Impact on Individual Behavior and Social Identity. *Communication Theory*. 2007;17(3):281-303.
173. Slater MD. Reinforcing Spirals Model: Conceptualizing the Relationship Between Media Content Exposure and the Development and Maintenance of Attitudes. *Media Psychology*. 2015;18(3):370-95.

174. Bourgeois A, Bower J, Carroll A. Social Networking and the Social and Emotional Wellbeing of Adolescents in Australia. *Journal of Psychologists and Counsellors in Schools*. 2014;24(2):167-82.
175. Koutamanis M, Vossen HGM, Peter J, Valkenburg PM. Practice makes perfect: The longitudinal effect of adolescents' instant messaging on their ability to initiate offline friendships. *Computers in Human Behavior*. 2013;29(6):2265-72.
176. Vossen HGM, Valkenburg PM. Do social media foster or curtail adolescents' empathy? A longitudinal study. *Computers in Human Behavior*. 2016;63:118-24.
177. Carroll A, Bower JM, Muspratt S. The conceptualization and construction of the Self in a Social Context—Social Connectedness Scale: A multidimensional scale for high school students. *International Journal of Educational Research*. 2017;81:97-107.
178. Robinson J, Cox G, Bailey E, Hetrick S, Rodrigues M, Fisher S, et al. Social media and suicide prevention: a systematic review. *Early Intervention in Psychiatry*. 2016;10(2):103-21.
179. Reich SM, Subrahmanyam K, Espinoza G. Friending, IMing, and hanging out face-to-face: overlap in adolescents' online and offline social networks. *Developmental Psychology*. 2012;48(2):356-68.
180. Bassler D, Mueller KF, Briel M, Kleijnen J, Marusic A, Wager E, et al. Bias in dissemination of clinical research findings: structured OPEN framework of what, who and why, based on literature review and expert consensus. *BMJ Open*. 2016;6(1):e010024.
181. Grinter RE, Palen L. Instant messaging in teen life. *Proceedings of the 2002 ACM conference on Computer supported cooperative work*; 2002/11/16. New York, NY, USA: Association for Computing Machinery; 2002. p. 21-30.
182. Rose AJ, Rudolph KD. A review of sex differences in peer relationship processes: potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological bulletin*. 2006;132(1):98-131.

183. Doey L, Coplan RJ, Kingsbury M. Bashful Boys and Coy Girls: A Review of Gender Differences in Childhood Shyness. *Sex Roles*. 2014;70(7):255-66.
184. Lewis AJ, Sae-Koew JH, Toumbourou JW, Rowland B. Gender differences in trajectories of depressive symptoms across childhood and adolescence: A multi-group growth mixture model. *J Affect Disord*. 2020;260:463-72.
185. Lavoie L, Dupéré V, Dion E, Crosnoe R, Lacourse É, Archambault I. Gender Differences in Adolescents' Exposure to Stressful Life Events and Differential Links to Impaired School Functioning. *J Abnorm Child Psychol*. 2019;47(6):1053-64.
186. Narr RK, Allen JP, Tan JS, Loeb EL. Close Friendship Strength and Broader Peer Group Desirability as Differential Predictors of Adult Mental Health. *Child Development*. 2017.
187. Gorrese A. Peer Attachment and Youth Internalizing Problems: A Meta-Analysis. *Child Youth Care Forum*. 2016;45(2):177-204.
188. Waters S, Lester L, Cross D. How does support from peers compare with support from adults as students transition to secondary school? *Journal of Adolescent Health*. 2014;54(5):543-9.
189. Oriol X, Torres J, Miranda R, Bilbao M, Ortuzar H. Comparing family, friends and satisfaction with school experience as predictors of swb in children who have and have not made the transition to middle school in different countries. *Children and Youth Services Review*. 2017:No-Specified.
190. Berndt TJ, McCandless M. Methods for Investigating children's relationships with friends. K H Rubin, W M Bukowski, & B Laursen (Eds), *Handbook of peer interactions, relationships, and groups*. 46, pp. 63–81. New York, NY, US: Guilford Press; 2013.
191. Zeng D, Lin DY. On random-effects meta-analysis. *Biometrika*. 2015;102(2):281-94.

Supporting information

The online supplement is available at the Figshare repository [<https://doi.org/10.6084/m9.figshare.7988417.v4>] and it includes following items:

A. Supplemental tables

- S1 Table – Study characteristics
- S2 Table – Measures of peer relationships quality
- S3 Table – List of excluded studies with reasons

B. Supplemental figures

- S1 Fig – Geographic data
- S2 Fig – Histogram of estimated correlations coefficients
- S3 – 95 Fig – Forest plots for all variables
- S96 – 219 Fig – Publication bias funnel plots

C. Supplemental documents

- S1 Doc – Search strategy
- S2 Doc – Risk of bias (RoB) tools adaptation
- S3 Doc – List of included studies
- S4 Doc – PRISMA checklist (2009)
- SD5 – PRISMA flow diagram (2009)

D. Data set

- Meta-analysis data set