

# **Systematic review and meta-analysis regarding the effectiveness of online/remote interventions for mental health in children, adolescents, and young adults after the onset of the COVID-19 pandemic**

Linda Fischer-Grote, Vera Fössing, Martin Aigner, Elisabeth Fehrmann, Markus Böckle

Submitted to: Journal of Medical Internet Research  
on: February 20, 2023

**Disclaimer:** © The authors. All rights reserved. This is a privileged document currently under peer-review/community review. Authors have provided JMIR Publications with an exclusive license to publish this preprint on its website for review purposes only. While the final peer-reviewed paper may be licensed under a CC BY license on publication, at this stage authors and publisher expressly prohibit redistribution of this draft paper other than for review purposes.

## ***Table of Contents***

---

**Original Manuscript..... 5**



# Systematic review and meta-analysis regarding the effectiveness of online/remote interventions for mental health in children, adolescents, and young adults after the onset of the COVID-19 pandemic

Linda Fischer-Grote<sup>1, 2</sup>; Vera Fössing<sup>3</sup>; Martin Aigner<sup>1, 4</sup>; Elisabeth Fehrmann<sup>1</sup>; Markus Böckle<sup>3</sup>

<sup>1</sup>Karl Landsteiner University of Health Sciences Krems AT

<sup>2</sup>University Hospital Krems Krems AT

<sup>3</sup>Research Centre Transitional Psychiatry Karl Landsteiner University of Health Sciences Krems AT

<sup>4</sup>Department of Psychiatry for Adults University Hospital Tulln Tulln AT

## Corresponding Author:

Elisabeth Fehrmann

Karl Landsteiner University of Health Sciences

Dr.-Karl-Dorrek-Straße 30

Krems

AT

## Abstract

**Background:** The prevalence of mental illness has increased in children, adolescents, and young adults during the COVID-19 pandemic, while at the same time, access to treatment facilities has been restricted, resulting in a need for the quick implementation of remote/online interventions.

**Objective:** To give an overview of randomized-control studies examining remote/online interventions for mental health in children, adolescents, and young adults and to explore the overall effectiveness of these interventions regarding different symptoms.

**Methods:** A systematic literature search was conducted according to PRISMA guidelines using PubMed and Google Scholar. A meta-analysis was applied using a random effects model to calculate overall effect sizes for interventions using standardized mean differences for post-intervention scores.

**Results:** Twelve articles with n=3833 participants could be included in the final sample, and nine were included in the quantitative analysis. The studies examined different digital interventions for several different outcomes, showing better outcomes than controls in some studies. Meta-analyses revealed significant medium overall effects for anxiety (SMD = 0.35, 95% CI: 0.06, 0.64) and social functioning (SMD = 0.42, 95% CI: -0.68, -0.17) and a small significant effect for depression (SMD = 0.21, 95% CI: 0.13, 0.30). In contrast, no significant overall treatment effect could be found for well-being, psychological distress, disordered eating, and COVID-19-related symptoms.

**Conclusions:** The qualitative and quantitative analyses of the included studies show some promising results regarding the effectiveness of online interventions, especially for symptoms of anxiety and depression and for training in social functioning. However, for other symptom groups, effectiveness is not apparent. All in all, more research with high-quality studies is needed.

(JMIR Preprints 20/02/2023:46637)

DOI: <https://doi.org/10.2196/preprints.46637>

## Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**

Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.

Only make the preprint title and abstract visible.

No, I do not wish to publish my submitted manuscript as a preprint.

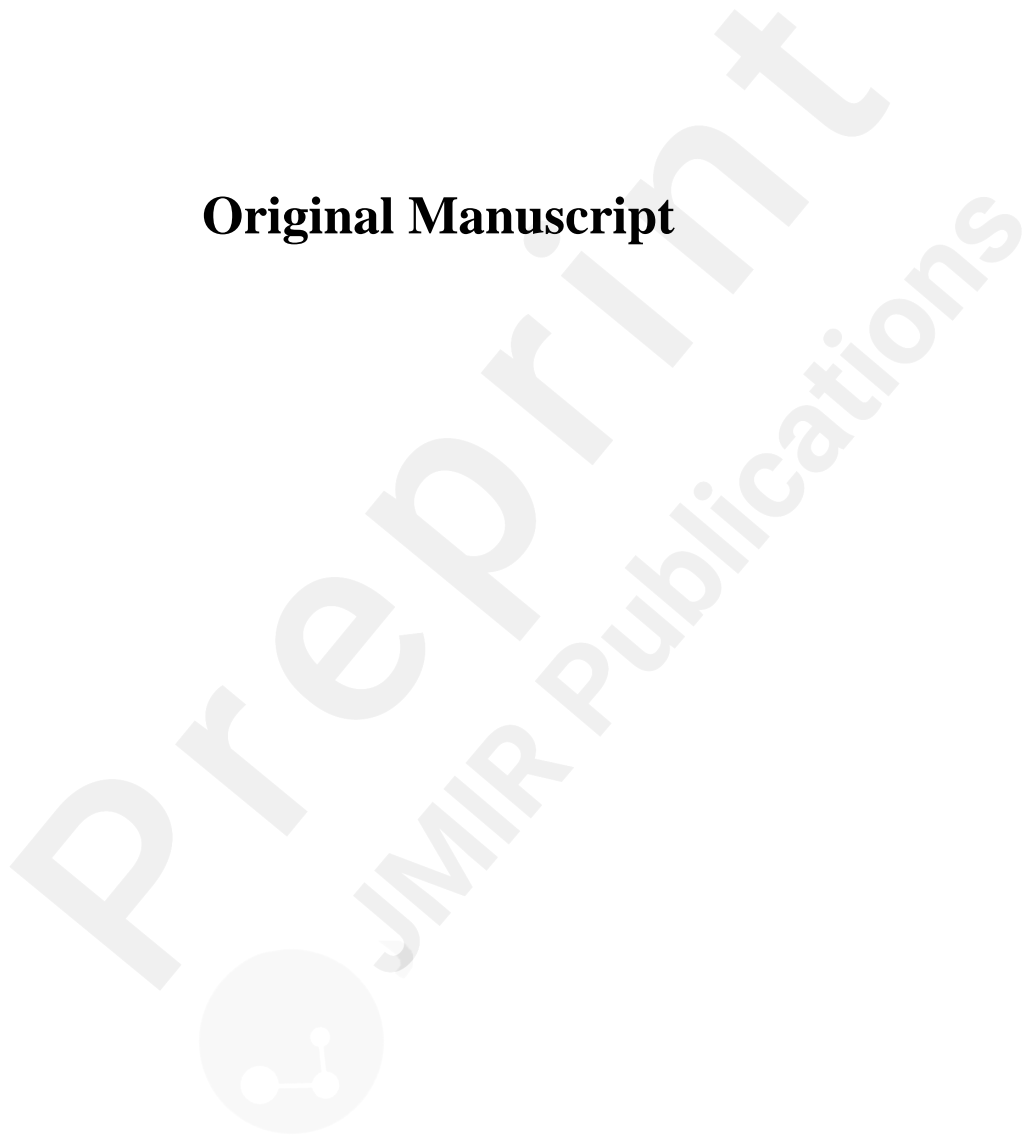
2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**

Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain visible to all users.  
Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in [JMIR Publications](#), the full manuscript will be available to all users.

Preprint  
JMIR Publications

## Original Manuscript



# Systematic review and meta-analysis regarding the effectiveness of online/remote interventions for mental health in children, adolescents, and young adults after the onset of the COVID-19 pandemic

Linda Fischer-Grote<sup>1,2</sup>, Vera Fössing<sup>3</sup>, Martin Aigner<sup>1,4</sup>, Elisabeth Fehrmann<sup>1\*</sup>, Markus Boeckle<sup>1,3</sup>

<sup>1</sup> Karl Landsteiner University of Health Sciences, Krems, Austria

<sup>2</sup> University Hospital Krems, Krems, Austria

<sup>3</sup> Karl Landsteiner University of Health Sciences, Research Centre Transitional Psychiatry, Krems, Austria

<sup>4</sup> Department of Psychiatry for Adults, University Hospital Tulln, Tulln, Austria

\*corresponding author:

Elisabeth Fehrmann

Karl Landsteiner University of Health Sciences

Dr.-Karl-Dorrek-Straße 30

3500 Krems an der Donau

Tel +43/650/3032923

Email [elisabeth.fehrmann@kl.ac.at](mailto:elisabeth.fehrmann@kl.ac.at)

## Abstract

**Background:** The prevalence of mental illness has increased in children, adolescents, and young adults during the COVID-19 pandemic, while at the same time, access to treatment facilities has been restricted, resulting in a need for the quick implementation of remote/online interventions.

**Objective:** To give an overview of randomized-control studies examining remote/online interventions for mental health in children, adolescents, and young adults and to explore the overall effectiveness of these interventions regarding different symptoms.

**Methods:** A systematic literature search was conducted according to PRISMA guidelines using PubMed and Google Scholar. A meta-analysis was applied using a random effects model to calculate overall effect sizes for interventions using standardized mean differences for post-intervention scores.

**Results:** Twelve articles with  $n=3833$  participants could be included in the final sample, and nine were included in the quantitative analysis. The studies examined different digital interventions for several different outcomes, showing better outcomes than controls in some studies. Meta-analyses revealed significant medium overall effects for anxiety (SMD = 0.35, 95% CI: 0.06, 0.64) and social functioning (SMD = 0.42, 95% CI: -0.68, -0.17) and a small significant effect for depression (SMD = 0.21, 95% CI: 0.13, 0.30). In contrast, no significant overall treatment effect could be found for well-being, psychological distress, disordered eating, and COVID-19-related symptoms.

**Conclusions:** The qualitative and quantitative analyses of the included studies show some promising results regarding the effectiveness of online interventions, especially for symptoms of anxiety and depression and for training in social functioning. However, for other symptom groups, effectiveness is not apparent. All in all, more research with high-quality studies is needed.

## Keywords

COVID-19 pandemic; online / digital mental health intervention; e-mental health; anxiety; social functioning; depression; well-being; psychological distress; eating disorder; COVID-19 Symptoms.

# 1. Introduction

The high prevalence of psychological disorders in children and adolescents is well known and has been reported for a long time [1–4]. Psychological disorders in these age groups often show long-term impacts on adult life as well [2,5]. Childhood and adolescence are relevant periods for learning and brain maturing, possibly resulting in either a positive or negative impact [6]. Due to these developmental aspects, adolescents have, e.g., been found to be especially vulnerable to addiction and addictive behavior [7].

A review from 2015 estimated the worldwide-pooled prevalence of mental illness in children and adolescents to be 13.4% [4], while recent point prevalence rates in Austria for psychological disorders range from about 16.5% [8] to about 25% [2,9], with lifetime prevalence estimated at 35.8% [9].

Due to the COVID-19 pandemic and all the accompanying characteristics, prevalence rates of mental health issues have increased in the general population [10], adolescents [11], and young adults, who are among the groups most at risk of suffering from COVID-19 related decrease in mental health [12–17]. A systematic review reports an increase in anxiety and depressive symptoms associated with the lockdown in children and adolescents and an increase in sleep disorders; as risk factors, a priori mental illnesses and high media exposure were identified [18]. Stress levels have also been found to be related to respective containment measures and different waves of the pandemic [17].

Earlier research spanning from 1946 till 2020 shows an increased risk of depression and anxiety in children and adolescents due to loneliness and isolation [19]. This is an important aspect the current pandemic brought along in many countries [11,19] due to lockdowns and/or homeschooling, possibly impacting especially adolescents as emotional support by peers is highly relevant at this age [11].

However, the negative impact of the pandemic consists not only of an increase in mental health issues but also significantly impedes accessibility of treatment options, among other aspects, due to the need for social distancing [10,20]. Even before the pandemic, some groups of patients were difficult to reach through mental health programs, like migrants [21], different groups of minorities [22], and people in remote areas [23]. Even before the onset of the pandemic, fewer than 50% of adolescents with depression used adequate services [24,25].

The sudden onset and accompanying restrictions of the pandemic made it even more necessary to increase the offers of online therapy to maintain treatment of patients with mental health issues and led to a sudden increase in therapists using online interventions [10,26–28], thereby seemingly decreasing perceived barriers by psychotherapists to use online or remote treatment options [10,27]. However, the sudden switch also resulted in insecurities and the need for further guidance for therapists [28].

The use of new media and online interventions have been developed and studied for years now [10], also in



the context of children and adolescents with psychosomatic illnesses [29], with some studies even finding advantages of virtual therapy compared to face-to-face treatments [30], or at least similar outcomes [31]. A review on videoconferencing technology to increase mental health found generally good user satisfaction and feasibility of interventions [31], and studies show that therapeutic alliances can also be reached in videoconferencing with clients rating bond and presence as equal to face-to-face settings [23]. Online help-seeking seems related to benefits like increased anonymity, accessibility, and inclusivity [32], and social media show benefits in offering mental health care [33].

Applications developed to enhance mental health in children and adolescents seem to show good acceptability [34]. Especially co-designed e-health for adolescents appears to be associated with a more engaging and satisfying user experience [35–38].

However, more research on effectiveness is needed [34], especially as risks of online interventions and offers have also been found. Risks of social media use include a possible negative impact on symptoms and fostering hostile interactions [33]. At the same time, technological issues might impede online delivered intervention and privacy concerns may arise [39]. Thus, especially considering the sudden switch to online therapies due to COVID-19, studies are needed to investigate the effectiveness of online or digital technologies delivered interventions for psychological disorders in a controlled and comparable way.

Some reviews have been conducted regarding the effectiveness of interventions for mental health related to the COVID-19 pandemic [40–43]. A review by Bonardi et al. [40] focused on RCTs explicitly designed to address mental health issues related to COVID-19 and found some with promising effects, but none for children or adolescents that met inclusion criteria. Regarding web-based exercise interventions for depressive symptoms and anxiety, a review found no clear recommendations [41], while Valentine et al. [42] found telehealth services for neurodevelopmental disorders to be mostly equal to control groups and focused on studies conducted before the onset of the COVID-19 pandemic. Yunus et al. [43] found efficacy in digitalized interventions for depression in pregnant women and included studies from before the pandemic.

Nevertheless, it seems of high relevance to identify studies of interventions for mental health conducted after the onset of the pandemic in children, adolescents, and young adults, as persons of these age groups are found to be at a higher risk of being negatively impacted by the pandemic, while there has also been such a sudden switch to online programs. Whereas children, adolescents, and young adults can be considered “digital natives” [44], which might make them especially receptive to online interventions, younger generations also seem to be especially vulnerable to negative aspects of digital media usage, e.g. problematic smartphone use [45].

Thus, this systematic review and meta-analysis aims to give a concise overview of studies examining the effectiveness of online/remotely delivered interventions or interventions delivered through digital media since the onset of the COVID-19 pandemic for specific mental health issues in children, adolescents, and young adults.

Preprint  
JMIR Publications

## 2. Materials and Methods:

### 2.1 Search Strategy

To identify papers published since early 2020 (after the initial onset of the COVID-19-pandemic) till August 2022, a literature search based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Framework [46] was conducted in *PubMed* and Google Scholar. The detailed search parameters are depicted in table 1. The reference search strategy was applied to locate additional relevant studies, and Google Scholar alerts were enabled.

**Table 1.** Search parameters used in the literature search

Database	Search parameters
PubMed	((depression) OR (anxiety) OR (mental health) OR (eating disorder) OR (stress) OR (sleeping disorder) OR (quality of life)) AND ((post covid) OR (long covid) OR (Covid) OR (Sars-cov-2)) AND ((adolescent) OR (child) OR (Juvenile) OR (teenager) OR (youth) OR (young adults) OR (emerging adult)) AND ((Psychology) OR (Psychotherapy) OR (psychiatry)) AND ((online) OR (digital) OR (video-based) OR (tele*)) AND ((effectiveness) OR (efficacy)) AND ((RCT) OR (Randomized controlled trial) OR (Case control) OR (observational cohort))

### 2.2 Study selection process

Before examining full texts, the authors independently screened the titles and abstracts for inclusion and exclusion criteria. See figure 1 for the detailed exclusion process at each stage. Studies were included if they were (a) original, interventional studies, (b) published not earlier than 2020 (after the onset of the COVID-19 pandemic), (c) in peer-reviewed journals, (d) written in English or German, (e) focusing on psychological or psychotherapy interventions that were delivered remotely, e.g. online, via mobile application, or telephone, (f) that target on mental health issues like distress, depression, or anxiety, psychological well-being, or quality of life (QoL), (g) in children, adolescents or young adults (up to the age of 30).

### 2.3 Statistical analysis

Meta-analyses were conducted to examine the interventions' effectiveness using standardized mean differences (SMD) as the outcome measure, which compares treatment with control group post-intervention scores. A positive SMD indicates lower outcome scores in the treatment group compared to the control.

Eligible studies were grouped by outcomes type and separate analyses were carried out for each group (anxiety, depression, well-being, disordered eating, psychological stress, social functioning, and COVID-19-related outcomes). Score polarity had to be reversed in one study [47]. Effect sizes were pooled using the package “metafor” [48] in the R environment. A random-effects model was fitted to the data to account for variations in sample size, measures, and methodologies between the different studies. Heterogeneity was assessed using Higgins’  $I^2$  [49]. Interpretation of the effects sizes is based on Cohen’s  $d$  [50,51].

Additionally, a risk-of-bias assessment for studies included in the meta-analysis was conducted based on the Joanna Briggs Institute Critical Appraisal Checklist for Randomized Controlled Trials, and on the Joanna Briggs Institute Critical Appraisal Tool for Quasi-Experimental Studies [52]. All statistical analyses were conducted in the R environment for statistical computing [53].

### 3. Results

#### 3.1 Sample of included studies

A total of 94 articles were found in the initial database search process, and 2 additional studies were identified through the reference search strategy. Of the total amount, 3 duplicates had to be removed. 33 articles were examined at a full-text level. Of these, 7 articles were excluded since they were not original articles, were no intervention studies, were not targeting the right outcome variables or groups, or were carried out before 2020. Additionally, 13 studies had to be excluded at the end of the search process as no results had been published yet for these trials. See Figure 1 for a detailed description of the inclusion and exclusion process.

The final sample in August 2022 amounted to 12 articles for the qualitative analysis, with overall  $n = 3833$  participants. Nine of these studies were included in the quantitative analysis. Eleven articles reported on RCTs, whereas one study [54] had only a quasi-experimental design with no control group. Only one study [55] explicitly compared the online intervention to a face-to-face setting. One study [56] was adapted as an online format during data collection due to the beginning of the COVID-19 pandemic.

Three [47,57,58] (25%) of the twelve studies were conducted in the USA, two (16.67%) in China [54,59], Australia [56,60], and the UK [61,62] each, and one (8.33%) study was carried out in Canada [63], Italy [55], and Iran [20]. Four included studies had an approximately ( $\pm 15\%$ ) equal distribution of female and male participants [20,54,62,63]. In contrast, six had more female participants [47,57–61], one more males [55], and one study was conducted with female participants only [56]. Half of the included articles focused on children and adolescents [54,55,57,58,61,63], while the other half included young adults in their samples [20,47,56,59,60,62].

Characteristics of the included studies can be viewed in table 2, while the risk of bias assessment is depicted in table 3.

**FIGURE 1. PRISMA Flow diagram.**

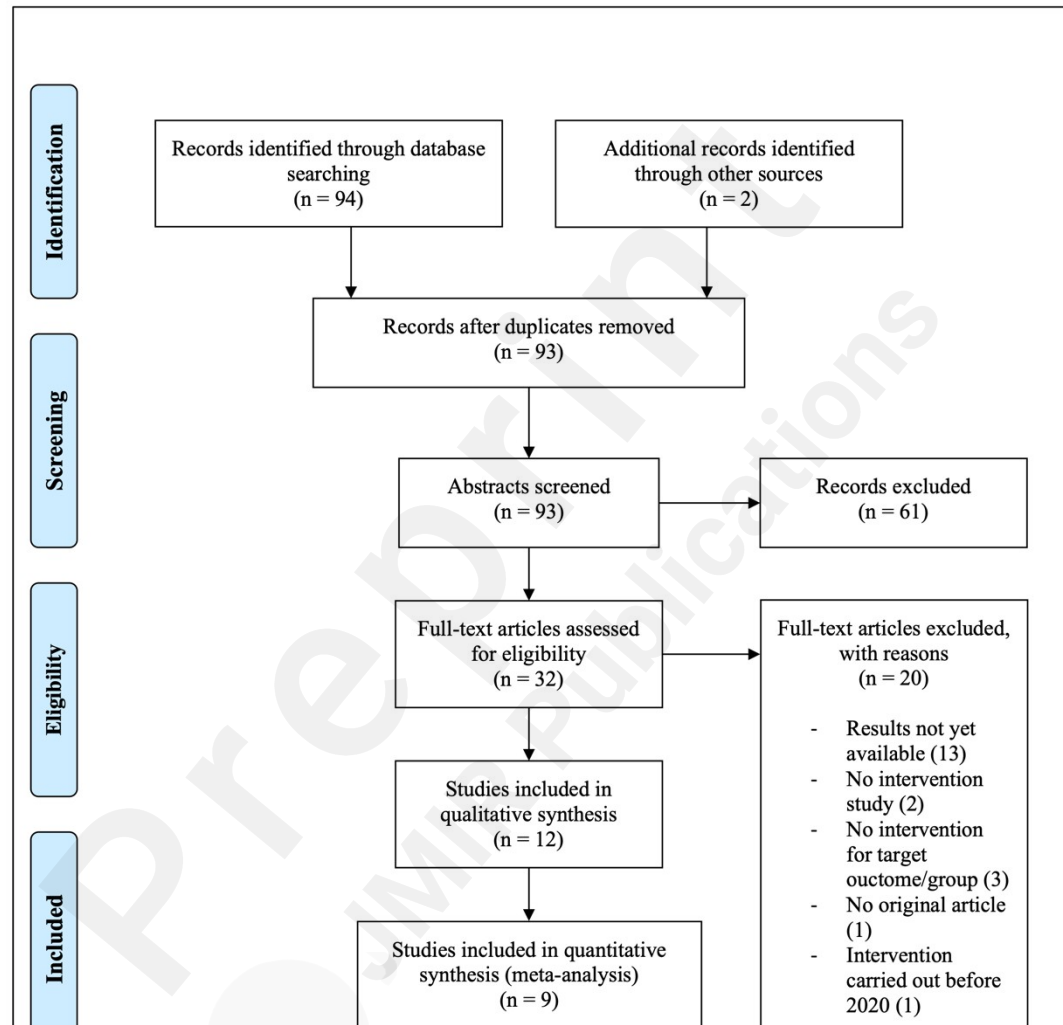


Table 2. Characteristics of the included studies

Study	Sample size	Sample recruitment	Gender	Age	Study type	Country	Intervention	E-Health technology	Target Outcomes	Results
Duan et al., 2022 [54]	N = 76	Online broadcasting platform	Female = 56.58% Male = 43.42%	= 10 – 12 years M = 10.72, SD = 0.48	Quasi-experiment, no control group	China	Online Strength-informed Acceptance and Commitment Therapy (SACT)	Video conferencing system	- Quality of Life - anxiety	Pre to post: Significant reduction of anxiety, but no sign. Increase in QoL Pre to 3-month-follow-up: Reduced anxiety and increased QoL
Kutok et al., 2021 [57]	Intervention group: n=36 Control group: n=44	Targeted Instagram advertisement	Female= 59%	13 - 17 years, M=15.3 (SD=1.35)	RCT	USA	IMPACT	Video intervention plus app-based automated messaging; control: enhanced web-based resources	Cyberbullying: to reduce consequences of cybervictimization, to increase bystander intervention	- Feasible, acceptable - improved bystander intervention and well-being in intervention group
Malboeuf-Hurtubise et al., 2021 [63]	N = 37 (MBI= 16; P4C= 21)	In 2 elementary schools	Female= 43% Male= 57%	M=8.18	RCT	Canada	MBI P4C Both group-based, online delivered	Teleconferencing platform	Anxiety Inattention symptoms Basic psychological need satisfaction (BPN) In the context of COVID-19	- P4C: more impact on anxiety and inattention - MBI: better outcomes for BPN
Pavarini et al., 2022 [61]	N = 100 Training group: n = 50 Wait-list: n = 50	Advertisement on social media	Female = 84% Male = 14% Male (transgender) = 1% Non – binary	16 – 18 years	RCT	UK	Online peer support training course “Uplift Peer Support Training”	Zoom, Smaller groups in breakout rooms or via WhatsApp	Primary outcomes: - motivation to provide support - perceived support-giving skills - frequency of	Primary outcomes: - No difference regarding motivation - significant

			= 1%						support provided - compassion towards others - connectedness to peers Secondary outcomes: - mental well-being - emotional symptoms - self-efficacy - civic engagement	effects of training regarding other primary outcomes Secondary outcomes: - significant effect of training
Prato et al., 2022 [55]	N = 40 Patients with the diagnosis of Tourette Syndrome at a child and adolescent neuro-psychiatry unit	Female = 10% Male = 90%	9 – 16 years (M = 13.5, SD = 2.0)	RCT	Italy	Behavior Therapy for youth with Tourette syndrome during COVID-19	Video-conference vs. face-to-face	- tic symptoms - obsessive compulsive symptoms - ADHD symptoms - anxiety - depressive symptoms	- both forms of delivery equally effective regarding most outcomes - online delivery more effective regarding depressive symptoms	
Schleider et al., 2022 [58]	N = 2452 Instagram advertisements	Female = 88.09% (biological sex)	13 – 16 years	RCT	USA	Online single-session intervention for depressive symptoms (Behavioral Activation SSI vs. Growth Mindset SSI vs. Supportive Therapy SSI = control)	Self-administered online intervention	- depressive symptoms - hopelessness - agency - Generalized anxiety - COVID-19-related trauma - Restrictive eating	- both active SSI showed significantly better outcomes regarding depression, hopelessness, agency, and restrictive eating than control group - no difference between behavioral action and	

											control group regarding generalized anxiety and COVID-19-related trauma symptoms, but between growth mindset vs. control
Shabahang et al., 2021 [20]	N = 150 (intervention: n = 75; control: n = 75)	Convenient from Guilan University, online advertisement in college student social network	Female = 51.33% Male = 48.67%	M = 24.7 SD = 5.4	RCT	Iran	Video-based cognitive behavioral intervention for COVID-19 anxiety (intervention vs. waiting-list control)	Self-administered video-based strategies, online booklet	- COVID-19 anxiety - Health anxiety - Anxiety sensitivity - Somatosensory amplification	Significant differences in outcomes between intervention and control group - High satisfaction of intervention group of participants	
Simonsson et al., 2021 [62]	N = 177 (treatment: n = 88; waitlist control: n = 89)	Students from the University of Oxford, UK	Female = 64.4%	18 – 24 years (71.8%)	RCT	UK	Online guided, eight-week mindfulness program	Online classes via Zoom,	- anxiety - depression	- larger reduction of anxiety in treatment group compared to control group - no difference regarding depression	
Suffoletto et al., 2021 [47]	N = 52 (intervention: n = 34; Usual care group: n = 18)	Young adults with current mental health diagnosis, recruited from primary care or a	Female = 85%	Intervention: M = 18.7, SD = 0.42 Usual care group: M = 18.7, SD =	Pilot RCT	USA	Mobile Support Tool for Mental Health (MoST-MH) vs. enhanced usual care	- text messaging - web-based check-ins - video feedback (psycho-	- Mental health symptoms - mental health self-efficacy - mental health health care use	MoST-MH: - reduction of all symptoms except substance abuse eUC:	



	mental health clinic		0.48				(eUC)	education)			- only reduction in general anxiety, family distress, hostility - no improvements regarding self-efficacy and care use in either group
Sun et al., 2022 [59]	N = 114 University students, online via WeChat-based flyers and websites targeting college students	Female 73.7%	=	M = 22.21 SD = 2.67	RCT	China	Mindfulness-based mobile health (mHealth) intervention vs. matched social support mHealth control	- Videoconferencing via Zoom - WeChat based miniprogram	Primary outcomes: - anxiety - depression Secondary outcomes: - mindfulness - social support Emotional suppression	- reduction in anxiety and depression and increase in mindfulness and social support in both groups - greater effect on anxiety through mindfulness intervention - greater engagement to mindfulness mHealth and higher acceptability	
Torok et al., 2022 [60]	N = 455 Social media: persons with suicidal thoughts in the past 12 months	Female 84.4%	=	18 – 25 years (M = 21.5, SD = 2.18)	RCT	Australia	Self-guided smartphone application based on DBT vs. smartphone application with general information on health and	Smartphone application (LifeBuoy)	Primary outcome: - suicidal ideation symptom severity Secondary outcomes: - depression - generalized anxiety - Distress	- significant higher effects of intervention regarding suicidal ideation - no superior effects regarding	

Zhou & Wade, 2021 [56]	N = 100 (pre-Covid: n = 41; during COVID: n = 59)	University students at risk of developing an eating disorder	Female = 100%	= 17 – 26 years (M = 19.85, SD = 2.01)	RCT	Australia	lifestyle	Online intervention to reduce disordered eating vs. no intervention	Online format introduced in April 2021	- Well-being	- disordered eating - body image flexibility - self-compassion - fear of self-compassion - negative affect	secondary outcomes	- significant higher symptom-mology during COVID than pre-COVID - active intervention significantly increased self-compassion compared to control - no other significant time x condition effects

Note: M = mean; SD = standard deviation; DBT: dialectical behavior therapy; IMPACT: Intervention Media to Prevent Adolescent Cyber-Conflict Through Technology; MBI: Mindfulness-based intervention; P4C: philosophy for children

Table 3. Risk of Bias Assessment

Randomized Controlled Trials										
Author	True randomization	Concealed Allocation	Similar groups at baseline	Participants /personell /outcome assessors blinded to assignment	Identical treatment of groups	Follow-up: complete/full description	Analysis of participants in their groups	Outcome measurement: Equal /reliable	Appropriate statistical analysis	Appropriate trial design / deviations accounted for
Kutok et al., 2021 [57]	Randomized, but stratified by age and gender	Yes	Yes	Participants & personell: no Outcome assessors: yes	Yes	Yes	Yes	Yes	Yes	Yes
Malboeuf-Hurtubise et al., 2021 [63]	Unclear	Unclear	No	Unclear	Yes	No follow-up	Yes	Yes	Yes	No real control-group, two interventions
Pavarini et al., 2022 [61]	Yes	Unclear	Yes	Unclear	More assessments in treatment group	Yes	Yes	Yes	Yes	Yes
Prato et al., 2022 [55]	Yes	Unclear	Yes	Participants & personell: no Outcome assessors: unclear	Yes	Yes	Yes	Yes	Yes	Yes
Schleider et al., 2022	Unclear	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes

[58]											
Shabahan g et al., 2021	Yes	Unclear	Yes	Unclear	Yes	No follow-up	Yes	Yes	Yes	Yes	Yes
[20]											
Simonso n et al., 2021	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes
[62]											
Suffoletto et al., 2021 [47]	Unclear	Yes	Partially	Outcome assessors: yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sun et al., 2022 [59]	Yes	Unclear	Unclear	Participant / research assistant: yes (at first)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Torok et al., 2022 [60]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zhou & Wade, 2021 [56]	Yes	Unclear	Yes	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	Sample size intervention/control unbalanced
<b>Quasi-Experimental Studies</b>											
<b>Author</b>	<b>Clear distinction cause / effect</b>	<b>Similar participant in comparison</b>	<b>Similar treatment of comparison group</b>	<b>Control group</b>	<b>Multiple measurement of outcome pre /post intervention</b>	<b>Complete follow-up or description</b>	<b>Equal measurement of participants in comparisons</b>	<b>Reliable measurement of outcomes</b>	<b>Appropriate statistical analysis</b>		
Duan et al., 2022 [54]	Yes	Not applicable	Nort applicable	No	Unclear	Yes	Not applicable	Yes	Yes		



## 3.2 Characteristics of online interventions used in the included studies

Most of the included studies [54–57,59,61–63] applied different versions of videoconferencing systems by which interventions were delivered remotely (see table 2). In an intervention targeted at cyberbullying (IMPACT), Kutok et al. [57] added app-based automated messaging to their video-delivered intervention. Pavarini et al. added possibilities for smaller group discussions by using breakout rooms and WhatsApp for their online peer support training [61]. The mindfulness-based mobile health (mHealth) intervention by Sun et al. was supplemented by a WeChat-based mini-program [59]. Other interventions delivered remotely via videoconferencing were the Online Strength-informed Acceptance and Commitment Therapy (SACT) [54], mindfulness-based interventions [62,63], philosophy for children (P4C) [63], behavior therapy for Tourette syndrome [55], and an intervention to reduce disordered eating [56].

Next to these online interventions with teleconferencing systems, two studies applied self-administered online interventions. Schleider et al. [58] examined online-single interventions for depressive symptoms, and Shabahang et al. [20] targeted COVID-19-related anxiety with self-administered video-based strategies and online booklets. Text-messaging, web-based check-ins, and video feedback with psychoeducation were applied in a study by Suffoletto et al. [47] as a mobile support tool for mental health (MoST-MH). One study, [60] used a smartphone application (LifeBuoy) based on dialectical behavior therapy (DBT) to target suicidal ideation.

Only few studies reported on the feasibility and acceptability of their interventions. Those who did, however, found their intervention to be feasible [57] and acceptable [57,58], to be met with high satisfaction [20], and greater acceptance and engagement in their treatment group compared to the control group [59].

## 3.3 Effectiveness of Online Intervention Regarding Mental Health Outcomes

Mental health-related outcomes varied in the included studies (see table 2) and included anxiety, depression, mental well-being, social functioning, COVID-19-related symptoms, cyberbullying, Tourette syndrome, disordered eating, suicidal ideation, and psychological stress, among others.

### 3.3.1 Anxiety

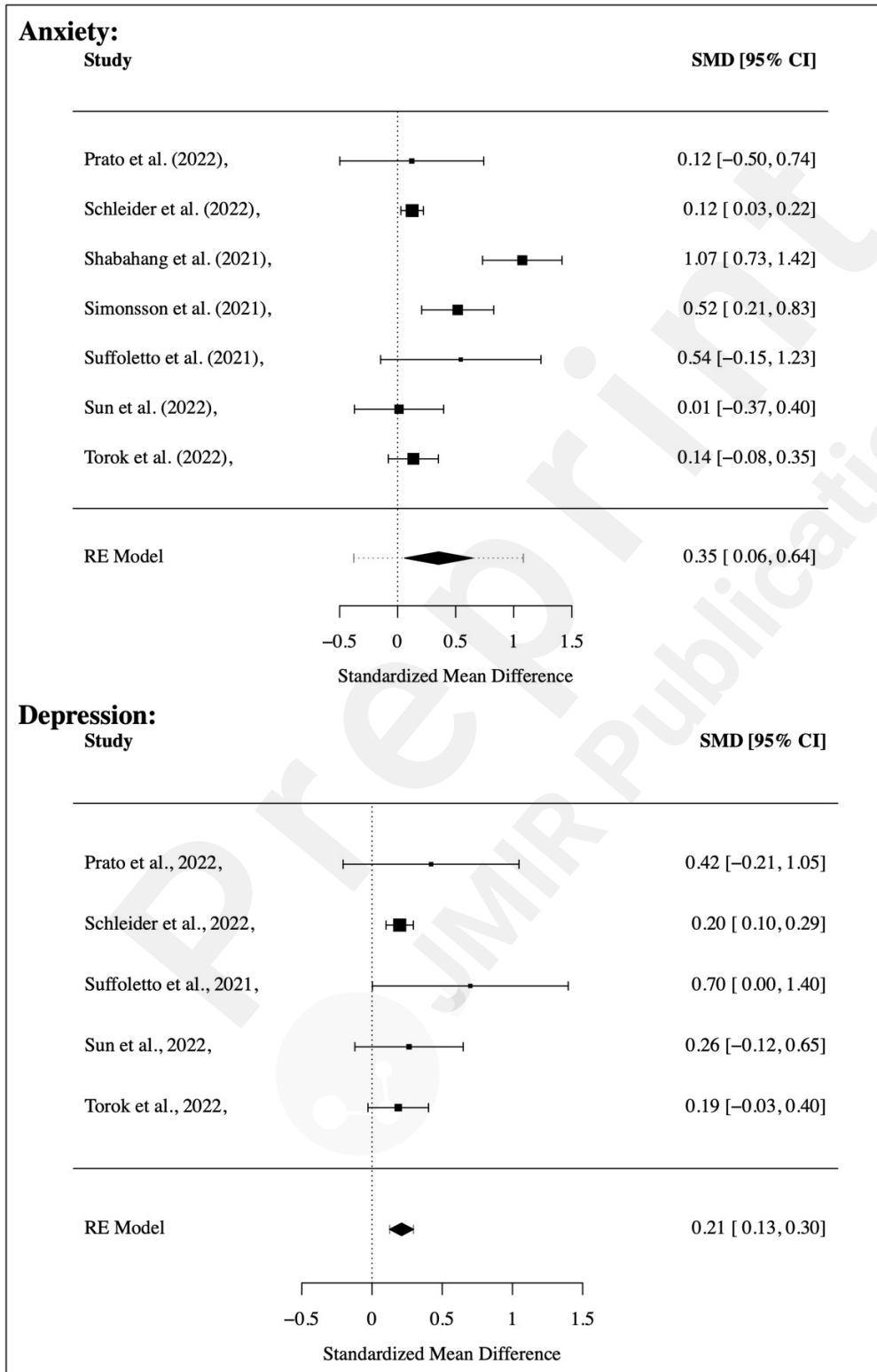
Several studies reported reduced anxiety [20,47,54,55,59,62,63]. The impact on anxiety was larger in

some studies for treatment than in control groups [20,59,62]. In contrast, others found only partial differences [58], equal effects, or no differences between groups [55,60]. Philosophy for children (P4C) was found to have a more significant impact on anxiety than mindfulness (MBI) in one study [63]. Meta-analysis of the seven studies, with six targeting generalized anxiety disorder and one health anxiety, showed an overall significant positive effect of interventions resulting in a decrease of symptoms (Standardized medium difference, SMD = 0.35, 95% CI 0.06 to 0.64,  $I^2 = 36\%$ ). Figure 2 shows a forest plot of the observed outcomes.

### 3.3.2 Depression

Reduced symptoms of depression were found in several studies [47,55,58,59] with superiority of the intervention group found in some [47,55,58]. The studies conducted by Sun et al. [59], Simonsson et al. [62], and Torok et al. [60] found no superior effects on depressive symptoms by the treatment groups. Nevertheless, a meta-analysis of five studies found a small treatment effect (SMD = 0.21, 95% CI 0.13 to 0.30,  $I^2 = 0.0\%$ .) The observed outcomes are depicted in a forest plot in figure 2.

**FIGURE 2. Meta-analysis of treatment effect regarding anxiety and depression**



Notes: Standardized mean differences and 95% confidence intervals for meta-analysis of interventions for anxiety and depression. Standardized mean differences are given for individual studies, as well as the overall standardized mean difference. Positive effect sizes indicate a decrease of symptoms. Confidence intervals including zero show non-significant effects.



### 3.3.3 Mental well-being, quality of life, agency/self-efficacy

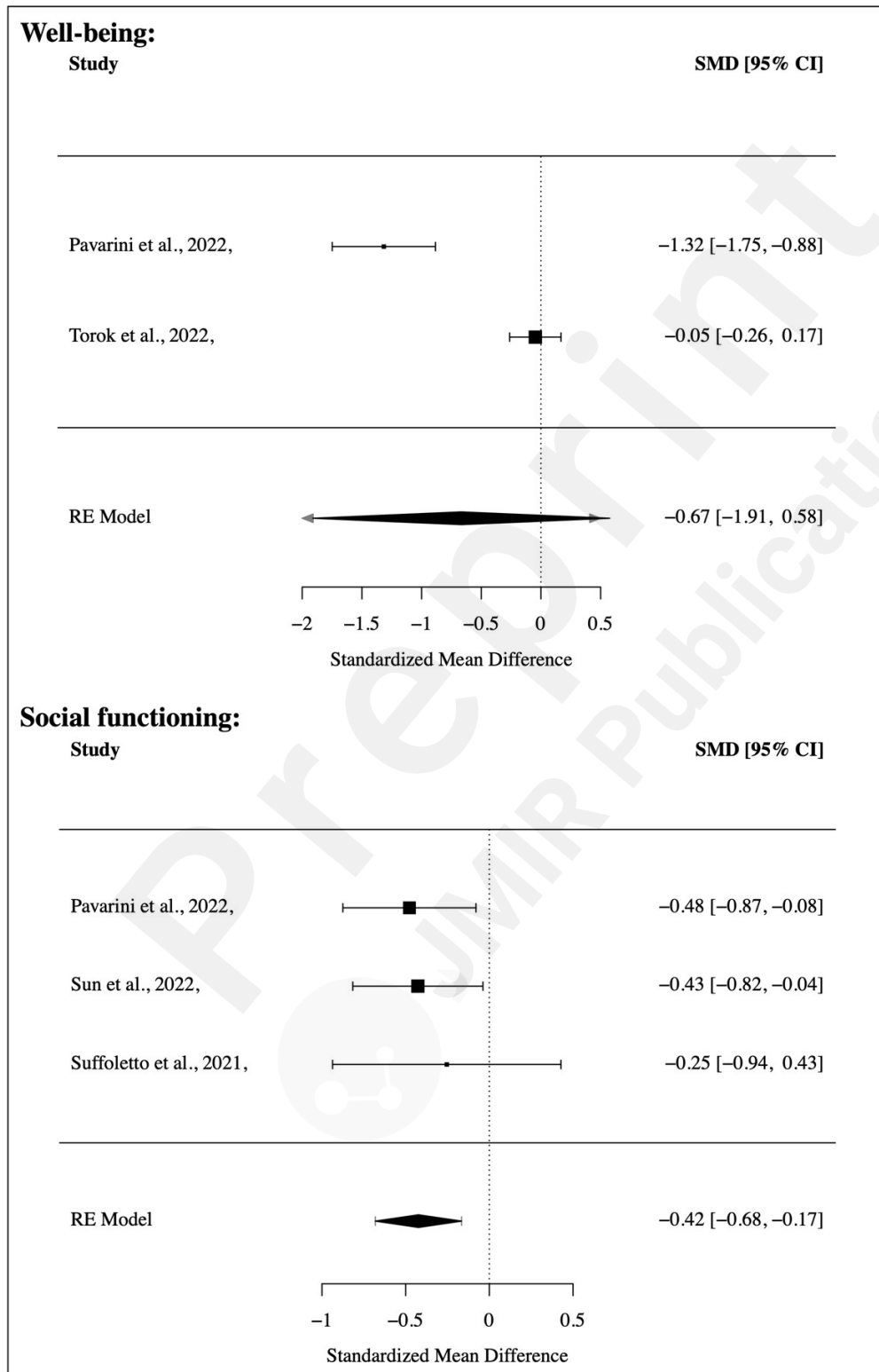
An increase in well-being was found in several studies [47,57,61,63]. Quality of life was found to be increased at three-month-follow-up in one study [54]. Self-efficacy or agency was increased in some studies [58,61], while one study found no effect [47]. Only two studies [60,61] were eligible for a meta-analysis analyzing the treatment effect on well-being. However, no significant effect was shown in the meta-analysis (see figure 3).

### 3.3.4 Other main outcomes

A study targeting cyberbullying increased bystander intervention in the treatment group [57], while another showed promising results regarding an increase in social support-giving skills, compassion towards others, and civic engagement, among other outcomes [61]. Tic and obsessive-compulsive symptoms in children and adolescents with Tourette syndrome were equally reduced via videoconference and face-to-face intervention [55]. By using a smartphone application, one study was able to reduce suicidal ideation significantly [60], and one study targeting disordered eating increased self-compassion through treatment, while no other effect was found [56].

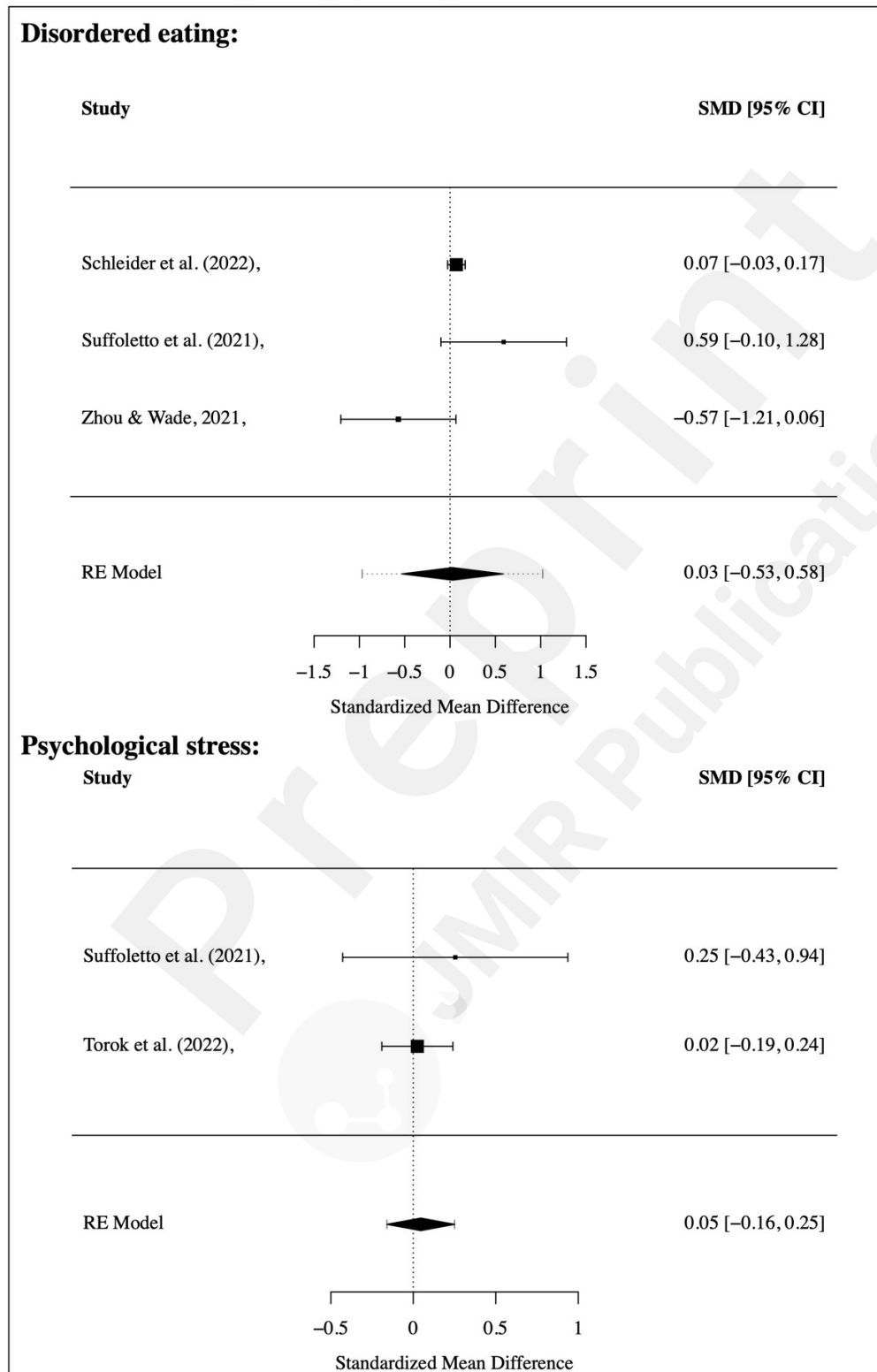
Meta-analyses were conducted for several of these outcomes. Regarding disordered eating, psychological stress (see figure 4), and covid-related trauma /anxiety (see figure 5), no significant treatment effects could be found across studies, while a significant medium effect (SMD = -0.42, 95% CI -0.68 to -0.17,  $I^2 = 0.0\%$ ) was found for interventions targeting social functioning in three studies [47,59,61] (see figure 3). For the outcomes, attention as well as emotional functioning, more data was needed for meta-analyses, respectively.

**FIGURE 3. Meta-analysis of treatment effect regarding well-being and social functioning**



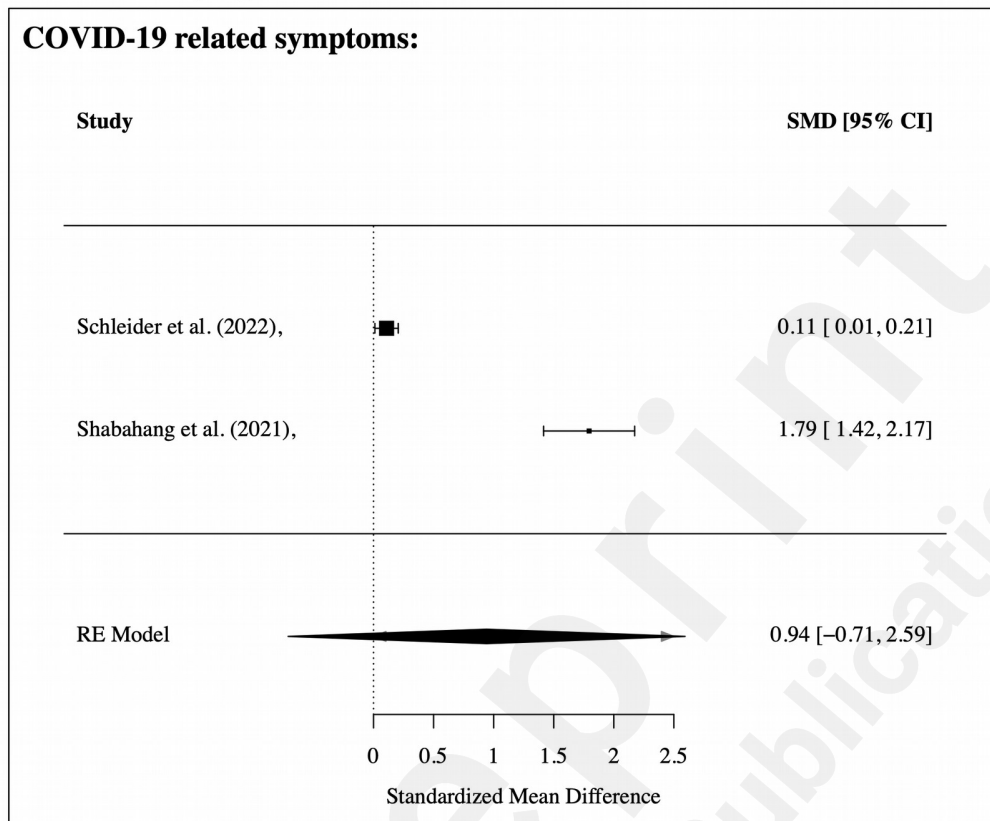
Notes: Standardized mean differences and 95% confidence intervals for meta-analysis of interventions for well-being and social functioning. Standardized mean differences are given for individual studies, as well as the overall standardized mean difference. Negative effect sizes indicate an increase of social functioning and well-being. Confidence intervals including zero show non-significant effects.

**FIGURE 4. Meta-analysis of treatment effect regarding disordered eating and psychological stress**



Notes: Standardized mean differences and 95% confidence intervals for meta-analysis of interventions for disordered eating and psychological stress. Standardized mean differences are given for individual studies, as well as the overall standardized mean difference. Confidence intervals including zero show non-significant effects. Positive effects indicate a reduction of symptoms.

**FIGURE 5. Meta-analysis of treatment effect regarding COVID-19 related symptoms**



Notes: Standardized mean differences and 95% confidence intervals for meta-analysis of interventions for COVID-19 related symptoms. Standardized mean differences are given for individual studies, as well as the overall standardized mean difference. Confidence intervals including zero show non-significant effects. Positive effects indicate a reduction of symptoms.

## 4. Discussion

### 4.1 Principal results

Twelve studies conducted between the onset of the COVID-19-pandemic and August 2022 were eligible for inclusion in this systematic review and meta-analysis examining the effectiveness of online/remote interventions for different mental health issues in children, adolescents, and young adults with the background of increased need for such interventions due to the COVID-19 pandemic. In essence, all the studies found at least effects on some of their targeted outcomes through their remotely delivered interventions.

Eleven [20,47,55–63] out of twelve included articles were randomized-controlled trials, although only one study compared the online intervention to a face-to-face intervention [55]. Nevertheless, this is expected due to the great need for fast solutions to deliver any interventions with the ongoing pandemic and obstacles like quarantine, lockdowns, and increased safety measures. The mentioned

study found almost equal effects of both online and not-online intervention [55].

While some of the included studies had waitlist- or no-intervention control groups [20,56,61,62], others compared different kinds of interventions [63] or used different contents as control groups [47,57–60], which might also impact the comparability of studies regarding the effectiveness of interventions. Most of the included studies used a videoconferencing system, although several applied interventions were developed or adapted especially for online delivery.

Meta-analyses on treatment effectiveness yielded small effects regarding depressive symptoms and medium effects regarding anxiety as well as social functioning. The results indicate that online/remote interventions show promising results regarding the variables mentioned above. Concerning depressive symptoms, only three [47,58,59] of five studies had depressive symptoms as the primary outcome. In comparison, in the other two [55,60], depressive symptoms posed only as secondary outcomes, which might indicate the good effectiveness of different interventions regarding these symptoms.

Concerning other variables, the picture could be clearer: interventions to improve well-being and to reduce psychological stress, disordered eating, and covid-related psychological symptoms did not show significant effects across studies in the meta-analyses. One must consider, however, that only a few studies each were eligible for these calculations. Only two studies could be included in the analyses regarding well-being. One used a zoom-based intervention focusing on peer support [61], while the other applied an app to reduce suicidal ideation [60]. Thus, next to different main interventions using different kinds of online/remote applications, it can be assumed that the baseline state of well-being or differently expressed amount of suffering is quite different between the two studies, which might explain the lack of a significant overall treatment effect.

Psychological stress was analyzed in two additional studies [47,60]; the same is true for the meta-analysis of interventions for covid-related outcomes [20,58]. There were also two different outcomes used in the latter two studies: one [58] examined covid-19 related trauma, while the other [20] focused on COVID-19-related anxiety. However, the systematic review by Bonardi et al. [40] found three high-quality studies which were able to reduce different covid-19-related symptoms like anxiety and depressive symptoms in adults post-intervention [64] or at least six weeks after intervention [65,66]; this shows that there seem to be some online/remote interventions available for adult participants.

Regarding disordered eating, the lack of overall treatment effect across the studies could indicate that more than remote therapy is needed in the case of eating disorders and symptoms. Eating disorders might require approaches that include the somatic aspects in a clinical setting to regularly control treatment compliance [67]. A previous meta-analysis found similar results with the lowest effectiveness of online interventions for eating disorders [68]. The study by Zhou and Wade [56]

compared symptoms before the onset of COVID-19 and during COVID-19 and found more symptoms during the pandemic, underlining the increased need for interventions due to the pandemic. While disordered eating and body image flexibility decreased in patients entering both before and during the pandemic, the impact of the intervention on self-compassion decreased during the pandemic. All in all, for all the variables showing no overall treatment effects, the small number of studies suggests that more research is needed before a clear conclusion regarding the effectiveness of remote/online interventions can be drawn.

The digital transition to online or remotely delivered interventions is important, not only in light of challenging circumstances like the COVID-19 pandemic, which made face-to-face treatment in many cases impossible, but also in light of the ever-increasing numbers of children, adolescents, and young adults experiencing mental health issues or who have psychological disorders. Thus, it is relevant to develop low-threshold interventions [10,11,16,18]. Nevertheless, several factors have to be kept in mind: legal frameworks might need to be adapted for different countries[10], and therapists might need support when transitioning to online interventions [10,28]. Regarding the development of such interventions, studies show positive effects by including peer groups in the development process [35,37], and also by using peers as advisors [36,38].

However, using digital media and smartphones in themselves might pose risk factors for children and adolescents: an increase in cyber victimization through media use has been found [57], and young people are more at risk for addictive behavior in general [7]. Problematic behavior has also been discussed for problematic smartphone use [45], which has been found to impede mental well-being and quality of life in children and adolescents [69].

## 4.2 Limitations

While the presented meta-analysis and literature review is the first to report the effects of online interventions for children, adolescents, and young adults during the pandemic, some limitations of this systematic review and meta-analysis have to be reported. One of the included studies is not a RCT [54]. However, the results of this study are only reported descriptively, as they are not included in the meta-analysis. Control groups in most studies do not consist of face-to-face interventions due to the nature of the pandemic; nevertheless, this might impede the validity of conclusions regarding the effectiveness of online interventions per se. In some cases, the risk of bias assessment revealed a need for more information regarding the concealment of allocation and blinding of participants, personnel, and/or outcome assessors. At the same time, proper randomization is only sometimes apparent (see table 3). This might reduce the quality of included studies. Above all, studies examined various outcomes and used different kinds of media/kinds of rendition of the online/remote intervention so that in the sample, no two studies examine the same intervention. The sample is relatively small, leading to even smaller sample sizes of the outcome groups that were analyzed quantitatively. When the literature

search was conducted, several other studies matching the search criteria were registered, but results were not yet available.

### 4.3 Comparison with prior work

To date, no systematic review or meta-analysis exists investigating online or remote intervention for psychological symptoms and disorders in children, adolescents, and young adults after the onset of the COVID-19 pandemic. A systematic review by Bonardi et al. [40] found three well-conducted studies on interventions regarding COVID-19-related symptoms like anxiety and depressive symptoms. Still, it did not include any study considering children and adolescents. Other reviews also included studies conducted before the pandemic [41,43] or only studies before the onset of COVID-19 [42]. The effectiveness of interventions was mostly found to be equal to control groups [41,42], and, like in this review, sample numbers of quality studies are small, and the need for future research is suggested [40–42]. Systematic reviews conducted before the pandemic on online interventions or prevention programs for mental health [70] and depression, specifically [71] in young people, have shown promising but not completely unequivocal results suggesting the need for more extensive quality research even before the pandemic. Not limited to adolescents and young adults, another review comparing digital to face-to-face cognitive behavioral therapy for depression found equal effectiveness [72].

### 4.4 Conclusion

All in all, the included studies show promising results regarding the implementation of online or app-based interventions for mental health issues for children, adolescents, and young adults both in light of increased need with increasing prevalence rates for psychological disorders in these groups but also in light of challenges like restricted access to treatment like due to the COVID-19 pandemic. However, more high-quality research is needed for different interventions with higher comparability.

## 5. Acknowledgements

The authors want to appreciate the contribution of NÖ Landesgesundheitsagentur, legal entity of University Hospitals in Lower Austria, for providing the organizational framework to conduct this

research. They also want to acknowledge support from the Open Access Publishing Fund of Karl Landsteiner University of Health Sciences, Krems, Austria.

## 6. Conflicts of interest

None declared

## 7. Abbreviations

CI: confidence interval

N / n: number

QoL: Quality of Life

SMD: standardized mean difference

## 8. References

1. Costello EJ, Mustillo S, Erkanli A, Keeler G, Angold A. Prevalence and Development of Psychiatric Disorders in Childhood and Adolescence. *Arch Gen Psychiatry* 2003 Aug 1;60(8):837–844. doi: 10.1001/archpsyc.60.8.837
2. Fuchs M, Karwautz A. Epidemiologie psychischer Störungen bei Kindern und Jugendlichen: Eine narrative Übersichtsarbeit unter Berücksichtigung österreichischer Daten. *neuropsychiatrie* 2017 Sep;31(3):96–102. doi: 10.1007/s40211-017-0238-x
3. Merikangas KR, Nakamura EF, Kessler RC. Epidemiology of mental disorders in children and adolescents. *Dialogues Clin Neurosci Taylor & Francis*; 2009 Mar 31;11(1):7–20. doi: 10.31887/DCNS.2009.11.1/krmerikangas
4. Polanczyk GV, Salum GA, Sugaya LS, Caye A, Rohde LA. Annual research review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *J Child Psychol Psychiatry Wiley Online Library*; 2015;56(3):345–365.
5. Wilson S, Hicks BM, Foster KT, McGue M, Iacono WG. Age of onset and course of major depressive disorder: associations with psychosocial functioning outcomes in adulthood. *Psychol Med* 2015 Feb;45(3):505–514. doi: 10.1017/S0033291714001640
6. Dahl RE, Allen NB, Wilbrecht L, Suleiman AB. Importance of investing in adolescence from a developmental science perspective. *Nature* 2018 Feb;554(7693):441–450. doi: 10.1038/nature25770
7. Chambers RA, Taylor JR, Potenza MN. Developmental Neurocircuitry of Motivation in Adolescence: A Critical Period of Addiction Vulnerability. *Am J Psychiatry American Psychiatric Publishing*; 2003 Jun;160(6):1041–1052. doi: 10.1176/appi.ajp.160.6.1041
8. Philipp J, Zeiler M, Waldherr K, Truttmann S, Dür W, Karwautz AFK, Wagner G. Prevalence of emotional and behavioral problems and subthreshold psychiatric disorders in Austrian adolescents and the need for prevention. *Soc Psychiatry Psychiatr Epidemiol* 2018 Dec;53(12):1325–1337. doi: 10.1007/s00127-018-1586-y
9. Wagner G, Zeiler M, Waldherr K, Philipp J, Truttmann S, Dür W, Treasure JL, Karwautz AFK. Mental health problems in Austrian adolescents: a nationwide, two-stage epidemiological study applying DSM-5 criteria. *Eur Child Adolesc Psychiatry* 2017 Dec;26(12):1483–1499. doi: 10.1007/s00787-017-0999-6
10. Eichenberg C. Onlinepsychotherapie in Zeiten der Coronapandemie. *Psychotherapeut*



2021 May;66(3):195–202. doi: 10.1007/s00278-020-00484-0

11. Magson NR, Freeman JYA, Rapee RM, Richardson CE, Oar EL, Fardouly J. Risk and Protective Factors for Prospective Changes in Adolescent Mental Health during the COVID-19 Pandemic. *J Youth Adolesc* 2021 Jan;50(1):44–57. doi: 10.1007/s10964-020-01332-9
12. Dale R, Budimir S, Probst T, Stipl P, Pieh C. Mental Health during the COVID-19 Lockdown over the Christmas Period in Austria and the Effects of Sociodemographic and Lifestyle Factors. *Int J Environ Res Public Health* 2021 Apr 1;18(7):3679. doi: 10.3390/ijerph18073679
13. Huscsava MM, Scharinger C, Plener PL, Kothgassner OD. ‘The world somehow stopped moving’: impact of the COVID-19 pandemic on adolescent psychiatric outpatients and the implementation of teletherapy. *Child Adolesc Ment Health* John Wiley & Sons, Ltd; 2022 Sep 1;27(3):232–237. doi: 10.1111/camh.12481
14. Özlü-Erkilic Z, Kothgassner OD, Wenzel T, Goreis A, Chen A, Ceri V, Fakhr Mousawi A, Akkaya-Kalayci T. Does the Progression of the COVID-19 Pandemic Have an Influence on the Mental Health and Well-Being of Young People? A Cross-Sectional Multicenter Study. *Int J Environ Res Public Health* 2021;18(23). doi: 10.3390/ijerph182312795
15. Pieh C, Plener PL, Probst T, Dale R, Humer E. Assessment of Mental Health of High School Students During Social Distancing and Remote Schooling During the COVID-19 Pandemic in Austria. *JAMA Netw Open* 2021 Jun 28;4(6):e2114866. doi: 10.1001/jamanetworkopen.2021.14866
16. Pierce M, McManus S, Hope H, Hotopf M, Ford T, Hatch SL, John A, Kontopantelis E, Webb RT, Wessely S, Abel KM. Mental health responses to the COVID-19 pandemic: a latent class trajectory analysis using longitudinal UK data. *Lancet Psychiatry* 2021 Jul;8(7):610–619. doi: 10.1016/S2215-0366(21)00151-6
17. Schlack R, Neuperd L, Junker S, Eicher S, Hölling H, Thom J, Ravens-Sieberer U, Beyer A-K. Changes in the mental health in the children’s and adolescent population in Germany during the COVID-19 pandemic – Results of a rapid review. *Robert Koch-Institut*; 2022 Dec; doi: 10.25646/10761
18. Panchal U, Salazar de Pablo G, Franco M, Moreno C, Parellada M, Arango C, Fusar-Poli P. The impact of COVID-19 lockdown on child and adolescent mental health: systematic review. *Eur Child Adolesc Psychiatry* 2021 Aug 18; doi: 10.1007/s00787-021-01856-w
19. Loades ME, Chatburn E, Higson-Sweeney N, Reynolds S, Shafran R, Brigden A, Linney C, McManus MN, Borwick C, Crawley E. Rapid Systematic Review: The Impact of Social Isolation and Loneliness on the Mental Health of Children and Adolescents in the Context of COVID-19. *J Am Acad Child Adolesc Psychiatry* 2020 Nov;59(11):1218-1239.e3. doi: 10.1016/j.jaac.2020.05.009
20. Shabahang R, Aruguete MS, McCutcheon L. Video-based cognitive-behavioral intervention for COVID-19 anxiety: a randomized controlled trial. *Trends Psychiatry Psychother Associação de Psiquiatria do Rio Grande do Sul*; 2021 May 21;43:141–150. doi: 10.47626/2237-6089-2020-0056
21. Gutmann MT, Aysel M, Özlü-Erkilic Z, Popow C, Akkaya-Kalayci T. Mental health problems of children and adolescents, with and without migration background, living in Vienna, Austria. *Child Adolesc Psychiatry Ment Health* 2019 Dec;13(1):35. doi: 10.1186/s13034-019-0295-y
22. Haner D, Pepler D. “Live Chat” Clients at Kids Help Phone: Individual Characteristics and Problem Topics. *J Can Acad Child Adolesc Psychiatry* 2016;25(3):138–144. PMID:27924143
23. Simpson SG, Reid CL. Therapeutic alliance in videoconferencing psychotherapy: A review: Alliance in videoconferencing psychotherapy. *Aust J Rural Health* 2014 Dec;22(6):280–299. doi: 10.1111/ajr.12149
24. Avenevoli S, Swendsen J, He J-P, Burstein M, Merikangas KR. Major Depression in

- the National Comorbidity Survey–Adolescent Supplement: Prevalence, Correlates, and Treatment. *J Am Acad Child Adolesc Psychiatry* 2015 Jan 1;54(1):37-44.e2. doi: 10.1016/j.jaac.2014.10.010
25. Forman-Hoffman V, McClure E, McKeeman J, Wood CT, Middleton JC, Skinner AC, Perrin EM, Viswanathan M. Screening for Major Depressive Disorder in Children and Adolescents: A Systematic Review for the U.S. Preventive Services Task Force. *Ann Intern Med* 2016 Mar 1;164(5):342. doi: 10.7326/M15-2259
26. Engelhardt E, Engels S. Einführung in die Methoden der Videoberatung. 2021;19.
27. Finger-Ossinger M. Internetberatung und Psychotherapie: reflektierte Erfahrungen von Psychotherapeut\_innen und Klient\_innen. *Psychother Forum* 2021 Dec;25(3–4):115–123. doi: 10.1007/s00729-021-00186-1
28. Zubala A, Hackett S. Online art therapy practice and client safety: a UK-wide survey in times of COVID-19. *Int J Art Ther* 2020 Oct 1;25(4):161–171. doi: 10.1080/17454832.2020.1845221
29. Felnhofer A, Fischer-Grote L. Einsatz neuer Medien in der pädiatrischen Psychosomatik. *Monatsschr Kinderheilkd* 2021 Jul;169(7):628–632. doi: 10.1007/s00112-021-01184-y
30. Schultze NG. Erfolgsfaktoren des virtuellen Settings in der psychologischen Internet-Beratung. 2007;8.
31. Backhaus A, Agha Z, Maglione ML, Repp A, Ross B, Zuest D, Rice-Thorp NM, Lohr J, Thorp SR. Videoconferencing psychotherapy: A systematic review. *Psychol Serv* 2012 May;9(2):111–131. doi: 10.1037/a0027924
32. Pretorius C, Chambers D, Coyle D. Young People’s Online Help-Seeking and Mental Health Difficulties: Systematic Narrative Review. *J Med Internet Res* 2019 Nov 19;21(11):e13873. doi: 10.2196/13873
33. Naslund JA, Bondre A, Torous J, Aschbrenner KA. Social Media and Mental Health: Benefits, Risks, and Opportunities for Research and Practice. *J Technol Behav Sci* 2020 Sep;5(3):245–257. doi: 10.1007/s41347-020-00134-x
34. Grist R, Porter J, Stallard P. Mental Health Mobile Apps for Preadolescents and Adolescents: A Systematic Review. *J Med Internet Res* 2017 May 25;19(5):e176. doi: 10.2196/jmir.7332
35. Thabrew H, Fleming T, Hetrick S, Merry S. Co-design of eHealth Interventions With Children and Young People. *Front Psychiatry* 2018 Oct 18;9:481. doi: 10.3389/fpsy.2018.00481
36. Jesser A, Schmalwieser S, Mädge A-L, Culen C, Schrank B, Böckle M. Chancen niederschwelliger online Peer-to-Peer Begleitung für Jugendliche am Beispiel der Online-Plattform OPEN. *Psychother Forum* 2021 Dec;25(3–4):154–160. doi: 10.1007/s00729-021-00188-z
37. Mittmann G, Schmalwieser SS, Diendorfer T, Schrank B, Boeckle M. Peer Facilitators as Core Co-developers of an Online Peer Encouragement Network (OPEN2chat) for Austrian Adolescents. *Front Digit Health* 2022 Jun 16;4:833006. doi: 10.3389/fdgth.2022.833006
38. Schmalwieser S, Jesser A, Mädge A-L, Schrank B, Böckle markus. open2chat – eine digitale Peer-to-Peer-Begleitung für Jugendliche. Theoretische Zugänge und praktische Lösungen. Universität für Weiterbildung Krems & e-beratungsjournal.net; 2022; doi: 10.48341/8PJB-9S38
39. Zubala A, Kennell N, Hackett S. Art Therapy in the Digital World: An Integrative Review of Current Practice and Future Directions. *Front Psychol* 2021 Apr 8;12:595536. doi: 10.3389/fpsyg.2021.600070
40. Bonardi O, Wang Y, Li K, Jiang X, Krishnan A, He C, Sun Y, Wu Y, Boruff JT, Markham S, Rice DB, Thombs-Vite I, Tasleem A, Santo TD, Yao A, Azar M, Agic B, Fahim C, Martin MS, Sockalingam S, Turecki G, Benedetti A, Thombs BD. Effects of COVID-19

Mental Health Interventions Among Children, Adolescents, and Adults Not Quarantined or Undergoing Treatment Due to COVID-19 Infection: A Systematic Review of Randomised Controlled Trials. *Can J Psychiatry* SAGE Publications Inc; 2022 May 1;67(5):336–350. doi: 10.1177/07067437211070648

41. Carneiro L, Rosenbaum S, Ward PB, Clemente FM, Ramirez-Campillo R, Monteiro-Júnior RS, Martins A, Afonso J. Web-based exercise interventions for patients with depressive and anxiety disorders: a systematic review of randomized controlled trials. *Braz J Psychiatry* 2021 Nov 24;44(3):331–341. PMID:34852034

42. Valentine AZ, Hall SS, Young E, Brown BJ, Groom MJ, Hollis C, Hall CL. Implementation of Telehealth Services to Assess, Monitor, and Treat Neurodevelopmental Disorders: Systematic Review. *J Med Internet Res* 2021 Jan 20;23(1):e22619. doi: 10.2196/22619

43. Yunus WMAWM, Matinelli H-M, Waris O, Upadhyaya S, Vuori M, Korpilahti-Leino T, Ristkari T, Koffert T, Sourander A. Digitalized Cognitive Behavioral Interventions for Depressive Symptoms During Pregnancy: Systematic Review. *J Med Internet Res* 2022 Feb 23;24(2):e33337. doi: 10.2196/33337

44. Colasante T, Lin L, De France K, Hollenstein T. Any time and place? Digital emotional support for digital natives. *Am Psychol United States*; 2022 Mar;77(2):186–195. PMID:32969678

45. Cha S-S, Seo B-K. Smartphone use and smartphone addiction in middle school students in Korea: Prevalence, social networking service, and game use. *Health Psychol Open* SAGE Publications Ltd; 2018 Jan 1;5(1):2055102918755046. doi: 10.1177/2055102918755046

46. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Ann Intern Med American College of Physicians*; 2009 Aug 18;151(4):264–269. doi: 10.7326/0003-4819-151-4-200908180-00135

47. Suffoletto B, Goldstein T, Gotkiewicz D, Gotkiewicz E, George B, Brent D. Acceptability, Engagement, and Effects of a Mobile Digital Intervention to Support Mental Health for Young Adults Transitioning to College: Pilot Randomized Controlled Trial. *JMIR Form Res* 2021 Oct 14;5(10):e32271. doi: 10.2196/32271

48. Viechtbauer W. Conducting Meta-Analyses in R with the metafor Package. *J Stat Softw* 2010 Aug 5;36(3):1–48. doi: 10.18637/jss.v036.i03

49. Higgins JPT. Measuring inconsistency in meta-analyses. *BMJ* 2003 Sep 6;327(7414):557–560. doi: 10.1136/bmj.327.7414.557

50. Cohen J. *Statistical power analysis for the behavioral sciences*. Hillsdale, N.J.: L. Erlbaum Associates; 1988. ISBN:978-0-8058-0283-2

51. Faraone SV. Interpreting estimates of treatment effects: implications for managed care. *P T Peer-Rev J Formul Manag United States*; 2008 Dec;33(12):700–711. PMID:19750051

52. Tufanaru C, Munn Z, Aromataris E, Campbell J, Hopp L. Chapter 3: Systematic reviews of effectiveness. In: Aromataris E, Munn Z, editors. *Joanna Briggs Inst Rev Man* 2017.

53. R Core Team. *R: A language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing; 2022. Available from: <https://www.R-project.org>

54. Duan W, Kong Y, Bu H, Guan Q, Chen Z, Luo Q, Zhang J. *The Online Strength-Informed Acceptance and Commitment Therapy Among COVID-19-Affected Adolescents*. *Res Soc Work Pract* SAGE Publications Inc; 2022 May 1;32(4):465–474. doi: 10.1177/10497315211067270

55. Prato A, Maugeri N, Chiarotti F, Morcaldi L, Vicario CM, Barone R, Rizzo R. A Randomized Controlled Trial Comparing Videoconference vs. Face-to-Face Delivery of Behavior Therapy for Youths With Tourette Syndrome in the Time of COVID-19. *Front Psychiatry* 2022 May 24;13:862422. PMID:35686189

56. Zhou Y, Wade TD. The impact of COVID-19 on body-dissatisfied female university students. *Int J Eat Disord* 2021;54(7):1283–1288. doi: 10.1002/eat.23521
57. Kutok ER, Dunsiger S, Patena JV, Nugent NR, Riese A, Rosen RK, Ranney ML. A Cyberbullying Media-Based Prevention Intervention for Adolescents on Instagram: Pilot Randomized Controlled Trial. *JMIR Ment Health* 2021 Sep 15;8(9):e26029. doi: 10.2196/26029
58. Schleider JL, Mullarkey MC, Fox KR, Dobias ML, Shroff A, Hart EA, Roulston CA. A randomized trial of online single-session interventions for adolescent depression during COVID-19. *Nat Hum Behav Nature Publishing Group*; 2022 Feb;6(2):258–268. doi: 10.1038/s41562-021-01235-0
59. Sun S, Lin D, Goldberg S, Shen Z, Chen P, Qiao S, Brewer J, Loucks E, Operario D. A mindfulness-based mobile health (mHealth) intervention among psychologically distressed university students in quarantine during the COVID-19 pandemic: A randomized controlled trial. *J Couns Psychol US: American Psychological Association*; 2022;69(2):157–171. doi: 10.1037/cou0000568
60. Torok M, Han J, McGillivray L, Wong Q, Werner-Seidler A, O’Dea B, Calear A, Christensen H. The effect of a therapeutic smartphone application on suicidal ideation in young adults: Findings from a randomized controlled trial in Australia. Tomlinson M, editor. *PLOS Med* 2022 May 31;19(5):e1003978. doi: 10.1371/journal.pmed.1003978
61. Pavarini G, Reardon T, Hollowell A, Bennett V, Lawrance E, Brooks-Hall E, Foster-Estwick A, Juma DO, Lewis P, Power L, Rogers M, Pinfold V, Singh I, Peer Support Young People’s Advisory Group. Online peer support training to promote adolescents’ emotional support skills, mental health and agency during COVID-19: Randomised controlled trial and qualitative evaluation. *Eur Child Adolesc Psychiatry* 2022 Feb 17; doi: 10.1007/s00787-021-01933-0
62. Simonsson O, Bazin O, Fisher SD, Goldberg SB. Effects of an eight-week, online mindfulness program on anxiety and depression in university students during COVID-19: A randomized controlled trial. *Psychiatry Res* 2021 Nov 1;305:114222. doi: 10.1016/j.psychres.2021.114222
63. Malboeuf-Hurtubise C, Léger-Goodes T, Mageau GA, Joussemet M, Herba C, Chadi N, Lefrançois D, Camden C, Bussi eres  -L, Taylor G,  thier M-A, Gagnon M. Philosophy for children and mindfulness during COVID-19: Results from a randomized cluster trial and impact on mental health in elementary school students. *Prog Neuropsychopharmacol Biol Psychiatry* 2021 Apr 20;107:110260. doi: 10.1016/j.pnpbp.2021.110260
64. Wahlund T, Mataix-Cols D, Olofsdotter Lauri K, de Schipper E, Lj tsson B, Aspvall K, Andersson E. Brief Online Cognitive Behavioural Intervention for Dysfunctional Worry Related to the COVID-19 Pandemic: A Randomised Controlled Trial. *Psychother Psychosom* 2021;90(3):191–199. doi: 10.1159/000512843
65. Kahlon MK, Aksan N, Aubrey R, Clark N, Cowley-Morillo M, Jacobs EA, Mundhenk R, Sebastian KR, Tomlinson S. Effect of Layperson-Delivered, Empathy-Focused Program of Telephone Calls on Loneliness, Depression, and Anxiety Among Adults During the COVID-19 Pandemic: A Randomized Clinical Trial. *JAMA Psychiatry* 2021 Jun 1;78(6):616. doi: 10.1001/jamapsychiatry.2021.0113
66. Thombs BD, Kwakkenbos L, Levis B, Bourgeault A, Henry RS, Levis AW, Harb S, Tao L, Carrier M-E, Bustamante L, Duchek D, Dyas L, El-Baalbaki G, Ellis K, Rice DB, Wurz A, Nordlund J, Gagarine M, Turner KA,  stb  N, Culos-Reed N, Hebblethwaite S, Patten S, Bartlett SJ, Varga J, Mouthon L, Markham S, Martin MS, Benedetti A. Effects of a multi-faceted education and support programme on anxiety symptoms among people with systemic sclerosis and anxiety during COVID-19 (SPIN-CHAT): a two-arm parallel, partially nested, randomised, controlled trial. *Lancet Rheumatol* 2021 Jun;3(6):e427–e437. doi: 10.1016/S2665-9913(21)00060-6

67. Walsh BT, Fairburn CG, Mickley D, Sysko R, Parides MK. Treatment of Bulimia Nervosa in a Primary Care Setting. *Am J Psychiatry* American Psychiatric Publishing; 2004 Mar 1;161(3):556–561. doi: 10.1176/appi.ajp.161.3.556
68. Barak A, Hen L, Boniel-Nissim M, Shapira N. A Comprehensive Review and a Meta-Analysis of the Effectiveness of Internet-Based Psychotherapeutic Interventions. *J Technol Hum Serv Routledge*; 2008 Jul 3;26(2–4):109–160. doi: 10.1080/15228830802094429
69. Fischer-Grote L, Kothgassner OD, Felhofer A. The impact of problematic smartphone use on children’s and adolescents’ quality of life: A systematic review. *Acta Paediatr* 2021 May;110(5):1417–1424. doi: 10.1111/apa.15714
70. Clarke AM, Kuosmanen T, Barry MM. A systematic review of online youth mental health promotion and prevention interventions. *J Youth Adolesc Springer*; 2015;44(1):90–113.
71. Rice SM, Goodall J, Hetrick SE, Parker AG, Gilbertson T, Amminger GP, Davey CG, McGorry PD, Gleeson J, Alvarez-Jimenez M. Online and Social Networking Interventions for the Treatment of Depression in Young People: A Systematic Review. *J Med Internet Res* 2014 Sep 16;16(9):e206. doi: 10.2196/jmir.3304
72. Kambeitz-Illankovic L, Rzayeva U, Völkel L, Wenzel J, Weiske J, Jessen F, Reininghaus U, Uhlhaas PJ, Alvarez-Jimenez M, Kambeitz J. A systematic review of digital and face-to-face cognitive behavioral therapy for depression. *Npj Digit Med* 2022 Sep 15;5(1):144. doi: 10.1038/s41746-022-00677-8