Application of Positive Psychology in Digital Interventions for Children, Adolescents and Young Adults: A Systematic Review and Meta-Analysis of Controlled Trials

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Abstract

Background: The rising prevalence of mental health issues in adolescents and young adults (AYA) has become an escalating public health issue, impacting approximately 10% to 20% of AYA on a global scale. Positive psychology interventions (PPIs) can act as powerful mental health promotion tools, offering an effective means to reach wide-ranging audiences that might otherwise be challenging to access.

Objective: We aimed to conduct a comprehensive synthesis of all randomized controlled trials (RCTs) involving AYA, encompassing both clinical and non-clinical populations, to comprehensively evaluate the effectiveness of digital PPIs within this age group, through a systematic review and meta-analysis.

Methods: After a literature search in 9 electronic databases uptil 12 January 2023, and grey literature uptil April 2023, we carried out a systematic review for 35 articles and a meta-analysis of 18 individual studies. PPIs included positive psychology online, digital or smartphone-based interventions in children, adolescents, and young adults with a mean age < 35 years. Outcomes of PPIs were defined as well-being and ill-being. We followed the PRISMA guidelines for studies selection and data extraction, and the CONSORT guidelines for the quality assessment of the studies. Standard mean differences (Hedge's g) were calculated as measures of effect sizes.

Results: PPIs included various components, such as online meditation and mindfulness (25.7%), positive psychology and self-compassion (28.6%), gratitude and acts of kindness (8.6%), optimism and positive emotion (14.3%), relationship satisfaction and acceptance (5.7%), purpose and well-being (14.3%). 74.4% of the included studies focused on ill-being outcomes. For well-being outcomes, meta-analytic results showed that PPIs augmented the feeling of purpose, gratitude, and hope, compassion, positive coping behaviors, body-image related outcomes, and positive mindset predisposition. For ill-being outcomes, PPIs reduced cognitive biases, negative emtoions and mood, and stress levels. To note, larger effect sizes were found when a waiting list control group was considered versus digital control group.

Conclusions: There's strong evidence that PPIs benefit AYA's well-being, from boosting positive feelings to reducing negative emotions. Digital platforms offer a unique way to address their mental health challenges. Future research should explore how how different PPIs increase well-being compared to other digital interventions.

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Abstract

Background

The rising prevalence of mental health issues in children, adolescents, and young adults has become an escalating public health issue, impacting approximately 10% to 20% of young people on a global scale. Positive psychology interventions (PPIs) can act as powerful mental health promotion tools, offering an effective means to reach wide-ranging audiences that might otherwise be challenging to access. That would enable prevention and widespread well-being promotion by enhancing self-efficacy and supporting the achievement of tangible objectives.

Objective

Our goal is to conduct a comprehensive synthesis of all randomized controlled trials (RCTs) and controlled trials (CTs) involving children, adolescents, and young adults, encompassing both clinical and non-clinical populations, to comprehensively evaluate the effectiveness of digital PPIs within this age group through a systematic review and meta-analysis.

Methods

After a literature search in 9 electronic databases until 12 January 2023, and grey literature until April 2023, we carried out a systematic review of 35 articles, of which 18 studies provided data for the meta-analysis. We included RCTs and CTs mainly based on online, digital, or smartphone-based interventions using a positive psychology framework as the main component. Studies included children, adolescents and young adults with a mean age < 35 years from both clinical and non-clinical populations. Outcomes of PPIs were classified into well-being (compassion, life satisfaction, optimism, happiness, resilience, emotion regulation and emotion awareness, hope, mindfulness,

purpose, quality of life, gratitude, empathy, forgiveness, motivation and kindness) and ill-being (depression, anxiety, stress, loneliness and burnout) indicators. PRISMA guidelines were used for the selection of studies and data extraction. Quality assessment was performed following the CONSORT guidelines. Standard mean differences (Hedge's *g*) were calculated as measures of effect sizes.

Results

For well-being outcomes, meta-analytic results showed that PPIs augmented the feeling of purpose, gratitude, and hope (Hedge's g=.555), compassion (Hedge's g=.447), positive coping behaviors (Hedge's g=.421), body-image related outcomes (Hedge's g= .238), and positive mindset predisposition (Hedge's g= .304). For ill-being outcomes, PPIs reduced cognitive biases (Hedge's g= -.637), negative emotions and mood (Hedge's g= -.369), and stress levels (Hedge's g=-.342). To note, larger effect sizes were found when a waiting list control group was considered *versus* digital control group. Funnel plot shows no publication bias. Meta-regression analyses showed that PPIs tended to show a larger effect size on well-being outcomes in studies including young adults, while no specific effect was found for ill-being outcomes.

Conclusions

Revised evidence suggests that PPIs benefit young people's well-being and mitigate ill-being symptoms. Digital platforms offer a unique way to address their mental health challenges, although without limitations. Future research should explore how they work and adapt to the needs of the young population and further examine age differences and what specific PPIs or combination of interventions is more beneficial with respect to other digital control groups.

Keywords: positive psychology; digital interventions; ill-being; well-being; systematic review; meta-analysis

Introduction

Mental health problems among children, adolescents and young adults are a growing public health concern, affecting 10% to 20% of young people worldwide [1]. According to World Mental Health Report 2022, 970 million people suffer from mental disorders, with 3-7% of mental disorders among <10 year olds, 13.5-14.7% among 10-19 years olds, and 14.1-14.9%% among 20-49 years old [2]. Globally, 1 in 7 (14%) 10-19 years old suffer from different mental health conditions and most of them remain untreated [3]. In addition, among three-quarters of adults, long-term mental health problems occurred before the age of 24 years [1]. According to the U.S. Surgeon General's Advisory Report, from 2009-2019, the proportion of high school students with persistent feelings of sadness or hopelessness increased by 40% [4]. In addition, the mental health conditions of young people faced unprecedented challenges during the COVID-19 pandemic, wherein depression and anxiety doubled [4], together with feelings of loneliness [5,6].

Considering the above statistics, enhancing youth well-being is today an urgent public health need and concern [7]. To date, the field of psychiatry and psychology have primarily addressed challenges in treating mental illness, focusing on therapy access and engagement [8], only after a symptomatology has occurred. However, there has been less attention on enhancing and protecting mental well-being [8,9], before the rising of issues. Interventions aiming at diminishing mental health problems by using the prevailing disease model of human functioning (i.e., ill-being model) largely ignore positive psychological assets like meaning, courage, compassion, and kindness that could not only relieve ill-being states but also prevent them [10]. Positive psychology aims to provide a more comprehensive scientific knowledge of the human experience, from positive to negative, and better integrate and complement the illness framework with concepts related to positive mental health and use them at-scale to solve public health issues [10].

Advocating for a more holistic approach to mental health promotion and expanding the field's focus to include strategies for improving mental well-being is today crucial to boost intervention

effectiveness, prevent mental illness and relapse, and broaden our understanding of how to support individuals in flourishing and improving their overall quality of life [9]. Tomé et al., conducted a systematic review on 13 studies, focusing on children and adolescents aged 0-18 years who had been a target audience for mental health and wellbeing promotion interventions and suggested that preventive school-based interventions can reduce the onset and progression of clinical disorders and promote good mental health [11]. Another systematic review and meta-analysis of 16 studies concluded that people with severe mental illness benefit from positive psychology interventions in terms of enhancing mental health [12]. Williams et al., proposed in their systematic review that that social interventions to increase positive emotions for people diagnosed with mental health disorders are suitable and effective adjuncts to mental health treatment [13].

Hence, in the current systematic review and meta-analysis, we aim to focus on digital interventions based on positive psychology as a promising option to promote well-being and prevent mental health issues in a population (children, adolescents, and young adults) that is not at a high risk of developing such issues.

Positive Psychology Framework

According to the American Psychological Association, positive psychology is defined as “a field of psychological theory and research that focuses on the psychological states (e.g., contentment, joy), individual traits or character strengths (e.g., intimacy, integrity, altruism, wisdom), and social institutions that enhance subjective well-being and make life most worth living” [14]. It is the scientific study of optimal functioning that identifies skills and strengths so that an individual or a community can thrive [15]. Positive psychology complements and extends the ill-being framework: Positive Psychology Interventions (PPIs) focus on the science of positive mental states and behavioral patterns to improve quality of life [16,17]. Positive psychology involves the promotion of well-being differentiated between hedonic well-being—focusing on happiness, pleasure attainment,

and pain avoidance—and eudaimonic well-being, related to meaning, self-realization, and full functioning of the person [18]. By doing so, positive psychology solves problems by identifying and leveraging individual and societal strengths [19]. Also, positive psychology enhances the importance of flourishing, a construct that encompasses positive emotions and relationships, engagement, meaning, and accomplishments directly or indirectly related to different dimensions of well-being, including psychological, emotional, social, and subjective [20].

Martin E.P. Seligman, the father of positive psychology, introduced five dimensions essential for well-being known as the PERMA model: Positive emotions, Engagement, Relationships, Meaning, and Accomplishment [21,22]. Positive emotions (e.g., joy, interest, contentment, and love) serve as markers of flourishing and optimal well-being [23]. Engagement is the extent of usage and a subjective experience characterized by interest, affect, and attention [24]. Positive relationships can be regarded as strong connections with family and friends, developing a sense of belonging [25]. Meaning is understood as coherence, purpose, and a sense of life's inherent value, making it worth living [26]. Accomplishment refers to achievement, mastery, and competence [27].

Positive Psychology Interventions

Based on positive psychology theories and empirical research, PPIs aim to ameliorate well-being and health outcomes by increasing positive feelings, healthier lifestyle behaviors, and better cognitive functioning [28]. PPIs promote positive well-being outcomes, especially in people dealing with stress, by fostering positive daily emotions, providing people with stress-free time, mindful attention and positive cognition, and strengthening social relationships based on the Positive Pathways to Health theoretical model [29–31]. This theoretical model posits that PPIs promote physical and psychological well-being for people dealing with stress by elevating positive emotions experienced in their daily lives [30]. PPIs rely on elements such as optimism, spirituality, hopefulness, happiness, gratitude, creativity, meaning, and purpose [32].

From a public health perspective, PPIs can serve as effective mental health promotion tools to reach large target audiences, which would be challenging to reach otherwise. PPIs can be used as preventive and easily accessible tools that can promote well-being at-scale by building self-efficacy and reinforcing the effects of meeting concrete goals [33]. Health promotion strategies can address complex mental health issues, treat pre-clinical and underdiagnosed cases, and prevent the recurrence of health problems to sustain health networks [34]. These strategies bolster public policies such as providing employment opportunities and anti-discriminatory laws, establishing supportive environments through interventions like parenting programs, strengthening community action through initiatives like media campaigns and research, and improving health services such as depression screening, all aimed at enhancing health and well-being [10].

Although mental health problems are a growing public health concern among youth, research on the impact of digital PPIs on this population remains limited. Prior reviews primarily addressed conventional interventions, such as in-person therapies within clinical settings and non-clinical settings [35–38]. However, considering the ongoing digitalization of healthcare, online resources and mental health applications have emerged as new avenues for young individuals to access healthcare services. Surprisingly, there is a notable absence of previous reviews exclusively focusing on digital PPIs for this demographic.

In previous reviews, individual meta-analyses for interventions were assessed for behavioral interventions [39] and Ecological Momentary Interventions - EMIs [40]. Other meta-analyses were performed for well-being components individually, e.g., optimism [41], anxiety [42,43], depression [44–48], well-being [46,47,49], employee/work-based well-being [50–52], happiness [49], and school-based well-being [53]. However, previous reviews/meta-analyses either excluded studies that did not mention outcome measure of well-being [54], had no restriction on age groups [47,55], included only adults [56,57] or clinical population (e.g., cardiovascular disease, psychiatric or somatic disorder, medical patients, schizophrenia, severe mental illness, chronic pain) [12,42,58–61].

Although these reviews provide in-depth analysis of the effects of PPIs, the effects of digital PPIs on children, adolescents and young adults have not been consistently summarized. Also, previous reviews mainly included traditional interventions (e.g., cognitive therapy or cognitive behavioral therapy (CT/CBT)), mindfulness CBT, face-to-face group therapies and meditation, college students, community members or clinical settings) [41,47,62], however with the digitalization process online resources and mental health apps are becoming the new way for youth to access to health services. Yet, no previous reviews focused only on digital PPIs. Finally, when it comes to included studies, few reviews/meta-analyses included design such as randomized controlled trials (RCTs) and/or controlled trials (CTs) [41,47,62].

Study Aim

To overcome the abovementioned limitations, our objective is to comprehensively synthesize all RCTs and CTs conducted with young population (i.e., children, adolescents, and young adults), encompassing both clinical and non-clinical populations, in order to assess the global effectiveness of digital PPIs on individuals in this age group holistically, without differentiation of prevention and treatment. In particular, we aim to carry out a systematic review and meta-analysis including both clinical and non-clinical population to determine the efficacy of digital PPIs by considering if digital PPIs maintain health (by improving wellbeing constructs of compassion, life satisfaction, optimism, happiness, hope, resilience etc or by reducing ill-being constructs of depression, anxiety, stress, loneliness, burnout etc) and if there is any difference with respect to other (digital) control conditions.

In this study, we will describe study characteristics, theoretical background of the PPIs, quality assessment of the studies, the diverse range of PPIs used by the studies, the well-being and ill-being outcomes of these PPIs and the meta-analytic results for the outcomes.

Methods

This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines [63]. The protocol was registered in the PROSPERO (registration no. CRD42023420092).

Study Sources and Searches

Nine electronic databases (Communication & Mass Media Complete, Psychology and Behavioral Sciences Collection, PsycINFO, CINAHL, ERIC: Education Resource Information Center, Medline Proquest, ProQuest Sociology, Web of Science (ISI Web of Knowledge), Medline PubMed) were searched up to 12 January 2023 (Table 1).

Online* OR internet* OR digital* OR smartphone* OR social media OR EMI* OR EMA* OR in-situ OR ecological momentary assess* OR ecological momentary intervention* OR ESM* OR experience sampling* OR ambulatory assess* OR trace data OR chatbot* OR artificial intelligence* OR AI*	positive psychology* OR positive psychotherapy* OR kindness* OR optimism* OR gratitude* OR happ* OR flourish* OR satisfaction* OR optimis* OR strength* OR forgiveness* OR positive relationship* OR savoring* OR altruism* OR gift* OR meaning* OR purpose* OR hedon* OR eudaimon* OR	Interven* OR treatment* OR therap* OR RCT* OR random* OR trial* OR control*

OR conversational agent* OR chatterbot* OR virtual agent*	compassion* OR hop*	

Table 1: Keywords used in the search string combined by the Boolean operator "AND".

All citations were imported into Zotero reference manager to automatically remove any duplicates. An additional hand search was carried out by scanning the references of relevant review articles identified along with all grey literature in Google Scholar until April 2023.

Study Selection

After duplicates were removed from the initial list of extracted publications, two authors independently completed title and abstract screening. For title and abstract screening, we included studies that were: (1) either RCTs or CTs, (2) the intervention was mainly based on positive psychology (e.g., gratitude, hope, optimism, etc.), as the main component (for interventions we included psychotherapies, therapy, interventions, mindfulness, training, exercise and similar) (3) including children, adolescents, and young adults with a mean age < 35 years. Although, mental health disorders and treatment vary among this diverse age range, aggregating mental health across this range is appropriate due to similarities in mental health challenges and responses to interventions observed across different developmental stages within this age range. The proportion of individuals with onset of any mental disorders before the ages of 14, 18, 25 were 34.6%, 48.4%, 62.5%, and peak age was 14.5 years [64]. Separation anxiety disorder, specific phobia, and social phobia have their mean onset before the age of 15 years, whereas agoraphobia, obsessive-compulsive disorder, posttraumatic stress disorder, panic disorder, and generalized anxiety disorder began, on average, between 21.1 and 34.9 years [65]. Mean age of <35 years is in line with the upper age limit of the early psychosis paradigm reporting on universal interventions or selective interventions [66–68]. Additionally, studies needed to include from (4) both clinical and non-clinical population, (5) and be carried out online, digital or through smartphone based. We excluded studies with face-to-face

interventions and psychotherapy only of any kind, including digital or online or smartphone based. We also excluded studies in which positive psychology was not the main focus of the intervention (e.g., when positive psychology was an additional component of a mindfulness-based intervention or cognitive behavioral therapy or other therapies). Also, we removed studies with no experimental design or control group and studies where the average age of the sample was higher than 35 years or the focus was on caregivers. We further excluded conference abstracts, theses, books, or book sections. We excluded studies that were not in English language. If at least one of the two authors decided to retain an article during the title/abstract screening process, we included it in the full-text screening. Discrepancies after full-text screening were solved through a consensus meeting with a third author.

Data Extraction

For each included study, we extracted information about the article (first author, year of publication, journal, and title), the study (country where the study was conducted, study design, sample size of experimental group, presence of control group, type of control group, sample size of control group, type of sampling, and attrition rates), characteristics of the sample (including clinical or general population with details, ethnicity, gender distribution, age). For intervention, we extracted information regarding the kind of positive intervention and its details, reference theory of the intervention, the type of activity/intervention, the setting of the intervention with details, duration of the intervention, number of follow-ups, and the time of the follow-ups, and data collection survey details. Outcomes included different ill- and well-being constructs. Finally, we collected information on intervention evaluation, statistical analyses, and results to be converted into effect sizes.

Quality Assessment

Two authors independently assessed the quality of the studies according to the CONSORT

guidelines [69] and a sum score was created, with a higher score indicating methodological quality. CONSORT guidelines are better suited for assessing the quality of study reporting for RCTs and CTs as recommended by Altman and Versluis et al [40,70]. As a form of quality assessment, we checked whether studies explicitly mentioned (i) title and abstract, (ii) introduction (including background and objectives), (iii) methods (including trial design, participants, interventions, outcomes, sample size, randomization-sequence generation, randomization-sequence allocation concealment, randomization-implementation, blinding, statistical methods), (iv) results (including participants flow diagram, participant flow, recruitment, baseline data, number analyzed, outcomes and estimations, ancillary analyses, and harms), and (v) discussion (including limitations, interpretations, generalizability, registration), and (vi) other information like funding and protocol. For each paper, we rated if each criterion of the quality assessment was 0= “absent”, 1= “completely met”. Then, we calculated a sum score of all criteria. The maximum score obtainable for each study was 34.

Data Synthesis and Analysis

We conducted the meta-analysis using “meta” [27] packages in R statistical software. A standardized mean difference (SMD) approach was used as a measure of effect size using the Hedges’ adjusted *g*, which is similar to Cohen's *d*, but it includes an adjustment for small sample bias [71]. All the analyses were implemented using the inverse-variance method with a Random Effects model, using the Hartung-Knapp-Sidik-Jonkman adjustment [55] to limit the effect of studies’ diversities. According to Cohen (2013), a final effect falling in the ranges of 0-0.2, 0.3-0.5, and 0.6-0.8 was interpreted, respectively, as small, moderate, and large [72]. Meta-analyses were run for well-being and ill-being outcomes separately, with additional specifications of the type of outcome. In particular, we further grouped well-being and ill-being outcomes in body image-related, cognitive bias/flexibility, compassion, coping, mindset predisposition, mood/affect/emotions, purpose/gratitude/hope, satisfaction/quality of life, stress, and three funny things/three good things. A

complete list of well- and ill- being outcomes categorized in each of the abovementioned dimensions is reported in Table 2.

Studies	Original Construct	Category	Outcome
Krifa et al (2022)	Absorption	Cognitive bias/flexibility	Well-being
	Emotion Regulation	Coping	Well-being
	Dedication	Mindset predisposition	Well-being
	Optimism	Mindset predisposition	Well-being
	Vigor	Mindset predisposition	Well-being
	Depression	Mood/Affect/Emotions	Ill-being
	Anxiety	Mood/Affect/Emotions	Ill-being
	Well-being	Mood/Affect/Emotions	Well-being
	Hope	Purpose/gratitude/hope	Well-being
	Stress	Stress	Ill-being
Drabu et al (2022)	Inclination to self-injury	Cognitive bias/flexibility	Ill-being
	Pain endurance	Cognitive bias/flexibility	Well-being
	Explicit self-criticism	Cognitive bias/flexibility	Ill-being
	Implicit affect towards self	Mindset predisposition	Well-being
Lennard et al (2021)	Fear of compassion from others	Cognitive bias/flexibility	Ill-being
	Fear of self-compassion	Cognitive bias/flexibility	Ill-being
	Psychological Flexibility	Cognitive bias/flexibility	Well-being
	Self-Compassion Action	Compassion	Well-being
	Self-Compassion Engagement	Compassion	Well-being
	Compassion from others Action	Compassion	Well-being
	Compassion from others Engagement	Compassion	Well-being
	Adjustment Anxiety	Mood/Affect/Emotions	Ill-being
	Adjustment Depression	Mood/Affect/Emotions	Ill-being
	Breastfeeding satisfaction Total	Satisfaction/Quality	Well-being
	Adjustment Stress	Stress	Ill-being
	Posttraumatic stress syndrome Total	Stress	Ill-being
Anderssson et al (2021)	Self-Compassion	Compassion	Well-being
	Emotion Awareness/ Alexithymia	Mood/Affect/Emotions	Ill-being
	Psychological Problems (CORE)	Mood/Affect/Emotions	Ill-being

	Perceived Stress	Stress	Ill-being
Beshai et al (2020)	Self-Compassion	Compassion	Well-being
	Dispositional Mindfulness	Mindset predisposition	Well-being
	Non-attachment	Mindset predisposition	Well-being
	State Mindfulness	Mindset predisposition	Well-being
	Anxiety	Mood/Affect/Emotions	Ill-being
	Depression	Mood/Affect/Emotions	Ill-being
	Stress	Stress	Ill-being
Kelman et al (2018)	Inadequate Self-Compassion	Cognitive bias/flexibility	Ill-being
	Self-Reassurance	Compassion	Well-being
	Affect	Mood/Affect/Emotions	Well-being
Kappen et al (2019)	Partner acceptance	Mindset predisposition	Well-being
	Relationship satisfaction	Satisfaction/Quality	Well-being
Koydemir et al (2016)	Emotional Well-being	Mood/Affect/Emotions	Well-being
	Happiness	Mood/Affect/Emotions	Well-being
	Psychological Quality of Life	Satisfaction/Quality	Well-being
	Social Quality of Life	Satisfaction/Quality	Well-being
	Satisfaction with Life	Satisfaction/Quality	Well-being
Sergeant and Mongrain (2014)	Maladaptive Belief	Cognitive bias/flexibility	Ill-being
	Engagement	Mindset predisposition	Well-being
	Depression	Mood/Affect/Emotions	Ill-being
	Meaning	Purpose/gratitude/hope	Well-being
	Pleasure	Satisfaction/Quality	Well-being
Lappalainen et al (2023)	Psychological Flexibility Behavior	Cognitive bias/flexibility	Well-being
	Psychological Flexibility Openness	Cognitive bias/flexibility	Well-being
	Psychological Flexibility Value	Cognitive bias/flexibility	Well-being
	Total Psychological Flexibility	Cognitive bias/flexibility	Well-being
	Self-Compassion	Compassion	Well-being
	Anxiety	Mood/Affect/Emotions	Ill-being
	Depression	Mood/Affect/Emotions	Ill-being
Webb et al (2022)	Body Image Flexibility	Body image related	Well-being
	Internal body shame	Body image related	Ill-being
	External body shame	Body image related	Ill-being
	Functional Body Appreciation	Body image related	Well-being
	Functional Body Awareness	Body image related	Well-being

	Functional Body Satisfaction	Body image related	Well-being
	Physical Activity Behavior	Body image related	Well-being
	Physical Activity Cognitive	Body image related	Well-being
	Body Appreciation	Body image related	Well-being
	Weight bias	Body image related	Ill-being
	Drive for leanness	Body image related	Ill-being
	Self-Compassion	Compassion	Well-being
Brouzos et al (2023)	Fear of COVID-19	Cognitive bias/flexibility	Ill-being
	Resilience	Coping	Well-being
	Empathic Concern	Mindset predisposition	Well-being
	Fantasy	Mindset predisposition	Well-being
	Perspective-Taking	Mindset predisposition	Well-being
	Emotional Loneliness	Mood/Affect/Emotions	Ill-being
	Positive Affect	Mood/Affect/Emotions	Well-being
	Negative Affect	Mood/Affect/Emotions	Ill-being
	Anxiety	Mood/Affect/Emotions	Ill-being
	Depression	Mood/Affect/Emotions	Ill-being
	Overall Loneliness	Mood/Affect/Emotions	Ill-being
	Social Loneliness	Mood/Affect/Emotions	Ill-being
	Personal Distress	Stress	Ill-being
Greer et al (2019)	Anxiety	Mood/Affect/Emotions	Ill-being
	Depression	Mood/Affect/Emotions	Ill-being
	Positive Emotion	Mood/Affect/Emotions	Ill-being
	Negative Emotion	Mood/Affect/Emotions	Well-being
Tagalidou et al (2019)	Subjective perceived change: Coping Humor	Coping	Well-being
	Cheerfulness: Coping Humor	Coping	Well-being
	Coping humor: Coping Humor	Coping	Well-being
	Depression: Coping Humor	Coping	Ill-being
	Bad mood: Coping Humor	Coping	Ill-being
	Happiness: Coping Humor	Coping	Well-being
	Seriousness: Coping Humor	Coping	Ill-being
	Seriousness: Three funny things	Three funny things/Three good things	Ill-being
	Seriousness: Three good things	Three funny things/Three good things	Ill-being
	Coping humor: Three funny things	Three funny things/Three good things	Well-being

	Coping humor: Three good things	Three funny things/Three good things	Well-being
	Subjective perceived change: Three funny things	Three funny things/Three good things	Well-being
	Subjective perceived change: Three good things	Three funny things/Three good things	Well-being
	Cheerfulness: Three funny things	Three funny things/Three good things	Well-being
	Cheerfulness: Three good things	Three funny things/Three good things	Well-being
	Depression: Three funny things	Three funny things/Three good things	Ill-being
	Depression: Three good things	Three funny things/Three good things	Ill-being
	Bad mood: Three funny things	Three funny things/Three good things	Ill-being
	Bad mood: Three good things	Three funny things/Three good things	Ill-being
	Happiness: Three funny things	Three funny things/Three good things	Well-being
	Happiness: Three good things	Three funny things/Three good things	Well-being
Bronk et al (2019)	Hope: Purpose	Purpose/gratitude/hope	Well-being
	Gratitude: Purpose	Purpose/gratitude/hope	Well-being
	Hope: Gratitude	Purpose/gratitude/hope	Well-being
	Gratitude: Gratitude	Purpose/gratitude/hope	Well-being
	Identified Purpose: Gratitude	Purpose/gratitude/hope	Well-being
	Identified Purpose: Purpose	Purpose/gratitude/hope	Well-being
	Prosocial Intentions: Gratitude	Purpose/gratitude/hope	Well-being
	Prosocial Intentions: Purpose	Purpose/gratitude/hope	Well-being
	Searching for Purpose: Gratitude	Purpose/gratitude/hope	Well-being
	Searching for Purpose: Purpose	Purpose/gratitude/hope	Well-being
Gu et al (2022)	Compassion Focused Theory: Self-Criticism	Cognitive bias/flexibility	Ill-being
	Compassion Focused Theory: Sensitivity to Others	Cognitive bias/flexibility	Ill-being
	Compassion Focused Theory: Shame	Cognitive bias/flexibility	Ill-being
	Rational Emotive	Cognitive bias/flexibility	Ill-being

	Behavior Therapy: Self-Criticism		
	Rational Emotive Behavior Therapy: Sensitivity to Others	Cognitive bias/flexibility	Well-being
	Rational Emotive Behavior Therapy: Shame	Cognitive bias/flexibility	Ill-being
	Rational Emotive Behavior Therapy: Tolerance of Uncomfortable Things	Cognitive bias/flexibility	Well-being
	Compassion Focused Theory: Tolerance of Uncomfortable Things	Cognitive bias/flexibility	Well-being
	Compassion Focused Theory: Compassion	Compassion	Well-being
	Compassion Focused Theory: Self-Compassion	Compassion	Well-being
	Rational Emotive Behavior Therapy: Compassion	Compassion	Well-being
	Rational Emotive Behavior Therapy: Self-Compassion	Compassion	Well-being
	Compassion Focused Theory: Kindness to Others	Mindset predisposition	Well-being
	Compassion Focused Theory: Kindness to Self	Mindset predisposition	Well-being
	Rational Emotive Behavior Therapy: Kindness to Others	Mindset predisposition	Well-being
	Rational Emotive Behavior Therapy: Kindness to Self	Mindset predisposition	Well-being
	Compassion Focused Theory: Anxiety	Mood/Affect/Emotions	Ill-being
	Compassion Focused Theory: Depression	Mood/Affect/Emotions	Ill-being
	Rational Emotive Behavior Therapy: Anxiety	Mood/Affect/Emotions	Ill-being
	Rational Emotive Behavior Therapy:	Mood/Affect/Emotions	Ill-being

	Depression		
Alexiou et al (2021)	Depersonalization	Cognitive bias/flexibility	Ill-being
	Personal Accomplishment	Mindset predisposition	Well-being
	Depression	Mood/Affect/Emotions	Ill-being
	Anxiety	Mood/Affect/Emotions	Ill-being
	Emotional Exhaustion	Mood/Affect/Emotions	Ill-being
	Positive Emotions	Mood/Affect/Emotions	Well-being
	Negative Emotions	Mood/Affect/Emotions	Ill-being
	Satisfaction with Life	Satisfaction/Quality	Well-being
	Stress	Stress	Ill-being
Manicavasagar et al (2014)	Depression	Mood/Affect/Emotions	Ill-being
	Anxiety	Mood/Affect/Emotions	Ill-being
	Well-being	Mood/Affect/Emotions	Well-being
	Stress	Stress	Ill-being

Table 2: Wellbeing vs Illbeing Outcomes for Meta-analysis

The heterogeneity of the effect size was computed with the between-study-variance τ^2, and the Hartung-Knapp-Sidik-Jonkman adjustment, which allows to control for errors due to diversities in the sample sizes [73]. Heterogeneity level was interpreted as low (25%), moderate (50%), and high (75%), according to Higgins, et al, 2003 [74]. Potential publication biases were assessed by both Funnel Plots and Egger's regression test for funnel plot asymmetry [75,76]. Additionally, influence analyses were carried out to test if a single study accounted for a significant part of the variance in the final effect. Additional subgroup analyses were carried out to test if the effect size differed depending on the control group (waiting list vs digital control) when possible ($k \geq 2$ in each subgroup). To further explore the effect of age, meta-regression analyses were carried out by different age categories (i.e., children, adolescents, and young adults, or a combination of these categories). In contrast to what we anticipated in our study protocol registered in PROSPERO, we could not run sub-group analyses to differentiate the effect of specific interventions due to the paucity of studies using the same PPIs.

Results

The study selection process is reported in the PRISMA flow chart (Figure 1). The initial database and hand search returned 1344 publications, of which 729 were duplicates which were removed. After title and abstract screening of 615 records, we assessed 120 full-text articles for eligibility. We then excluded 85 articles, resulting in a qualitative assessment of 35 articles and a meta-analysis of 18 studies. The reasons of exclusion include: out of age range or the age was not explicitly mentioned (n=51), positive psychology was not the main focus of the intervention (n=7), the CBT was internet-based (n=3), the intervention were not online (n=2), the trials were either not RCT (n=11) and CT (n=1), the intervention was hybrid (n=1), repetitions (n=5), the research was still ongoing (n=4). Cohen's kappa was calculated as a measure on inter-coder reliability, and it was excellent (kappa=.95).

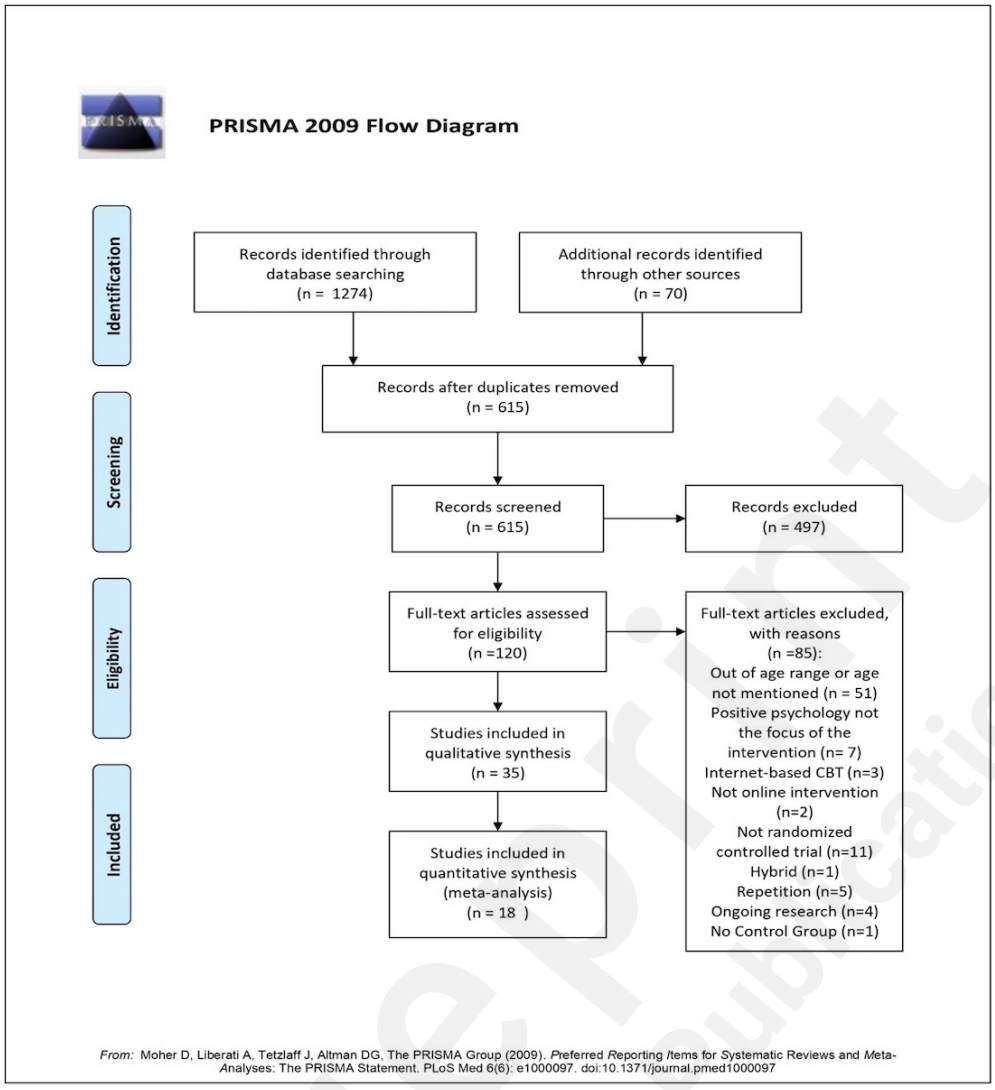

Figure 1: PRISMA flow chart of included studies in systematic review and meta-analysis.

Study Characteristics

The systematic review is based on 35 studies (Multimedia Appendix 1). Overall, the analytical sample amounts to 7,341 participants, of which 19 studies (54.2%) mentioned young adults aged 20-35 years of age, eight studies (23%) were focused on children and adolescents up to 20 years of age, three studies (9%) mentioned children, adolescents, and young adults up to 35 years of age. Three studies (9%) mentioned young adults and adult participants. One study (3%) mentioned children, adolescents, and adults, while one study (3%) mentioned all age groups, i.e., children, adolescents, and young adults, and adults. Gender distribution for males and females has been

mentioned separately in 28 studies, while 7 studies only mentioned the percentage of female participants [77–83]. Twenty-seven studies (77%) mentioned the ethnicity of the participants.

Thirteen (37%) studies were conducted in Europe (Sweden, Slovakia, London, Netherlands, Norway, Turkey, Finland, Germany, Greece, Spain, and Austria), 11 (31%) studies were conducted in North America (both USA and Canada combined), seven (20%) in Asia (Turkey, Singapore, India, China, Japan, South Korea), three (9%) in Australia, and one (3%) in Africa (Tunisia). The duration of the interventions varied from 1 week to a maximum of 12 weeks. Of all studies, 23 studies (66%) had follow-up assessments. In particular, 19 studies (54.3%) had one follow-up, two studies (6%) had two follow-ups and two (6%) had three follow-ups (Table 5). The duration of follow-ups ranged from 2 weeks to 12 weeks. The range of the interventions was 11 weeks (from 1 week to 12 weeks), while the median duration was 12 weeks.

Data from the participants were collected through online surveys and questionnaires as well as in-person data collection. Twenty-six studies (74.3%) used convenience sampling techniques and seven studies (20%) used purposive sampling procedures. In one study (3%), experience sampling was used, while in one study (3%) the details of sampling were not clearly mentioned; 29 studies (83%) conducted the trial on the general population (non-clinical), while six studies (17.1%) conducted the trial on clinical population (engaged in non-suicidal self-injury, scored high on scales of depression, anxiety and stress, mental disorder or psychological stress, autism spectrum disorder, active cancer treatment). Twenty-eight studies (80%) conducted the intervention in an online setting or internet- or web-based settings. Four studies (11.4%) conducted the intervention through smartphone-based applications or SMS. One study (3%) used a hybrid setting, and another one conducted the intervention in a telehealth setting [84,85]. Interestingly, one study (3%) conducted the intervention through Instagram and one study (3%) used the Vivibot chatbot [86,87] (Table 3).

Theoretical Background

The Broaden and Build theory was the widely used theory in five studies (14.3%) [82,87–90]. The Broaden-and-Build theory of positive emotion states that certain discrete positive emotions e.g., joy, contentment, pride, and love, share the ability to broaden momentary thought-action repertoires of people and build their enduring personal resources, ranging from physical and intellectual resources to social and psychological resources [91]. Other studies frequently mentioned in the articles included acceptance and commitment theory [78] (oriented towards development of psychological flexibility), affect theory [92] (emotions generating weak or strong ties to relations), attachment theory [84,92,93] (individuals born with innate behaviors function to attract proximity to attachment figures), Eisenberg's theory of parent emotion socialization [94] (parents' emotion socialization behaviors driving children's emotion socialization), emotion-focused therapy theory [95] (integrating person-focused care with modern emotion theory), motivational theory of life-span development (Heckausen's theory) [80] (role of individual in life-span development), Bandura's self-efficacy theory [96] (belief that one can execute needed steps to achieve a goal), social mentality theory [84,93] (both care-seeking and caregiving mentalities are activated when one is being self-compassionate/reassuring), embodiment theory [77] (psychological processes influenced by body), self-determination theory [89] (internalizing regulation and self-regulation), theory of mindfulness [97] (being actively engaged is beneficial for a rigid and judgmental mindset), Festinger's social comparison theory [86] (based on social comparison), stress and coping theory [87] (coping with stressful situations) and humor theory [98] (cognitive view of humor).

Quality Assessment

Among all 35 articles, the summary score of the quality assessment ranged from 12 [99] to 29 [86,100], with a median of 22.5 points. Among all criteria, most of the papers (n=31; 89%) did not report all important harms or unintended effects in each group and protocol of the full trial. Blinding

was either not performed or was not explicitly reported by 86% (n=30) of the studies. Also, the majority of the papers (n=26; 74%) lacked more detailed information about any changes to trial outcomes after the trial started with reasons, and 24 studies (69%) lacked information regarding the mechanism used to implement the random allocation sequence (such as sequentially numbered containers) describing any steps taken to conceal the sequence until interventions were assigned, 23 studies (66%) did not report explanation of any interim analyses and stopping guidelines, and 22 studies (63%) did not mention essential changes to methods after trial commencement (such as eligibility criteria) with reasons. Finally, 21 studies (60%) did not calculate both absolute and relative effect sizes for binary outcomes. A detailed description of each study evaluation is reported in Multimedia Appendix 2.

Positive Psychology Interventions (PPI's)

A diverse range of PPIs were conducted among the study participants (Table 3).

Study	Reference Theory	Intervention (Main Focus)	Intervention (Type of Activity)	Setting
Mahalik et al (2022)	N/A	Increase fathers' sense of purpose	On the Fatherhood Project's webpage, participants are presented with an opportunity for reflection and self-discovery. They were first asked to engage with "10 Facts about Father Engagement" and then encouraged to express their thoughts on father involvement without constraints on length or a right/wrong framework. The second part of this psychoeducation exercise seek to deepen fathers' understanding of the impact they can have on their children's lives. By prompting fathers to consider their long-term goals and aspirations for their children, recent positive experiences, core values, character strengths, and areas for skill development, the exercise fostered introspection to encouraged fathers to explore the purpose of their roles in their children's lives, emphasizing the multifaceted nature of fatherhood.	Online/ Webpage.
Krifa et al (2022)	N/A	Assess the efficacy of an internet-based positive psychology program in improving mental health, including stress, anxiety, and depression, as well as overall well-being, among Tunisian university students during the COVID-19 pandemic, with the aim of bolstering the mental health of this at-risk group.	The CARE (Coherence, Attention, Relationship, and Engagement) multi-component positive psychology self-help program was structured around three key processes aimed at enhancing well-being. These processes included the redirection of focus toward the positive and fulfilling aspects of life, fostering compassion and self-compassion, and engaging in meaningful actions. Expert videos were included to provide insights and perspectives, enhancing the educational aspect. Psychoeducation helped participants understand the psychological principles underpinning the practices. The core of the program lied in positive psychology exercises and one to two weekly activities assigned to the students. The entire program was eight sessions, with each session requiring about 45 minutes of commitment per week to complete the online activities. These sessions consisted of a blend of expert insights and hands-on exercises. Importantly, if participants hadn't visited the program's website on their own initiative, they were prompted with email reminders to encourage them to log in and engage with the activities throughout the week.	Online

Drabu et al (2022)	N/A	Effectiveness of a concise online self-compassion training program in reducing both overt and underlying self-criticism, enhancing pain tolerance, and decreasing the tendency to participate in self-harming behaviors among individuals who engage in or contemplate non-suicidal self-injury (NSSI).	In the training group, participants were initially provided with a concise introduction to the mindful self-compassion practice. Following this, they engaged in a single self-compassion-based guided meditation session known as "Loving Kindness for Ourselves," which is part of the Mindful Self-Compassion (MSC) program. This guided meditation session had a duration of 20 minutes. Subsequently, participants were instructed to spend the next 5 minutes crafting a self-compassionate letter to themselves. All participants underwent a distress protocol, and their next lab session was scheduled for one week later, where they completed the T2 measurements. The first lab session spanned 90 minutes, while the second session lasted for 20 minutes. During the interim between the two training sessions, the training group received daily email links that included audio-guided meditations for them to follow, accompanied by the task of writing a daily self-compassionate letter. These emails also solicited feedback and experiences related to their daily practice. In the initial lab session, participants experienced the same guided meditation on the 2nd and 3rd days as they did during the lab session. For the 4th and 5th days, they received the Compassionate Body Scan meditation. Finally, on the 6th and 7th days, they were provided with the Affectionate Breathing meditation.	Online
Lennard et al (2021)	Acceptance and commitment theory	Assess the efficacy of online materials aimed at enhancing self-compassion in mothers with infants (< 2 years).	The intervention provided online self-compassion resources, including two instructional videos and a downloadable tip-sheet. The first video offered psychoeducation on self-compassion in the context of motherhood, while the second video featured a guided self-compassion visualization exercise. The tip-sheet contained practical strategies for nurturing self-compassion, such as empathizing with others, being receptive to giving and receiving compassion, envisioning support from a compassionate person, recognizing shared experiences, and scheduling self-kindness activities. Participants in the intervention group had unrestricted access to these materials during	Online/ SMS/ Videos

			the study, with seven weekly SMS reminders to encourage their utilization, thereby supporting mothers in enhancing self-compassion.	
Andersson (2021)	Affect theory, Attachment theory	Assess the impact of a smartphone app featuring a compassion-focused psychological program on self-compassion, stress levels, emotional awareness, and overall distress in stressed university students.	The Compassion Mindset Intervention is a comprehensive program designed to cultivate compassion, emotional awareness, emotion regulation, and resilience to stress. It was six weekly modules, each focused on a specific theme: (1) understanding compassion, (2) Gilbert's three-circle model for emotion regulation, (3) self-compassion, (4) nurturing a compassionate mindset, (5) extending compassion to others, and (6) practicing gratitude and wisdom. Each module comprises five core elements: theoretical insights, guided meditations, reflective exercises, breathing practices, and practical exercises that promote the integration of a compassionate approach into daily life. Participants were encouraged to allocate 10-15 minutes per day to the program over six weeks. The Mindfulness App program, on the other hand, consisted of a 7-day introduction to mindfulness, followed by a self-guided practice spanning five weeks with the aid of six guided meditations, breathing exercises, and body scans. Additionally, participants were offered 15 supplementary exercises for added variety. The mindfulness training was self-administered, and participants were encouraged to invest 10-15 minutes daily for a total of six weeks in this practice. These programs aimed to enhance the participants' well-being and emotional resilience through structured and accessible training modules.	Smartphone-based (App)
Beshai (2020)	N/A	Evaluated the effectiveness of a new program, Mind-OP, combining mindfulness and self-compassion approaches.	Each weekly module comprised of psychoeducational videos introducing new concepts, followed by audio guided meditations aimed at instilling these concepts. Each module included a scheduler for setting meditation schedules, as well as motivational interviewing exercises to boost commitment to the practice. Week 1 included two 5-minute videos and one 5-minute guided meditation. Week 2 centered on mindfulness of body and thoughts, incorporating video and audio components. Week 3 involved two videos and two guided meditations. In Week	Internet-based

			4, one video discussed self-kindness and self-pity, and another addressed self-kindness in the context of stress.	
Chilver and Gatt (2022)	N/A	Implement online Multi-component Positive Psychological Intervention (MPPI) within a university sample. Examined whether the initial levels of resiliency, denoting the support systems accessible to participants, would influence the intervention's impact.	The intervention comprised three modules, each spanning two weeks with distinct activities. Firstly, the self-compassion module guided participants to reflect on past experiences causing self-doubt, fostering self-compassion by writing a compassionate letter to themselves. Secondly, participants brainstormed and performed acts of kindness for others. Thirdly, they recalled significant life events, conveying them as if to a friend. In the control group, the self-esteem module focused on finding positivity in negative situations. The acts of novelty module encouraged changes in routine. The neutral reminiscence module used prompts related to personal strengths and emotional moments rather than overcoming challenges.	Online
Hussong et al (2020)	Eisenberg's theory of parent emotion socialization	Assess the effects of the Gratitude Conversations program on intended mediators (parental intentions, confidence, and knowledge), as well as specific outcomes (utilization of gratitude strategies, parenting behaviors, and children's gratitude experiences).	The Gratitude Conversations program served as an online parenting training tool rooted in cognitive-behavioral change principles. It encompassed multiple components within a 45-minute framework, designed to engage participating parents effectively. The program commenced with psychoeducation, emphasizing the significance of gratitude, its core elements, challenges children face in expressing gratitude, and the CARE and SHARE strategies for parent-adolescent communication. Moreover, the program featured videos of three parent-youth dyads, illustrating both poor and exemplary gratitude conversations and missed opportunities. After viewing, parents engaged in reflection, identifying aspects they found favorable or unfavorable within these conversations. The dyads' interactions were critiqued with respect to the application of CARE and SHARE strategies. Parents did set specific change goals, select 1-2 strategies for implementation, address potential obstacles, and partake in program evaluation.	Online
Halamova et al (2018)	Emotion-focused therapy theory	Assess the short-term and enduring effects of an internet-based	EFT-SCP integrated elements from Compassion Mind Training (CMT) and the MSC with principles from Emotion-focused therapy. CMT involved 6 to 12 weekly sessions lasting 1-2	Online

		adaptation of Emotion Focused Training for Self-Compassion and Self-Protection (EFT-SCP) on self-compassion, self-criticism, and their respective components within a non-clinical sample.	hours, with group meetings held once or twice weekly. MSC comprised 2-2.5-hour group sessions weekly for eight weeks, with daily home exercises. In Emotion-focused therapy, therapists guided clients to connect with primary adaptive emotions, allowing them to access valuable information and action tendencies to facilitate problem-solving within the therapeutic process.	
Kelman et al (2018)	N/A	Investigate potential distinctions in various outcomes between Cognitive-Behavioral Therapy (CBT) and CMT among women who are either perinatal or planning to become pregnant.	The online materials consisted of interactive lessons addressing four key topics: (a) thoughts, (b) activities, (c) assertiveness, and (d) sleep. Participants received these materials in subsequent emails over the 2-week course to reinforce the concepts covered in the instructional part of the course.	Online
Hamm et al (2019)	Motivational theory of life-span development (Heckhausen's theory)	A goal engagement intervention aimed at improving self-regulatory SSC (Selective Secondary Control) processes to a group of students with different levels of high school grades (ranging from low to high) and optimism (varying from low to high).	The goal engagement treatment comprised a one-hour session with three stages. First, the activation phase prompted reflection on academic successes and failures to enhance the treatment's relevance. Then, the induction phase involved a video presentation on self-regulatory SSC strategies (anticipation, prioritization, and persistence). Lastly, the consolidation stage involved a writing activity where participants set academic goals, wrote about anticipated positive emotions, why their goals were a priority, and a personal persistence model.	Online
Daugherty et al (2018)	N/A	Perform a feasibility assessment of a smartphone EMI aimed at nurturing hope to enhance overall well-being.	Participants in the intervention group received a 28-day mobile app intervention that provided random in-the-moment hope notifications, which included hope picture-statements, hope statements, and questions from the Snyder Hope scale. Additionally, they had access to peer stories of hope obtained from university students	Smartphone app based.

		Investigate the effectiveness of a hope EMI delivered through a versatile mobile app system in elevating hope levels and improving heuristic and eudemonic well-being, including emotional and psychological well-being.	and selected with input from the research team.	
Halamova et al (2020)	N/A	Assess the short-term and lasting effects of an online intervention rooted in the MSC program on self-compassion, self-criticism, and self-reassurance in individuals without clinical conditions.	The program consisted of both in-class and home-based exercises, including formal practices like loving-kindness meditation and informal practices like self-compassionate gestures when distressed. Participants met weekly for 2-2.5 hours over eight weeks, with the option to attend a half-day silent meditation retreat. The program primarily focused on teaching self-compassion skills, dedicating only one session to mindfulness. Those in the MSC group were prompted via email to complete daily exercises for 14 consecutive days, each taking at least 15 minutes. These exercises were accessible on any device through an email link, featuring topics like "How Would You Treat a Friend?" and "Appreciating Yourself" on the final day.	Online
Kappen et al (2019)	N/A	Whether engaging in mindfulness practices might lead to subsequent impacts on the dynamics of a romantic relationship.	The mindfulness intervention included psychoeducation, daily reporting of negative relationship incidents, and daily mindfulness exercises. Participants practiced mindfulness every day, regardless of relationship incidents. The mindfulness exercises focused on present awareness, breathing, and bodily sensations. Guided audio instructions were provided for 8 to 10 minutes. Participants were encouraged to apply mindfulness to daily activities.	Online
Galante et al (2016)	Broaden and Build theory; Empathy-Altruism	Assessing the Efficacy of an Online Loving-Kindness Meditation (LKM)	Participants engaged in real-time practice by mirroring the exercises demonstrated by actors in video sessions. Clear voiceover instructions were provided, detailed enough to allow participants to follow along with their eyes	Online/ Internet Based

	theory	Training Program for Enhancing Well-Being.	closed if they preferred. New 10-minute video sessions were made accessible each weekday, totaling 20 sessions in the course. Automated email reminders were sent to participants who fell behind their session schedule, although they had the flexibility to catch up. Previous sessions were also available for review, and written summaries in PDF format were provided. LKM exercises primarily involved repetitive phrases (e.g., "May you be well and happy") or visualizations of radiating light from oneself to others, aimed at cultivating feelings of loving-kindness toward the meditation's focal point.	
Halamova et al (2018)	N/A	Assess the short-term and long-term effects of an internet-based Mindfulness-Based Intervention (MBI) involving Mindfulness-Based Stress Reduction (MBSR) practices on self-compassion, self-criticism, and self-reassurance in a non-clinical sample.	The MBSR program encompassed formal mindfulness practices, including body scan, yoga, sitting meditation, and loving kindness meditation, alongside informal mindfulness practices integrated into daily activities like washing dishes and driving. Structured group sessions provide training in both formal and informal mindfulness practices, allowing participants to share their experiences with mindfulness in daily life. The MBSR program spans eight weeks, involving weekly 2.5-hour sessions and a one-day six-hour session. Most exercises were audio-guided, while yoga exercises are presented visually. All materials, including audio recordings, are available in Slovak. Participants received the intervention through an accessible link via email, with a sequence starting with "Body Scan," followed by "Sitting meditation," "Yoga," and concluding with "Loving Kindness Meditation" and "Informal mindfulness practices." Participants in the MBI group practiced daily for 15 consecutive days, dedicating 15 minutes to each exercise.	Online/ Internet Based
Drozd Filip et al (2014)	N/A	Assess the impacts of a web-based positive psychology program focusing on gratitude, enjoyable activities, personal strengths, achievement, acts	'Better Days' (BD) is a fully automated internet-based program aimed at enhancing daily life and well-being, drawing from principles of positive psychology. The program is structured into 13 sessions spanning four weeks, each designed to be completed in approximately 10 minutes, considering typical website visit durations. These concise 10-minute sessions were crafted to effectively deliver positive psychology interventions (PPIs) while ensuring participant	Internet-based

		of kindness, optimism, flow, attributions, and mindfulness.	engagement. Additionally, participants received homework assignments to facilitate the integration of intervention materials into their daily routines, promoting sustainable improvements. Each session was divided into psychoeducational and exercise sections, offering a variety of interventions, totaling nine diverse strategies such as gratitude, acts of kindness, optimism, coping techniques, living in the present moment, and character strengths.	
Koydemir et al (2016)	Broaden-and-build theory of emotions. Theory of flow. Seligman's well-being theory (2011).	Investigated the impact of an 8-week online intervention that focuses on individual strengths in enhancing the subjective and psychological well-being of first-year university students.	The intervention program encompassed five modules distributed over an 8-week period, covering the following topics: 1. Identifying strengths and setting goals. 2. Enhancing emotion regulation and boosting positive emotions. 3. Cultivating social support, improving communication, and nurturing positive relationships. 4. Developing effective problem-solving skills and decision-making abilities. 5. Fostering motivation, experiencing flow, and practicing gratitude. These modules were delivered through a diverse range of methods, including psychoeducational webinars, audio and text materials, hands-on experiential activities, game-based exercises, instructional videos, and interactive activities involving personal sharing.	Online/ Webinars/ Videos
Sergeant and Mongrain (2014)	N/A	Compared the impact of an empirically based online optimism exercise to a neutral diary-writing exercise on psychological well-being. It investigated whether enhancing optimism, a potentially malleable trait related to well-being, could have lasting positive effects. The study also considered	The experimental condition included two alternating exercises aimed at cultivating optimism: (a) encouraging a cognitive bias toward recalling positive life experiences, and (b) fostering a perspective that deems goals achievable and valuable. In the first exercise, participants were instructed to list five things that brought joy and enrichment to their lives, along with three ways to find positivity in challenging situations. The next exercise, which occurred 48 hours later, involved briefly describing a goal to be achieved within the next day or two and outlining the necessary steps. Participants continued to alternate between these exercises throughout the 3-week intervention period.	Online

		trait pessimism as a potential moderator of these effects.		
Lappalainen et al (2023)	N/A	The primary goal of this study was to assess the impact of the online HOPE intervention on help-seeking attitudes and intentions among young adults (aged 18 to 24) at a Singaporean university. Additionally, the study conducted a process evaluation of the online HOPE intervention.	Two intervention groups were tested: the iACT student coach + virtual coach group, which received a five-week Youth Compass online program with two 45-minute video calls from a student coach and support from a virtual coach (chatbot and SMS coaching), and the iACT virtual coach group, which received the same program with one 15-minute video call from a student coach and support from the virtual coach. The student coaches, who were psychology students trained in ACT, coached around eight randomly selected adolescents, while the virtual coach provided SMS support and guidance throughout the program.	Online
Tay (2022)	Bandura's Self-Efficacy Theory	The primary goal of this study was to assess the impact of the online HOPE intervention on help-seeking attitudes and intentions among young adults (aged 18 to 24) at a Singaporean university. Additionally, the study conducted a process evaluation of the online HOPE intervention.	The HOPE intervention was a web-based platform comprising four sessions, with participants encouraged to complete two sessions weekly. Each session included quizzes, videos, and information related to mental health. The first session provided insights into depression, covering myths, causes, symptoms, self-help strategies, and treatments. The second session introduced strength-based, affect-based, and gratitude exercises from established psychology manuals. The third session focused on anxiety disorders, discussing myths, causes, symptoms, self-help strategies, and treatments. The final session addressed relaxation techniques and cognitive management. Weekly reminders via WhatsApp and email were sent to participants to promote intervention compliance.	Online/ Website
Paetzold et al (2022)	Attachment theory, and social mentality theory	Evaluate a compassion-focused intervention for improving resilience in young help-seeking individuals through a combination of	Participants engaged in 4 individual smartphone app-based sessions with daily training. The intervention offered two tracks, basic and elaborate, depending on initial impressions and experiences. The basic track aimed at creating calmness and safety through breathing exercises and soothing imagery, while the elaborate track extended these practices to include self-compassionate imagery and writing. The	Hybrid (EMI and guided face-to-face sessions)

		online and in-person sessions and investigate whether participants' initial characteristics are linked to the intervention's mechanisms and outcomes.	intervention included 3 guided sessions introducing compassion-focused principles, practical tasks, and feedback on progress. Sessions were conducted in person or via video calls, with in-person sessions held in dedicated rooms, and home-based sessions for video calls.	
Qu et al (2022)	N/A	Assess Chinese parents' views on their engagement in a culturally tailored group-based parent coaching program delivered through telehealth. This evaluation aims to gauge parents' levels of satisfaction, acceptability, appropriateness, and the feasibility of the intervention.	The Group-based Parent Coaching Intervention is a culturally adapted 12-week program structured around Parent-mediated Early Start Denver Model (P-ESDM) and delivered in Chinese through the Canvas online platform. Each module covers diverse topics related to autism and child development. To cater to Chinese parents' needs, the program utilizes a family capacity-building approach, incorporating four intervention components: asynchronous lectures with practice manuals, demonstration and commentary videos, web-based Q&A sessions, and optional homework. These resources enhance parents' understanding and application of strategies for children with Autism Spectrum Disease (ASD). The active comparison group navigated the program at their own pace, while the treatment group (web+group therapy) followed the same program and engaged in weekly 1.5-hour virtual group therapy sessions via DingTalk, guided by a standardized protocol.	Telehealth. Canvas Online Managemen t System.
Webb et al (2022)	Embodiment theory	Assess the workability, approval, and initial effectiveness within the group of ethnically diverse college women with higher body weight who successfully completed the integrative online mind-body program (i.e., per-protocol analysis).	Participants in the experimental group were instructed to engage in yoga practice at least three times a week, following 15-minute Curvy Yoga Studio video links sent via email. Week 1 focused on a "Morning Wake-up" practice, incorporating gentle yet energizing yoga sequences. Week 2's "Find Your Steady and Sweet" practice emphasized balance and lovingkindness. Week 3's "Living Your Body Positive Intention" added new poses and affirmations. In week 4, participants could choose any of the previous videos. They were encouraged to set intentions, use props, and practice at their own pace. Participants also kept a daily body gratitude journal.	Online
Nawa and	Broaden-	Examined the	Participants were required to access the online	Online/

Yamagishi (2021)	and-build theory. Self-determination theory.	effects of online gratitude journal intervention on the academic motivation of university students.	system daily for two weeks. After logging in, a calendar displayed daily tasks. By clicking on a task (e.g., Diary), participants entered information on task-specific pages. They had flexibility in terms of location, time, duration, and device for access, like laptops or smartphones. For the first 6 days of each week, the gratitude group described up to 5 events or thoughts making them feel grateful. They also rated various aspects of their daily lives, such as stress and happiness, using sliding bars. Control group participants performed similar self-assessments but were not tasked with the gratitude journal. An instructional video on system usage was provided and encouraged before starting the activities.	Web-based
Brouzos et al (2023)	N/A	Assessed the efficacy of an online group positive psychology intervention (OPPI) in alleviating the psychological consequences of the COVID-19 pandemic and its associated containment measures.	The "Staying Home – Feeling Positive" program discussed in this paper is a two-week online group intervention consisting of six sessions. It draws from the positive psychology framework while also integrating elements from cognitive-behavioral therapy. The intervention is conducted through online teleconferencing software (e.g., Skype) with small groups of 5–7 participants. Each session has a duration of approximately 50 minutes, and sessions are held three times a week. Each session focuses on a distinct topic, such as self-protection, relaxation techniques, mindfulness coping, fostering a positive mindset, promoting empathy, altruism, and love, and concluding the program.	Online
Pizarro-Ruiz et al (2021)	Theory of mindfulness	Assess the impact of a brief Mindfulness-Based Intervention (MBI) administered via a smartphone app on various factors associated with positive job performance, including traits of mindfulness, emotions, forgiveness, character strengths,	The experimental group was directed to install and utilize a readily available smartphone app called "Aire Fresco," which offered guided mindfulness sessions. They were instructed to engage in one session each day for the following 14 days. These mindfulness sessions typically lasted around 15 minutes and 47 seconds, with the longest session being 26 minutes and 8 seconds, and the shortest lasting 11 minutes and 47 seconds. In contrast, the control group received similar instructions but were required to download a different smartphone app, "Lumosity." This app provides a variety of activities collectively referred to as "mind training," encompassing games targeting	Smartphone -app (Aire Fresco (Fresh Air); (Lumosity).

		and life satisfaction.	attention, memory, speed, flexibility, and problem-solving. Participants in the control group were asked to dedicate approximately 16 minutes per day to using this app during the same 14-day period as the experimental group.	
Halamova et al (2020)	N/A	Assess the effects of a condensed online version of CMT on self-compassion and self-criticism within a non-clinical sample.	Participants in the online intervention were tasked with completing a daily CMT exercise over the course of 13 consecutive days, starting the day after they were assigned to the intervention group. Each participant received an email instructing them to access the CMT exercise through a provided link. The exercises were structured with the aim of enhancing their potential impact on well-being. After each exercise, participants were prompted with free-text questions encouraging them to reflect on how they could integrate the exercise into their daily lives and describe certain aspects of their experience, such as their "safe place." Additionally, these post-exercise tasks served as a fidelity check, sending email reminders to those who hadn't completed the exercise. The exercises were selected from a variety of options available in Compassionate Mind Training and presented in a specific order, including "Soothing Rhythm Breathing," "Compassionate Body Scan," "Imaging the Self-Critical part of Self," "Creating a Safe Place," "Compassionate Colour," "Developing the Inner Compassionate Self," "Working with Troubled Self," "Working with Anxious Self," "Compassion Flowing into you from Others," "Compassion Flowing Out," "Compassionate Letter Writing," "Compassionate Dialogue Writing," and "Creating your Ideal Caring-compassionate Image."	Online
Sampson et al (2020)	Festinger's Social Comparison Theory	Assess the impact of visual-focused social media on body and facial dissatisfaction and explore the relationship between increased social media use and these	Two image sets were created: the experimental group had 60 attractive smiles from Instagram users (rated for attractiveness, appeal, quality, and enjoyment), and the control group had 60 nature images. Participants viewed these images on Apple iPads through the Instagram app.	Social networking Site (Instagram Users)

		dissatisfactions.		
Greer et al (2019)	Stress and Coping theory and the Broaden-and-Build theory	Assess the interaction and user-friendliness of the Vivibot chatbot and examine the initial impact of positive psychology skills provided by Vivibot on important psychosocial well-being factors in young adults undergoing cancer treatment.	Vivibot is an automated chatbot delivering a prewritten cognitive and behavioral intervention to enhance positive emotions, based on Moskowitz et al.'s work. Users were informed they were interacting with a computer system and repeatedly reminded of this. The intervention covers eight positive psychological skills, adapted into seven conversational teaching lessons and seven practice lessons, each repeated three times over 28 days. The control group received delayed access to the full Vivibot content, with a message notifying them of a 4-week delay.	Vivibot chatbot and Facebook Messenger
Tagalidou et al (2019)	Humor theory. Wellenzohn's solving stressful situations in a humorous way.	Evaluate the relative effectiveness of both humor-based interventions compared to the placebo control condition. Investigate the parity in efficacy between the two humor-based interventions and the three good things intervention. Assess whether the three good things intervention surpasses the placebo control condition.	"Three Funny Things" involves documenting three daily humorous incidents and related emotions for a week. "Coping Humor" focuses on humorously resolving daily stressors through guided techniques for seven days. "Three Good Things" requires recording three positive daily experiences.	Web-based
Bronk et al (2019)	Broaden-and-build theory	Assess the effectiveness of two web-based toolkits (Purpose and Gratitude) aimed at nurturing a sense of purpose in young adults.	The Purpose Toolkit had three activities, each lasting 15-20 minutes over three days. Participants viewed videos, reflected on their values and future goals, and imagined their best possible future life, even designing a symbolic tattoo. The Gratitude Toolkit, also lasting three days for 15-20 minutes per day, included a gratitude	Online

			walk, listing things they were grateful for and why, learning about benefit appraisals, and writing a letter of gratitude to someone who had helped them.	
Gu et al (2022)	Attachment theory, and social mentality theory?	Examine the impact of an online Compassion focused therapy (CFT)-based intervention (CFI) and rational emotive behavior therapy (REBT) on depression, anxiety, and shame using a Randomized Controlled Trial (RCT) with Chinese international students who exhibit elevated levels of self-criticism.	The CFI group engaged in a 4-week program involving weekly 2-hour online individual counseling sessions. This program, primarily rooted in CFT, focused on cognitive education related to the three emotion regulation systems, identifying and validating the inner critical voice, as well as practicing imagery and meditation. These meditation practices included mindfulness and compassion meditation, drawn from the Mindful Self-Compassion program. All participants were required to dedicate 20 minutes daily to home practice (guided meditation provided as MP3 files). During the 2-week follow-up, participants were encouraged to maintain their home practice. The REBT group also took part in a 4-week program based on self-help approach involved attending a 2-hour online lecture each week. During these lectures, a sample case and case analysis were presented, and participants were tasked with applying these principles to their own lives as home practice.	Online
Alexiou et al (2021)	N/A	Assess the efficacy of a 21-day online positive psychology program for Greek healthcare professionals experiencing depression, anxiety, stress, or burnout.	Week one involved a "Three Good Things" exercise where participants noted three positive occurrences each day along with a causal explanation. Week two featured "Acts of Kindness," requiring participants to perform five kind acts on a single day. In the third week, participants engaged in a "Best Possible Self" exercise, envisioning their ideal future selves across various life domains and outlining steps to actualize these visions.	Online (Website)
Manicavasagar et al (2014)	N/A	Examine the practicality of introducing the Bite Back program, a multifaceted positive psychology initiative created by the Black Dog Institute, as a well-	Bite Back is an online platform designed for teenagers, offering a blend of engaging activities and educational content spanning nine positive psychology areas: gratitude, optimism, flow, meaning, hope, mindfulness, character strengths, healthy living, and positive relationships. Additionally, the platform supplies information on the advantages of enhancing well-being, strategies to cultivate proficiencies in each positive psychology domain, connects users to	Online

		being intervention for youth.	additional pertinent resources, and facilitates discussions through comments and online forums. Geared towards adolescents aged 13 to 17, the platform maintains a pre-moderation process, ensuring that all comments and uploads are reviewed and approved before being visible to the public.	

Table 3: Characteristics of the Positive Psychology Intervention

Online Meditation and Mindfulness: Drabu et al, used online self-compassion-based guided meditation for non-suicidal self-injury [99]. Krifa et al, experimented with an online multi-component intervention that included lectures, expert videos, psychoeducation, and positive psychology practices to assist Tunisian students with mental health [100]. Kelman et al compared online Compassion Mind Training (CMT) and CBT for perinatal and pregnant women [101]. Beshai et al utilized online psychoeducational videos, guided meditations, and exercises to reduce anxiety and depression [102]. Halamova et al studied self-compassion and self-criticism through various online and smartphone-assisted exercises [95,103,104]. Pizarro-Ruiz et al conducted guided mindfulness sessions via a smartphone app (Aire Fresco) [97]. Gu et al, experimented on Chinese students to mitigate depression and anxiety through online individual counseling sessions regarding mindfulness meditation (MP3 files) [93].

Positive Psychology and Self-Compassion: Lennard et al provided online self-compassion training for mothers [78]. Drozd et al experimented with an internet-based program, "Better Days," which included psychoeducational exercises to increase happiness [105]. Halamová et al, explored emotion-focused training and loving-kindness meditation [106]. Galante et al practiced loving-kindness meditation through online videos [82]. Webb et al used an online yoga program to improve body image satisfaction and self-compassion [77]. Nawa and Yamagishi assessed academic motivation using journal writing and online self-assessments, including gratitude and other daily life aspects [89]. Brouzos et al tested the "Staying Home – Feeling Positive" online positive psychology intervention during the COVID-19 pandemic [107]. Andersson et al provided compassion mindset intervention training via smartphone app among

university students [92]. Alexiou et al, assessed burnout and depression among Greek healthcare professionals by conducting a positive psychology intervention [108]. Manicavasagar et al, used “Bite Back”, a multi-component online positive psychology webpage to increase well-being among young adults [109].

Gratitude and Acts of Kindness: Chilver and Gatt explored self-compassion and acts of kindness through online modules [79]. Hussong et al examined parent-child gratitude conversations using online tools [94]. Tagalidou et al used web-based humorous diary writing techniques to address happiness and depression [98].

Optimism and Positive Emotion: Sergeant and Mongrain analyzed optimism among participants through online diary-writing exercises [83]. Tay assessed an online HOPE (Hope, Optimism, and Positive Emotion) intervention [96]. Sampson et al used Instagram images to assess body, facial, and smile dissatisfaction [86]. Koydemir et al analyzed optimism among participants by using alternating online diary-writing exercises [90]. Hamm et al, focused on improving goal engagement and optimism among university students [80].

Relationship Satisfaction and Acceptance: Kappen et al assessed relationship satisfaction and partner acceptance through online psychoeducation [110]. Qu et al analyzed sensory social routines, attention, dyadic engagement, and non-verbal communication in children with autism using synchronous group-based parent coaching sessions via telehealth [85].

Purpose and Well-Being: Mahalik et al assessed the Father Project Webpage's intervention for fathers' sense of purpose [111]. Paetzold et al aimed to enhance resilience through online EMI and face-to-face sessions [84]. Lappalainen et al used ACT intervention to increase self-compassion skills and psychological flexibility during COVID-19 [112]. Bronk et al conducted the Purpose Toolkit and Gratitude Toolkit to increase a sense of purpose among

participants [88]. Greer et al studied psychological well-being among cancer patients using Vivibot, a chatbot designed to deliver positive psychological skills [87]. Daugherty et al employed a smartphone app for hope and well-being [81].

Digital Control vs Waitlist Control

The control groups were categorized into two groups: digital controls (15/35, 43%) and waitlist controls (19/35, 54.3%) (Table 4). Digital controls involved some form of digital or online interaction but do not include the full intervention content. They had access to certain activities or features but did not receive the complete intervention that the experimental group received. For example, digital control groups included audio recording, video watching, and Internet-based communication [99,101,102]. In other cases, psychoeducation, online daily registry of relationship experiences, online diary writing activities without positive psychology components, and digital placebo activities (writing daily events, early memories and life events) [83,108–110]. Other control measures included elements of positive psychology that differed from the focus of the intervention, identical initial app assessment as the intervention group but did not receive the complete treatment, and website featuring inspirational phrases [79,81,82,96]. Even conducting daily self-evaluations without an equivalent active task, downloaded the Lumosity smartphone app, and using neutral Instagram images of nature [85,86,89,97].

Waitlist controls referred to control groups in which participants did not receive the active intervention during the initial phase of the study but were promised or scheduled to receive it at a later time. Waitlist control group participants do not receive the full intervention immediately and instead are placed on “waitlist” to receive the intervention after a specified waiting period. RCTs control groups either received no treatment or were given access to full digital intervention content after the trial. In one study (1/35, 2.8%), the category of control group was not explicitly

mentioned [107].

Study	Study Design	Duration of Intervention	Follow-up and Timing of Follow-up	Experimental group	Control Group	Characteristics of Control Group	Samplin
Mahalik et al (2022)	RCT	N/A	N/A	Psychoeducation= 61, Psychoeducation and purpose-reflection= 70	52	Waitlist Control	N/A
Krifa et al (2022)	Two armed RCT, PRE and POST	8 weeks	1 (12 weeks)	183	183	Waitlist Control	Convenien sampling
Drabu et al (2022)	RCT, PRE and POST	T1-1 week-T2	1 (2 weeks after completion of second session)	30	33	Digital Control	Convenien Purposive sampling
Lennard et al (2021)	RCT	N/A	1 (8 weeks)	231	239	Waitlist Control	Convenien sampling
Andersson (2021)	RCT, PRE and POST	6 weeks	N/A	Compassion and Mindfulness group = 25 each	15	Waitlist Control	Convenien sampling
Beshai (2020)	RCT, PRE and POST	4 weeks	N/A	227	229	Digital Control	Convenien sampling
Chilver and Gatt (2022)	RCT, PRE and POST	6 weeks	1 (7 weeks)	205	204	Digital Control	Convenien sampling
Hussong et al (2020)	RCT, PRE and POST	1 week (Parents asked to complete the program within the	1 (4 weeks)	53	51	Waitlist Control	Convenien Purposive Sampling

		week)					
Halamova et al (2018)	RCT, PRE and POST	2 weeks (14 days)	1 (8 weeks)	70	53	Waitlist Control	Convenien sampling through snowballin technique
Kelman et al (2018)	RCT, PRE and POST	2 weeks	1 (2 weeks)	69	68	Digital Control	Convenien Sampling
Hamm et al (2019)	RCT, PRE and POST	4 weeks = 1 month	3 (12 weeks)	628		Waitlist Control	Convenien Sampling
Daugherty et al (2018)	Quasi-experimental, RCT, PRE and POST	1 month = 28 days	N/A	66	46	Digital Control	Convenien sampling
Halamova et al (2020)	RCT, PRE and POST	2 weeks = 14 days	1 (8 weeks)	69	53	Waitlist Control	Convenien sampling
Kappen et al (2019)	RCT, PRE and POST	2 weeks= 12 days	N/A	56	57	Digital Control	Convenien sampling
Galante et al (2016)	RCT, PRE and POST	4 weeks	N/A	409	400	Digital Control	Convenien sampling
Halamova et al (2018)	RCT, PRE and POST	2 weeks (15 days)	1 (8 weeks)	93	53	Waitlist Control	Convenien sampling,
Drozd Filip et al (2014)	RCT	4 weeks	3 (4 weeks, 8 weeks, 24 weeks)	112	94	Waitlist Control	Convenien sampling
Koydemir et al (2016)	RCT	8 weeks	N/A	48	44	Waitlist Control	Convenien sampling
Sergeant and Mongrain (2014)	RCT	3 weeks	2 (4 weeks, 8 weeks)	253	213	Digital Control	Convenien sampling
Lappalainen et al (2023)	RCT, PRE and POST	5 weeks	N/A	iACT student coach + virtual coach group = 116 and iACT virtual coach group= 116	116	Waitlist Control	Convenien sampling

Tay (2022)	RCT, PRE and POST	2 weeks	1 (8 weeks)	97	78	Digital Control	Convenien sampling a Purposive sampling
Paetzold et al (2022)	RCT, PRE and POST	6 weeks	1 (4 weeks)	46	46	Waitlist Control	Experience sampling
Qu et al (2022)	RCT	12 weeks	N/A	Program Evaluation: 56.25% Focus Group Interview: 70.8%	Program Evaluation: 43.75% Focus Group Intervie w: 29.2%	Digital Control	Convenien sampling a Snowball sampling.
Webb et al (2022)	RCT, PRE and POST	4 weeks	1	159	129	Waitlist Control	Purposive sampling
Nawa and Yamagishi (2021)	RCT, PRE and POST	2 weeks	2 (4 weeks, 12 weeks)	42	42	Digital Control	Convenien Sampling
Brouzos et al (2023)	Quasi-experimental, PRE and POST	2 weeks	1 (2 weeks)	44	38	Not Explicit	Convenien sampling
Pizarro-Ruiz et al (2021)	RCT, PRE and POST	2 weeks = 14 days	N/A	89	75	Digital Control	Convenien sampling
Halamova et al (2020)	RCT, PRE and POST	13 days= 2 weeks	1 (8 weeks)	91	53	Waitlist Control	Convenien sampling
Sampson et al (2020)	RCT, PRE and POST	Recruitment: 5 months= 20 weeks	N/A	71	61	Digital Control	Convenien sampling
Greer et al (2019)	RCT	4 weeks = 28 days	1 (8 weeks)	25	20	Waitlist Control	Convenien and Snowb sampling
Tagalidou et al (2019)	RCT, PRE and POST	1 week	1 (4 weeks)	Coping humor = 35, Three funny things = 46, Three good things= 52	Early memorie s: 49	Waitlist Control	Convenien sampling
Bronk et al	RCT,	3 days	1 (1	74 in the	71 in the	Waitlist Control	Convenien

(2019)	PRE and POST and LAGGED POSTTEST		week)	gratitude condition, 79 in the purpose condition.	control condition		sampling
Gu et al (2022)	RCT, PRE and POST	4 weeks	1 (2 weeks)	Compassion focused therapy (CFT)-based intervention (CFI)= 10 and rational emotive behavior therapy (REBT)= 10	12	Waitlist Control	Convenien Sampling
Alexiou et al (2021)	RCT, PRE and POST	3 weeks	1 (4 weeks)	19	19	Digital Control	Purposive AND/OR Convenien Sampling
Manicavasagar et al (2014)	RCT, PRE and POST	6 weeks	N/A	120	115	Digital Control	Convenien Sampling

Table 4: Study Characteristics

Outcomes of PPIs

Outcomes were related to both ill- and well-being components (see Table 2). In particular, 26 studies (74.4%) focused on ill-being, including depression (n=15), anxiety (n=11), and stress (n=9), loneliness (n=1), burnout (n=1) using measures like the Depression, Anxiety and Stress Scales (DASS-21), the Generalized Anxiety Disorder scale (GAD-7), the short and long forms of the Spielberger State-Trait Anxiety Inventory (STAI), De Jong Gierveld Loneliness Scale, and Maslach Burnout Inventory (MBI).

Well-being outcomes included compassion (n=11), life satisfaction (n=7), optimism (n=4), happiness (n=4), resilience (n=3), emotion regulation and emotion awareness (n=3), hope (n=3),

mindfulness (n=2), purpose (n=2), quality of life (n=2), gratitude (n=2), empathy (n=1), forgiveness (n=1), motivation (n=1), kindness (n=1) using the the Self-Compassion Scale (SCS and SCS-SF), Satisfaction with Life Scale (SWLS), Life Orientation Test–Revised (LOT-R), Authentic Happiness Inventory (AHI), Connor-Davidson Resilience Scale (CD-RISK-10), Profile of Emotional Competence (PEC), Snyder Hope scale, The Five Facet Mindfulness Questionnaire – 15 (FFMQ-15), Claremont Purpose Scale (CPS), 'Psychological Health' and 'Social Relationships' subscales of WHO Quality of Life-BREF (WHOQOL Group), Gratitude Questionnaire (GQ-6), Interpersonal Reactivity Index (IRI), Heartland Forgiveness Scale (HFS), and Chinese Compassion Scale (CCS).

Both ill-being and well-being included components of Self-criticism/self-reassurance (n=6), well-being (both positive and negative) (n=5), positive and negative effect (n=4) using Forms of Self-Criticism/Reassuring Scale (FSCRS), Warwick-Edinburgh Mental Well-being Scale (WEMWBS) and Positive and Negative Affect Scale (PANAS).

Meta-Analytic Results

Meta-analyses on well-being outcomes showed that PPIs improved purpose, gratitude, and hope with a medium-to-large effect size (k=12, Hedge's g=.555 , 95%CI (.348; .761), *P*<.001 , I^2=70%). Only one study involved a digital control group, for which the reported effect was significantly smaller (g=.09). Additionally, PPIs augmented levels of compassion (k=13, Hedge's g=.447, 95%CI (.210; .684), *P*=.001, I^2=62%), with no significant differences (*P*=.343) between waiting list (k=11, g=.356) and digital control group (k=2, g=.670). Additionally, PPIs augmented positive coping behaviors (k=6, Hedge's g=.421, 95%CI (.072; .770), *P*=.003, I^2=72%) with a medium effect size. PPIs interventions also improved body image-related outcomes with a medium effect (k=7, Hedge's g= .238 , 95%CI (.090; .388), *P*=.007, I^2= 0%). A

small-to-medium effect was found for mindset predisposition (k=13, Hedge's g= .304 , 95%CI (.072; .537), *P*=.015, I^2= 74%), with a significant difference between control groups (*P*=.012). In particular, effect size was larger and significant when a waiting list (k=6, g=.534) was included as control group when compared to digital controls (k=7, g=.092). Also, a small-to-medium effect was also found for the variable three funny things/three good things (k=8, Hedge's g=-.206 , 95%CI (-.328; -.083), *P*=.005, I^2= 0%) with all studies including waiting list control groups. A non-significant effect was found for cognitive flexibility (k=7, Hedge's g=.054, 95%CI (-.265; .372), *P*=.694, I^2= 75%), and mood/affect/emotions (k=8, Hedge's g= .364 , 95%CI (-.120; .849), *P*=.118, I^2= 81%) – the latter with no difference in control groups (*P*=.401) although participants in the waiting list showed a larger effect size (k=5, g=.570) when compared to digital control (k=3, g=.088). Also, satisfaction and quality of life (k=7, Hedge's g=.338 , 95%CI (-.119; .793), *P*=.121, I^2= 81%) showed a non-significant effect, with no differences between subgroups (*P*= .653) (see Figure 2).

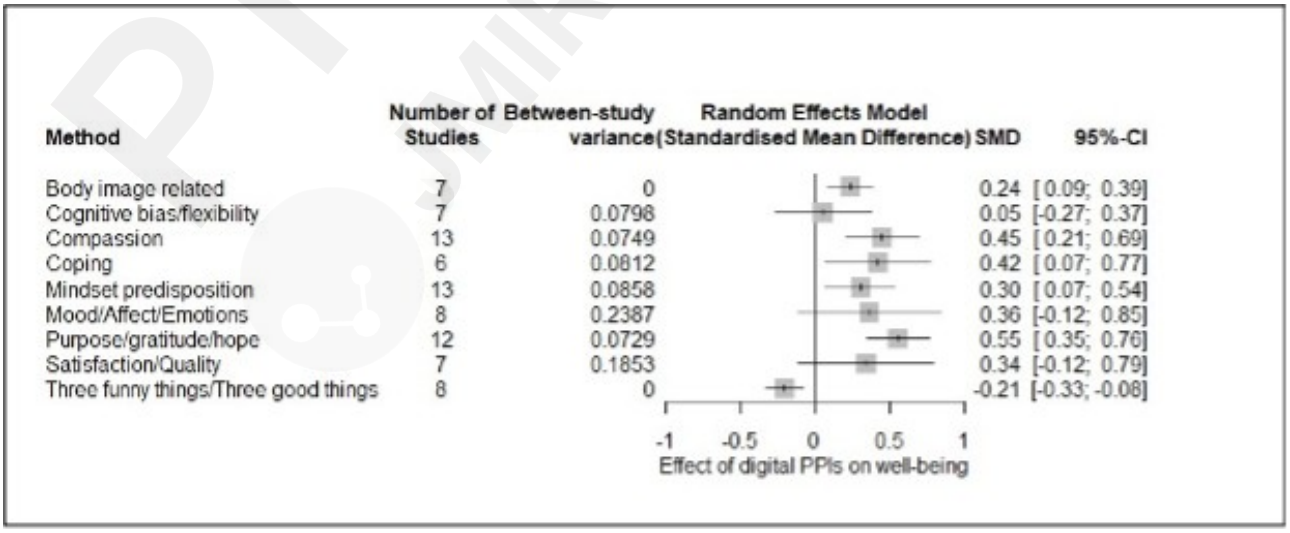

Figure 2: Meta-Analyses on Well-Being Outcomes for positive psychology interventions (PPIs).

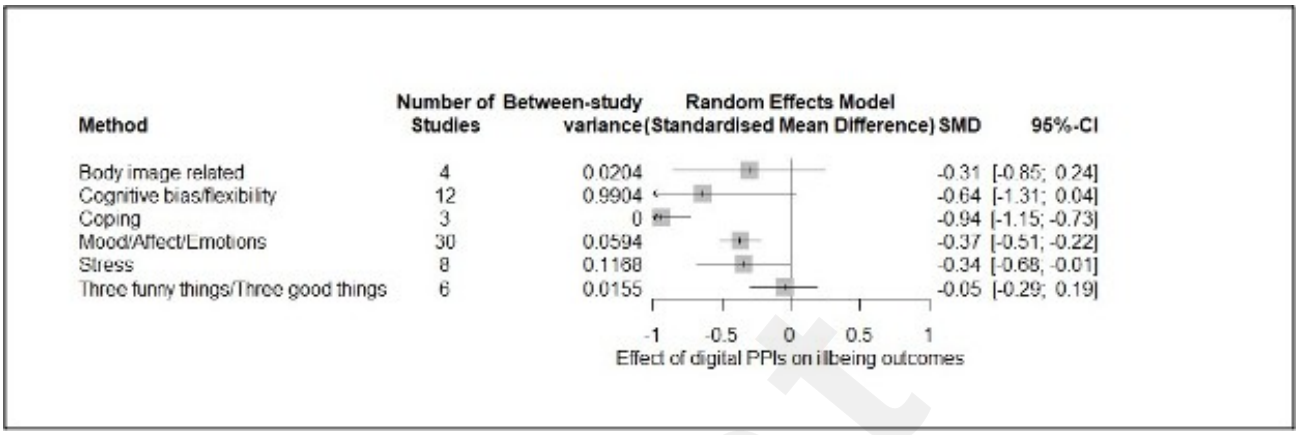

Figure 3: Meta-Analyses on Ill-Being Outcomes for positive psychology interventions (PPIs).

Ill-being outcomes were less represented in the included studies (Figure 3). Meta-analyses showed a large negative effect for the reduction of cognitive biases (k=14, Hedge's g= -.637, 95%CI (1.309; -.036), *P*=.05, I^2=94%) – with no group differences between waiting list and digital control group (*P*=.537), although once again effect sizes tended to be larger when a waiting list (k=7, g=-.799) was considered with respect to digital control groups (k=5, g=-.405). PPIs showed a medium-to-large effect on the reduction of negative emotions and mood problems (k=30 , Hedge's g= -.369, 95%CI (-.513; -.225), *P*<.001 , I^2=60%). Interestingly, subgroup differences showed that the effect size was significantly (*P*=.030) larger for studies including a waiting list (k=21, g= -.456) when compared to studies including digital control groups (k=9, g= -.200). PPIs also diminished stress levels (k= 8, Hedge's g=-.342, 95%CI (-.677; -.007), *P*=.045, I^2=81%) – with no significant differences in the effect size (*P*=.350) between studies including waiting list (k=5, g= -.441) versus digital control groups (k=3, g=-.157). A very large effect was found for coping (k=3, Hedge's g= -.939 95% CI (-1.151 - -.728), *P*= .003, I^2=0%), however interpretation of this result would be limited to the low number of studies. While the effect sizes were not significant for body image-related outcomes (k=4, Hedge's g= -.305, 95%CI (-.851;

-.240), *P*=.173 , I^2=17%), and three funny things/three good things (k=6 , Hedge's g= -.048, 95%CI (-.289; -.192), *P*=.627 , I^2=28.5%).

Funnel plots were symmetrical for both the overall meta-analysis of well-being and ill-being outcomes (see Figures 4 & 5), and the regression test for funnel plot asymmetry was not significant in both cases as well, thus confirming the absence of publication biases. Influence analyses did not that single studies accounted for a significant part of the variance in the final effect.

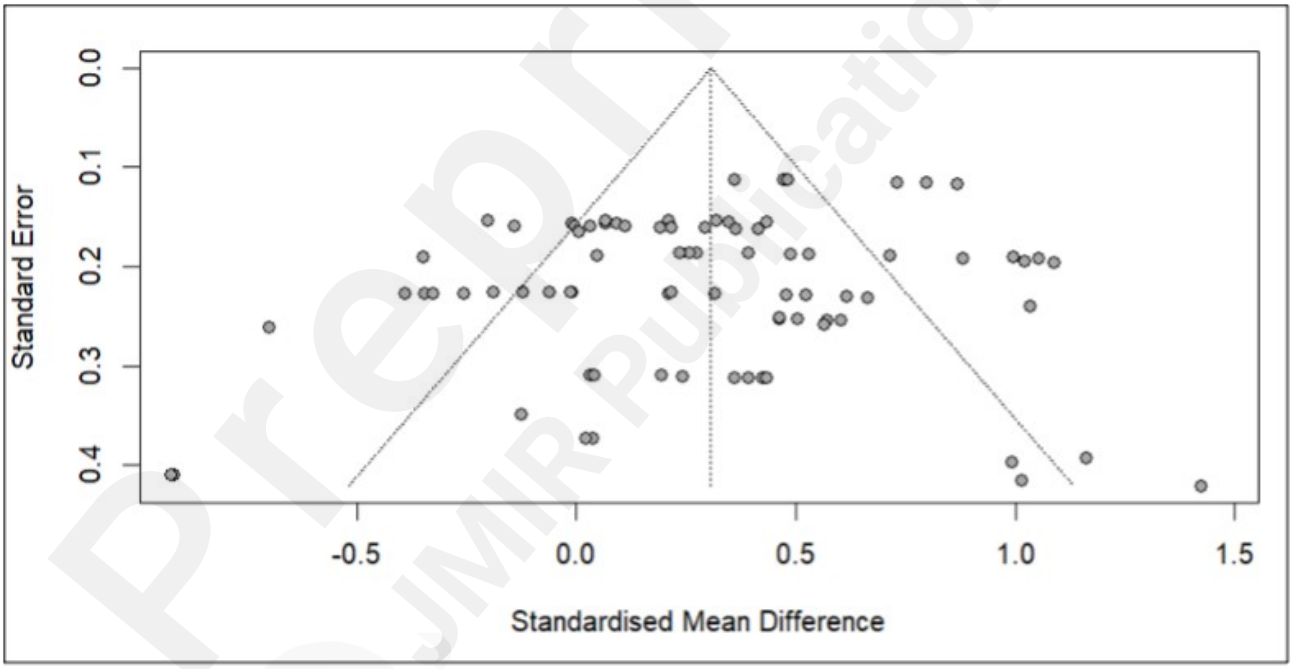

Figure 4: Funnel Well-Being Outcomes for positive psychology interventions (PPIs).

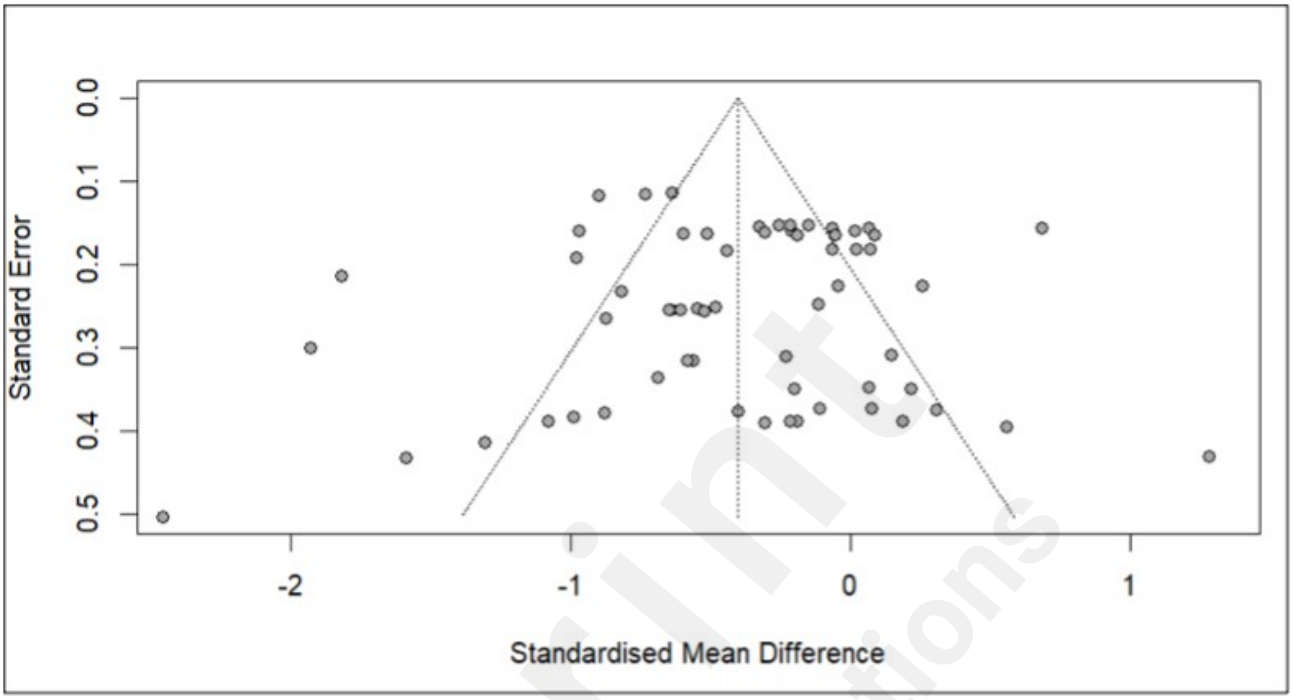

Figure 5: Funnel Ill-Being Outcomes for positive psychology interventions (PPIs).

Finally, meta-regression analyses showed that PPIs tended to show a larger effect size on well-being outcomes in studies including young adults (β=.322, *P*=.008), while no specific effect was found for ill-being outcomes. Figure 1 and 2 in the Supplement material report additional detailed information of each meta-analysis.

Discussion

Summary of Findings

In our systematic review and meta-analysis of 35 studies, we examined the impact of digital interventions grounded in positive psychology on the well-being and ill-being of children, adolescents, and young adults. Our results showed four main findings. First, when it comes to well-being outcomes, PPIs enhanced various facets of well-being, notably purpose, gratitude,

and hope, with a medium-to-large effect, compassion and positive coping – e.g., coping with humor –, and body-image related concerns with a medium effect. Smaller effects were found for mindset predisposition and three funny things/three good things. While PPIs did not seem to improve mood and positive emotions, satisfaction and quality of life, and cognitive flexibility. This aligns seamlessly with prior investigations of PPIs in traditional settings [17]. These interventions seem to provide robust support in enhancing aspects of well-being that involve an individual's outlook on life and their ability to foster a sense of personal achievement and satisfaction.

Second, when we looked at ill-being outcomes, the picture was different. In particular, the larger effect was found for diminishing cognitive biases – including self-criticism and fears, followed by a decrement in negative emotions and mood problems, especially when participants of the experimental group were compared to waiting list. Hence, PPIs can be a useful tool in reducing cognitive biases typical of, for example, mood problems, and stress levels [110]. To note, it is crucial to differentiate control groups in the analyses. Indeed, although we could not make subgroup comparisons for all the outcomes due to the paucity of studies in each group, we showed that effects sizes tended to be consistently larger in studies including a waiting list rather than a digital control group (e.g., including some sort of online interactions). Digital control groups, such as those engaging in non-specific digital activities or using general health apps, could serve as valuable benchmarks. This would allow us to distinguish the specific contributions of PPIs from broader digital engagement effects. Such comparisons would shed light on the specific psychological mechanisms activated by PPIs compared to general digital exposure, helping to isolate the unique elements of PPIs that contribute to improved well-being outcomes.

Third, several studies within our review highlighted the efficacy of interventions tailored to specific settings and contexts. For example, digital interventions aimed at fostering hope and optimism were found to be particularly beneficial for college students prone to failure and those with low optimism levels [63]. Also, interventions focusing on self-compassion were found to be especially beneficial for mothers of infants, offering them a respite from the unique challenges of early parenthood [61]. On the other hand, interventions that utilized smartphone delivery, such as the hope intervention, showcased the adaptability and accessibility of digital platforms, making well-being practices more integrated into daily routines [64]. Another noteworthy finding was the positive impact of multi-component PPIs delivered online for subjective well-being of young adults [62].

Fourth, when age was considered as moderator, studies with young adult participants showed larger effect sizes in the meta-analysis with well-being outcomes, but no differences emerged with respect to ill-being indicators. That is an important consideration since young adults might be more inclined to understand the importance of promoting well-being and thus more willing to take part in intervention and experiencing the positive effects. However, while some demographic groups appeared to benefit more from certain types of interventions, the overall evidence was not strong enough to conclusively determine that these effects were consistently replicated across different age groups, such as children, adolescents, or young adults [17,31].

Finally, the variability in intervention efficacy highlights the critical role of intervention design and implementation in achieving desired outcomes. This variation underscores the need for carefully tailored interventions that consider the unique needs and circumstances of the target

demographic to optimize efficacy. Therefore, while PPIs hold promise, the evidence suggests a nuanced approach to their application is necessary, where factors such as intervention type, target population, and desired well-being outcome are all carefully considered to maximize benefits [17,31].

When compared to existing literature, our findings provide a nuanced view that aligns with some previous studies but also highlights the complexity of applying PPIs across diverse populations and settings. Unlike some optimistic narratives, our results suggest that while PPIs can be beneficial, their efficacy is not universal and depends on specific intervention types and target populations. Furthermore, our findings diverge from studies like the MYRIAD trial , underscoring the need for cautious interpretation of PPI efficacy and the potential for adverse effects.

Future Directions

The findings from this systematic review and meta-analysis provide a solid foundation for understanding the effectiveness of PPIs in young populations. However, as with all research, there are avenues that remain unexplored and warrant further investigation. One primary recommendation is to conduct more rigorous randomized controlled trials with larger and more diverse samples. This would not only enhance the generalizability of the findings but also allow for a more in-depth exploration of the nuances and specific components of the interventions that are most effective. Also, we suggest that PPIs should be integrated in interventions that also collect biological information to further assess their efficacy.

Another crucial area for future research is the examination of the long-term effects of these digital interventions. While our review captured the immediate and short-term benefits, understanding the sustainability of these positive outcomes over extended periods is essential.

This would provide insights into whether these interventions lead to lasting changes in well-being and mental health or if periodic "booster" sessions are required to maintain the benefits. Additionally, given the rapid advancements in technology, exploring the integration of emerging technologies, such as virtual reality or augmented reality, into PPIs could offer innovative ways to engage and support adolescents.

From a practical implementation perspective, stakeholders in the field of AYA mental health should consider incorporating evidence-based digital interventions into broader mental health programs and curricula. Schools, community centers, and mental health organizations can benefit from these scalable and accessible tools, especially in regions where traditional face-to-face interventions might be limited. Collaborations between researchers, technologists, and educators can further refine and optimize these interventions, ensuring they remain relevant and effective in the ever-evolving digital landscape.

Limitations

Our study, while extensive, exhibits limitations that warrant attention for a comprehensive understanding of the scope and applicability of our findings. One major limitation is the heterogeneity in study settings and targeted age groups, which ranged from school environments to clinical settings, and included diverse demographic categories from children to young adults [30]. This wide variability complicates the task of uniformly generalizing the results across different settings and age demographics. Additionally, the medium-to-low quality of some included studies potentially undermines the reliability and robustness of our findings. The varying methodological rigor and potential biases in study design across the analyzed studies necessitate a cautious interpretation of the effectiveness and

applicability of PPIs based on this current evidence base. Although, we did not divide the results or their interpretation between interventions aiming at preventing versus treating mental health problems since our aim was to explore the literature and treatment effects of PPIs in general, however, we do acknowledge that absence of improvement in a prevention intervention may not be the evidence that an intervention is ineffective, hence we should keep in mind this interpretation to avoid biasing the findings of the meta-analysis. Hence, we suggest that future studies should look more carefully at this differentiation.

In addition, an important aspect that was not covered in our review is the assessment of the safety and potential adverse effects of PPIs. Not including an evaluation of harms, as highlighted by the findings from larger trials such as the MYRIAD trial, which documented no significant effects and even potential harm in certain subgroups, poses a noteworthy gap in our analysis [114]. This aspect highlights an area for further investigation, particularly considering the intricate nature of mental health interventions and their varied effects across diverse individuals. Additionally, the absence of data from lower-middle-income countries and the lack of studies not published in other languages rather than English limits the generalizability of our conclusions globally, raising concerns about the effectiveness and safety of PPIs in these regions where cultural, economic, and healthcare contexts may differ significantly from those in high-income countries [30,31]. Finally, although we calculated the inter-coder reliability for the screening process, we were not able to provide a measure of reliability for the quality assessment of the studies, hence, we encourage future studies to consider carrying out the assessment blind and calculate a measure of agreement.

Conclusion

In conclusion, our systematic review suggests that while PPIs can enhance certain aspects

of well-being among children, adolescents and young adults, the effects are not consistent across all domains or demographic groups. The evidence supports the effectiveness of specific types of PPIs, particularly those that enhance gratitude, purpose, and hope. However, these benefits are not uniform, and the impact varies by the type of well-being outcome and the population segment. Moreover, given the significant variability in intervention settings, the diversity of outcomes, and the medium-to-low quality of the studies reviewed, any conclusions about the efficacy of PPIs should be viewed as tentative. The findings underscore the necessity for further rigorous research to better understand the mechanisms and effectiveness of PPIs, assess their safety, and evaluate their applicability in different geographical and clinical contexts. Future studies should also explore how digital platforms might uniquely influence the success of these interventions and consider the theoretical underpinnings of PPIs in more depth to enhance their practical and academic contributions.

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Conflict of Interest

The authors report there are no competing interests to declare.

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Multimedia Appendix 1: Basic Characteristics

Multimedia Appendix 2: Quality Assessment

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Supplementary Files

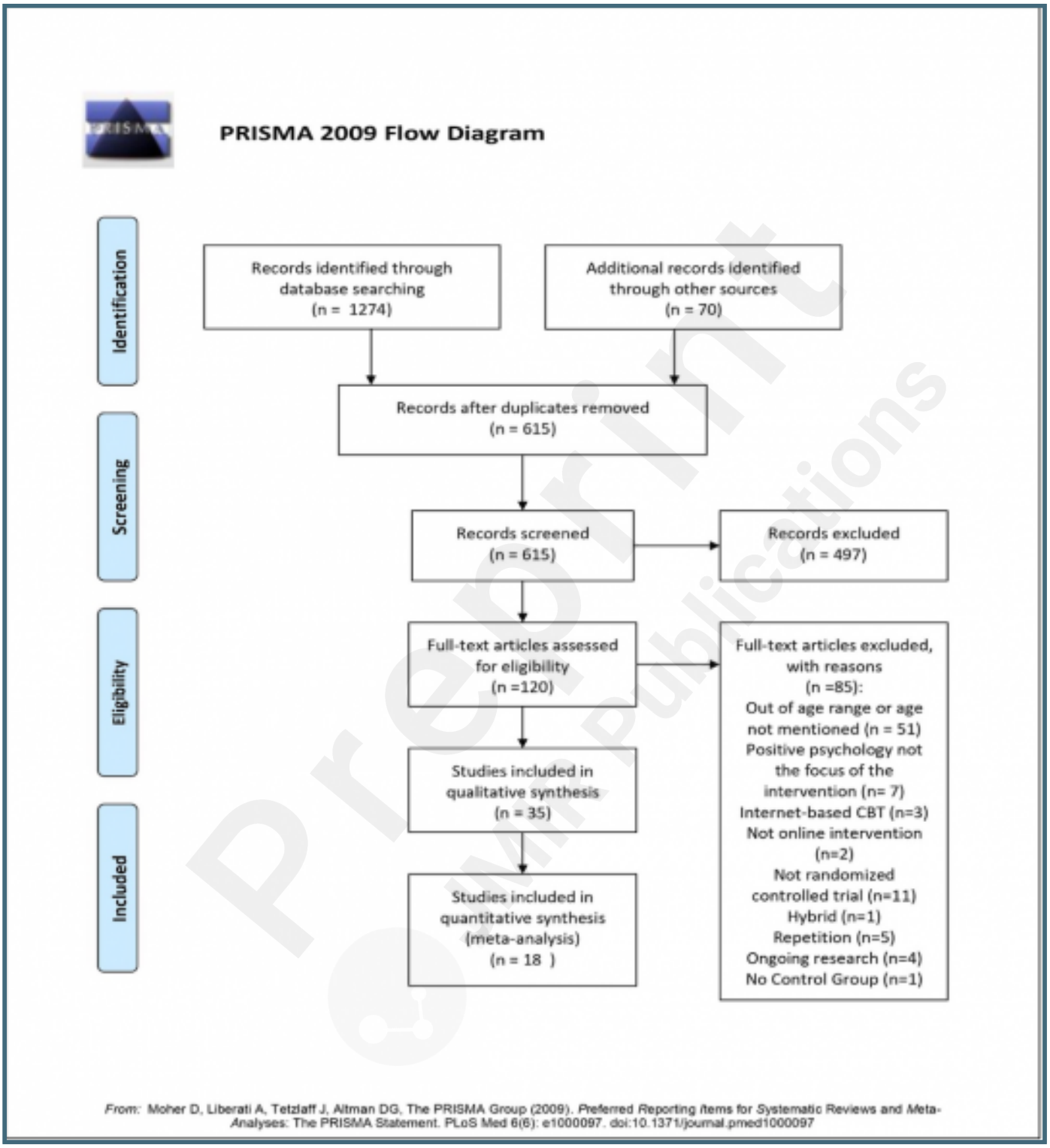
Manuscript with Table 1 (search string) added.
URL: http://asset.jmir.pub/assets/da1a4673f2e0ed18d25fe03a876358af.docx

Supplementary Figure 1.

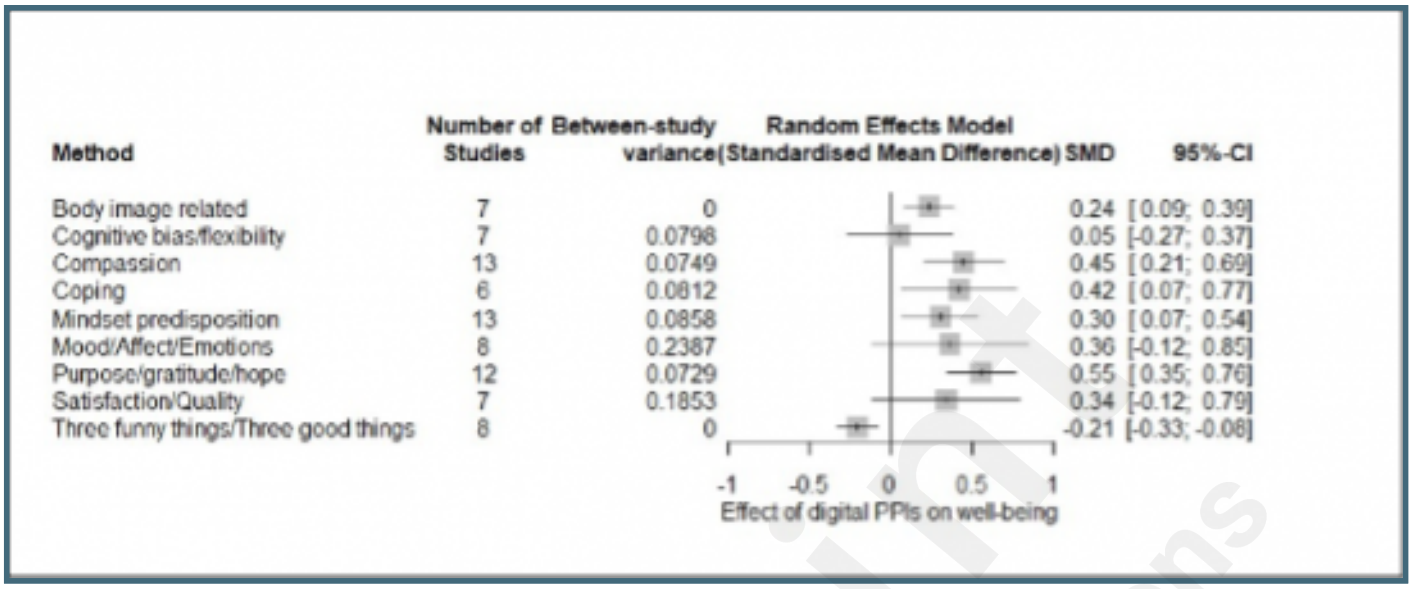
Supplementary Figure 2.

Figures

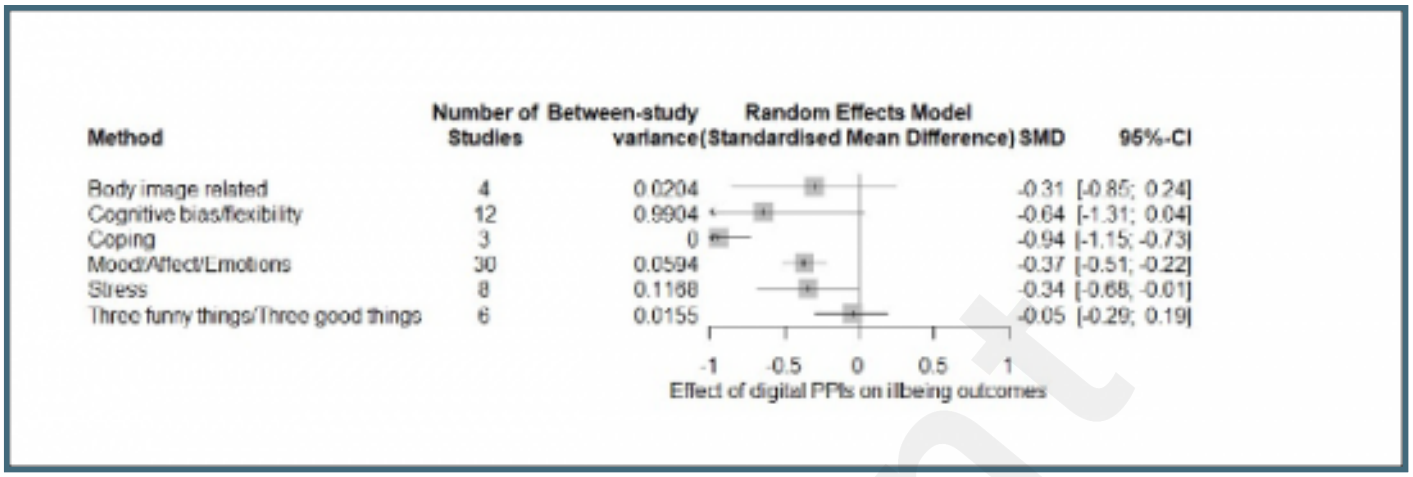
PRISMA flow chart of included studies in systematic review and meta-analysis.



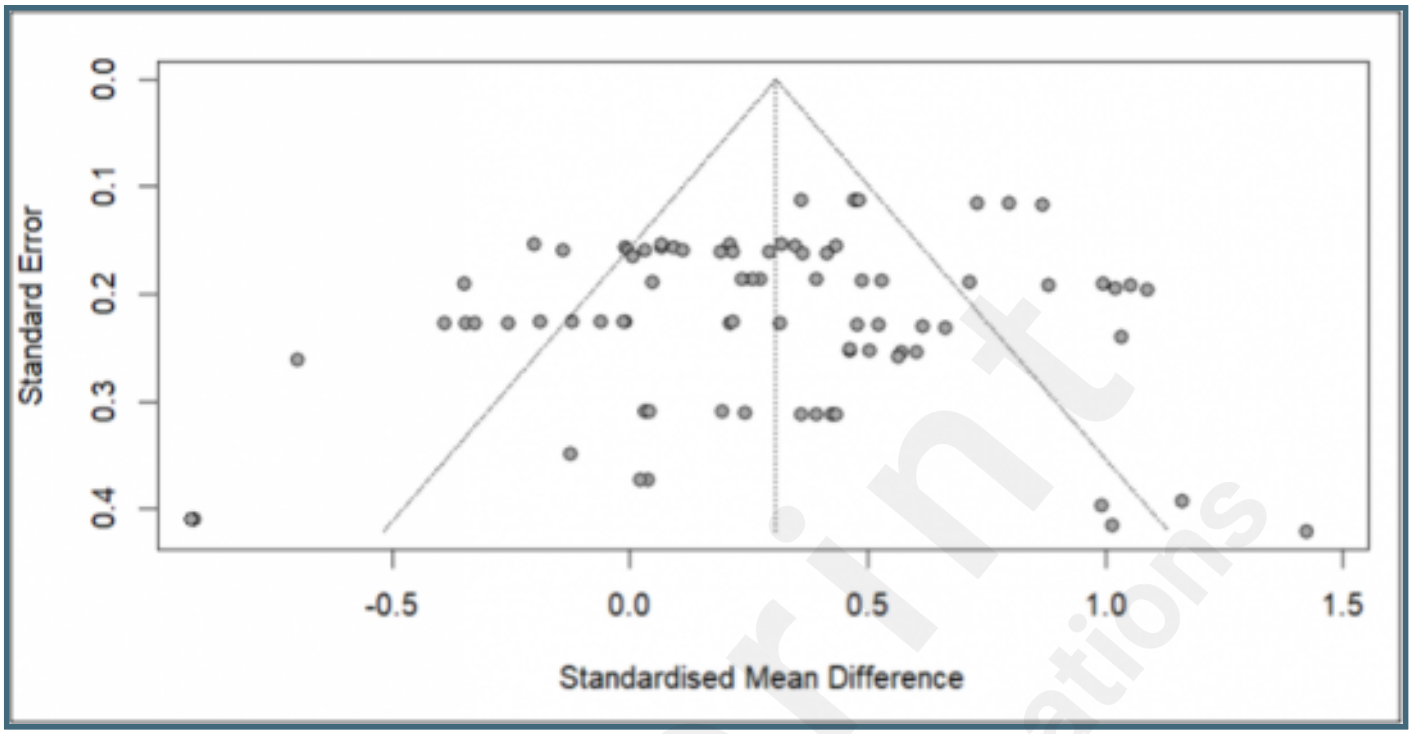
Meta-Analyses on Well-Being Outcomes for positive psychology interventions (PPIs).



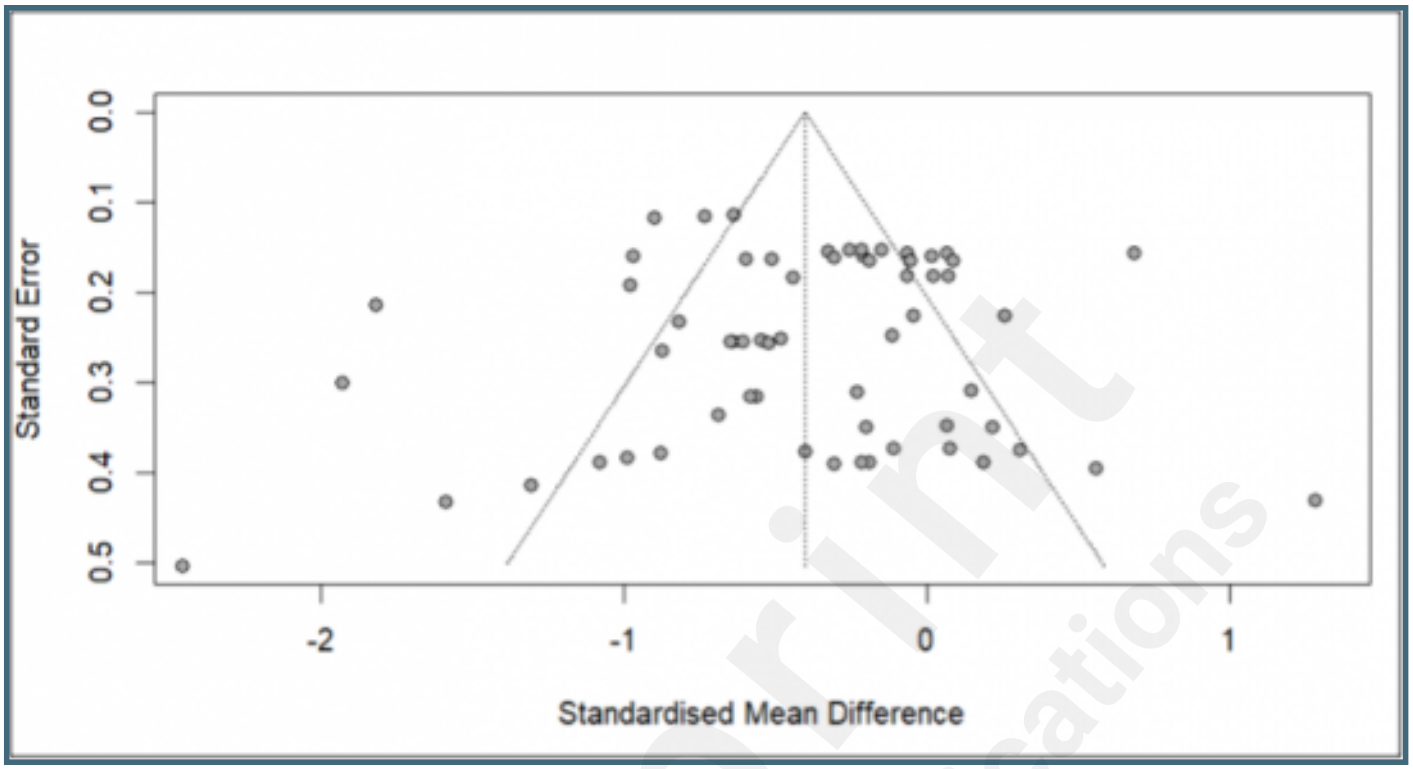
Meta-Analyses on Ill-Being Outcomes for positive psychology interventions (PPIs).



Funnel Well-Being Outcomes for positive psychology interventions (PPIs).



Funnel Ill-Being Outcomes for positive psychology interventions (PPIs).



Multimedia Appendixes

Basic Characteristics.
URL: http://asset.jmir.pub/assets/72d2888a13d71af07e292e40d4836058.docx

Quality Assessment.
URL: http://asset.jmir.pub/assets/a2e3ce9a5680d80752ad7e64489a8b2b.docx

CONSORT (or other) checklists

PRISMA checklist.
URL: http://asset.jmir.pub/assets/6ab7c69166e580c06b6e3c24ad86a574.pdf