Psychological Responses to the COVID-19 Pandemic and the Role of Psychological Interventions

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Chapter 1

Psychological Interventions for COVID-19 Pandemic-Related Anxiety: A Systematic Review

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Abstract

The COVID-19 pandemic was associated with increased levels of anxiety, fear and psychological distress across our global population. A range of existing psychological interventions were adopted and/or adapted to target pandemic-related anxiety and distress. This systematic review examined the characteristics and effectiveness of psychological interventions that focus on pandemic-related anxiety and assess the quality of the studies reporting on these interventions. Three databases were searched for quantitative research with controlled and uncontrolled designs published between 2019 and 2025. A structured narrative synthesis was conducted with an effect direction plot, in line with Synthesis Without Meta-Analysis (SWiM) guidance. Thirteen studies were included, seven of which utilised a randomised control trial design. Intervention modalities included cognitive behavioural therapy, acceptance and commitment therapy, transdiagnostic and multimodal approaches. All interventions that reported delivery dates occurred between 2020 and 2023, during the COVID-19 pandemic. Formats included individual, self-guided and group, with some delivered in person and others face-to-face. All studies were rated as moderate or high quality and all showed reductions in pandemic-related anxiety, with effects ranging from medium to large. Improvements were observed across different populations, intervention modalities and delivery formats. The findings suggest that psychological interventions can be effective in reducing pandemic-related anxiety. The review concludes by highlighting the relevance of developing and evaluating interventions that are adaptable across different phases of a pandemic and assessing their effectiveness over time as the nature of anxiety and its maintaining processes evolve.

Keywords

Pandemic; Anxiety; Psychology; Therapy; Pandemic-anxiety; COVID-19; Systematic review

Introduction

The profound impact of the COVID-19 global pandemic to mental health has been well documented with research showing an increased prevalence of anxiety and low mood during and following the pandemic (Santabárbara et al., 2021; Patel et al., 2022; Ding et al., 2025). In addition to general mental health difficulties, the COVID-19 pandemic was accompanied by specific concerns and worries, including heightened concern and uncertainty about the health and wellbeing of an individual's self and community (Bakioğlu et al., 2021). For some individuals, these concerns about one's health and wellbeing developed into pervasive and persistent worries and COVID-19 related fears that did not resolve with reduced infection risk or reduced public health restrictions. Such experiences significantly interfere with daily functioning and overall quality of life, forming what is now considered pandemic-related anxiety in the context of the COVID-19 pandemic (Radević et al., 2023; Crawford et al., 2024). Research has defined pandemic-related anxiety by adapting the Generalised Anxiety Disorder symptoms (Schonfeld et al., 2023) outlined in the fifth edition of the Diagnostic and Statistical Manual (American Psychiatric Association, 2013).

Various terms have been used to describe this condition, including COVID-19 anxiety, pandemic anxiety, coronavirus anxiety, epidemic-related anxiety, along with the colloquial term "coronaphobia" (Asmundson & Taylor, 2020; Lee, 2020; Crawford et al., 2023). To describe the psychological distress experienced by individuals in the context of the COVID-19 pandemic, "pandemic-related anxiety" will be the term used throughout this review. This type of anxiety is accompanied by specific concerns, fears, obsessions, or worries about social isolation, financial difficulties, personal health, the health of others, contracting COVID-19, and the impact of COVID-19 on society (Lee, 2020). Studies have shown that individuals with severe anxiety concerning COVID-19 spent considerable amount of time online reading about the virus, took excessive measures to avoid the virus, and presented with poor overall mental health and social functioning (King et al., 2023).

Due to the psychological distress and functional impairment associated with this condition, psychological interventions have been put in place to help manage this type of anxiety. This is particularly important considering fear of COVID-19 at the beginning of the pandemic predicted higher levels of anxiety, depression, loneliness and psychosocial distress when

assessed two years later (Autenrieth et al., 2024). This means addressing early fears and distress around the pandemic could have mitigated the onset of later negative outcomes. Anxiety management interventions are often based on theories of Cognitive Behavioural Therapy (CBT) that hypothesise unhelpful thoughts and maladaptive behaviours as central to the maintenance of anxiety disorders (Curtiss et al., 2021). The aim of introducing psychological techniques to manage anxiety is to reduce the negative impact to functioning within an individual's life, increase their ability to cope, and alleviate negative symptoms of poor mental health associated with anxiety.

. While pandemic-related anxiety can occur across different global health crises, the COVID-19 pandemic represents a uniquely global, prolonged and well-documented event. Its scale, duration and impact has resulted in a substantial body of research which justifies a focused examination of COVID-19 specific evidence. It is therefore important to summarize and synthesize the existing evidence base on the quality and effectiveness of the psychological interventions designed to address pandemic-related anxieties. This review will inform psychological interventions in response to mental health consequences as a function of other public health crises and in relation to health anxiety generally. Therefore, the main aim of this review is to assess the quality of evidence on psychological interventions targeting pandemic-related anxiety and explore the characteristics and effectiveness of these interventions.

Review Questions

1. What are the types of psychological interventions that have been implemented to manage pandemic-related anxiety?
2. How effective or beneficial are psychological interventions in reducing pandemic-related anxiety symptoms?

Methods

Protocol and Registration

This systematic review was conducted in alignment with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA: See Figure 1 and Appendix A on page 87)

guidelines. The protocol for this systematic review was registered with PROSPERO (REF No. CRD42025606094) on 31/01/2025.

Eligibility Criteria

The PICOS (Patient/Population/Problem, Intervention, Comparison/Control, Outcome, Study Design; Richardson, 1995; Amir-Behghadami & Janati, 2020) framework was used to develop this review's eligibility criteria and to guide the search strategy (see Appendix B, page 91). Eligibility criteria are described in detail below.

Inclusion Criteria

1. Published in English language.
2. Studies with a quantitative approach.
3. Any population across all age groups, without geographical restrictions.
4. Studies focused on psychological therapies for individuals experiencing distress, excessive worry, anxiety and/or fear which is due to the COVID-19 pandemic.
5. Delivery modes are therapist-delivered, therapist-guided, and/or self-help/guided interventions.
6. Studies that are published from November 2019 onwards.
7. Studies must have measured the pandemic-related anxiety outcome using a quantitative outcome measure relevant to anxiety or pandemic-related anxiety, such as using scales like GAD-7 (Spitzer et al., 2007) or COVID-19 Anxiety Questionnaire (CVAQ: Taylor et al., 2020).

Exclusion Criteria

1. Non-empirical studies (e.g., reviews)
2. Qualitative research focus

Search Strategy and Screening

The search was run on 21st August 2025 and the following electronic databases were searched: PsychInfo, Medline and SCOPUS. The search strategy aligned to guidelines proposed by Boland and colleauges (2017) which consist of ten distinct phases. The search

terms were developed using the PICO framework (see Appendix B, page 91) and were inclusive of English and American spelling variations (see Appendix C, page 92).

An initial set of search terms relating to psychological interventions and pandemic related distress were developed and piloted during an initial scoping phase, with results reviewed to ensure the retrieval of key studies previously identified during protocol development. Boolean operators (e.g. AND, OR), truncation and synonyms were used to maximize search sensitivity and inclusivity. Based on the results of the preliminary searches, the strategy was refined through modification and addition of terms. The final search strategy was reviewed in consultation with the research team and librarian at the University of Glasgow to ensure relevance and effectiveness. In addition, manual searches across the reference lists of key papers were also conducted to identify potentially relevant studies that had not been identified through electronic database searches.

The search process, including the identification and screening of studies, was managed on EndNote 21.4 where papers from databases were imported into for references to be organised, duplicate removal and the creation of a secure back-up of data collected. The Endnote de-duplication tool was used, followed by a manual de-duplication process. Title and abstract screening was undertaken by the lead researcher based on the eligibility criteria. A second reviewer independently screened 20% of titles and abstracts (N=1,969). Inter-reviewer agreement at this level was 99.8%, with four discrepancies identified, discussed and resolved. Full-text screening was also conducted by the lead researcher and 20% of the articles (N=9) were independently screened by the second reviewer. Agreement at full-text stage was 87.5%, with one discrepancy identified which was resolved through discussion.

Data Extraction

Information was extracted using a structured extraction form developed in Microsoft Excel and adapted from the Review template for RCTs and non-RCTs provided by The Cochrane Collaboration (Higgins et al., 2011). The form was piloted prior to full data extraction to ensure consistency and completeness. For each included study, the following information was extracted: review title or ID, study ID, country and setting, study design and rationale,

study objectives, hypotheses or aims, population characteristics, inclusion and exclusion criteria, sampling methods and recruitment strategies, total sample size, withdrawals and dropouts, participant demographics, intervention name and description, comparator details, primary focus, outcome measures, data collection protocol and method, start and end dates, duration of participation, participant ethics and consent procedures, timing of outcome assessment, results, statistical analyses, interpretation of findings, funding sources and conflicts of interest. Where required, additional information was obtained from study authors' supplementary materials or trial protocols to ensure an accurate and comprehensive extraction process. In cases where statistical data were missing, corresponding authors were contacted to request further information. To ensure accuracy of extraction, the second reviewer independently extracted data for five of the included 13 studies. No errors or discrepancies were identified.

Quality Assessment

Methodological quality and risk of bias of included studies were assessed using the Crowe Critical Appraisal Tool (CCAT: Crowe, 2013). The CCAT is a validated appraisal tool designed for use across a range of quantitative study designs, making it appropriate for the diversity of study designs included to this review. The CCAT assesses studies across the following domains: preliminaries, introduction, design, sampling, data collection, ethical matters, results and discussion. Each domain is scored on a six-point scale ranging from 0 (no evidence) to 5 (excellent). There is a maximum possible total score of 40 per study. High scores indicate stronger methodological quality and lower risk of bias. Quality categories developed and used in previous research (e.g. Shumba et al. 2020) were applied in the current study for descriptive purposes. Studies scoring 30 or higher were considered to be of high quality, studies scoring between 25 and 29 were considered moderate, while those scoring 24 and below were considered low quality. Risk of bias assessment was also conducted independently by the second reviewer for five out of 13 studies. Following independent assessment, the reviewers met to compare ratings. Agreement between reviewers on overall study quality was observed for all included studies across categories. In three studies, reviewers' total CCAT scores differed by one point. This minor discrepancy did not result in differences in overall quality ratings. The discrepancies only occurred among

studies rated as high quality and did not result in any study moving to a different cut-off boundary.

Synthesis of Findings

A narrative synthesis approach was used to summarise and integrate findings of the included studies. A quantitative meta-analysis was not feasible due to insufficient or unavailable data. The narrative synthesis approach was guided by the Cochrane Consumers and Communication Review Group (2013). The reporting and writing process followed the SWiM guidelines (Campbell et al., 2020) which provide an alternative to synthesising material in the absence of a meta-analytic approach. Studies were therefore grouped and synthesised narratively based on similarities in study design, intervention type, findings, and limitations. The direction, strength of effects and statistically significant findings across studies were described. In accordance with SWiM recommendations, the synthesis explicitly reports how studies were grouped, how outcomes were prioritised, and how results were compared across studies. The methodological quality and risk of bias assessment using CCAT for individual studies were considered and integrated into reporting when interpreting findings. An effect direction plot (Boon and Thomson, 2021) was used to visualize findings and summarise changes in pandemic-related anxiety severity across the studies.

Results

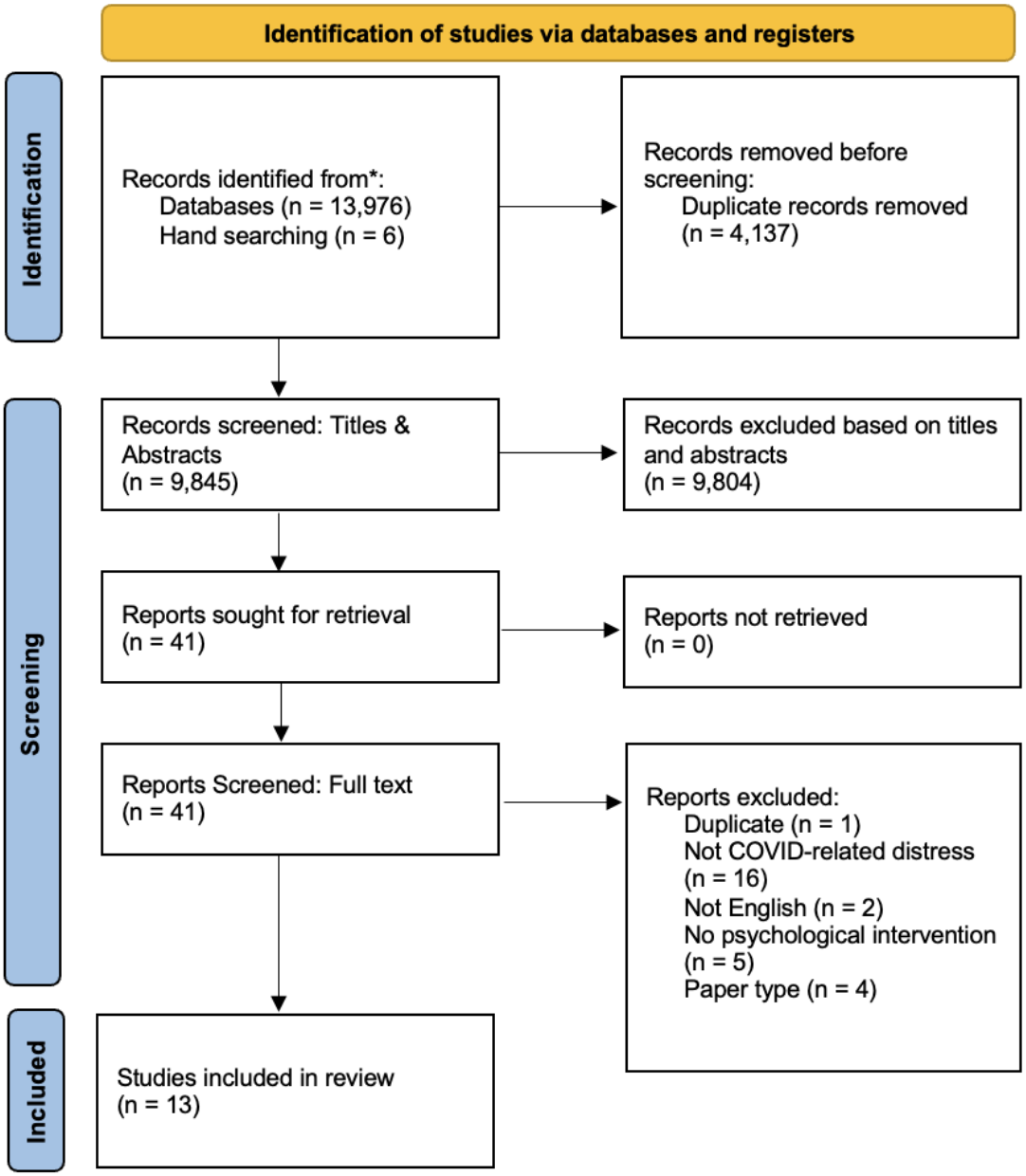

Figure 1: PRISMA Flow Diagram

Study Selection and Screening

A PRISMA flow diagram (see Figure 1) was used to illustrate the search and study selection process. Searches of electronic databases retrieved 13,976 records and six additional records were identified through hand searching. After de-duplication, 9,845 records were screened by title and abstract where most were excluded at this stage. 9,804 papers were

excluded and the remaining 41 full texts were sought and screened against the eligibility criteria. Thirteen papers met inclusion criteria and were retained for review.

Study Characteristics

Study characteristics and participant details are summarised in Table 1. The 13 papers included for review were published between 2021 and 2025 and were conducted in a range of countries, most commonly Iran (N=6), and the remaining were across the UK (N=1), Sweden (N=1), Denmark (N=1), Australia (N =1), Canada (N=1), the United States of America (N=1), and Oman (n=1). Study designs included randomised controlled trials (RCTs; N=7) and uncontrolled pre-post designs (N=6) within which one of the pre-post studies contained a nested feasibility trial. Eight study interventions were delivered in 2020 (N=2), 2020-2021 (N=1), 2021 (N=1), 2021-2022 (N=2), 2022 (N=2). Five studies did not report specific dates of when the intervention was carried out (Shabahang et al., 2021; Joharifard et al., 2022; Alavi et al., 2023; Renganathan et al., 2023; Zepeda et al., 2023). Sample sizes ranged widely from small pilot samples of 15 participants to larger scale sample sizes consisting of 670 participants at baseline. Participants were recruited primarily from community settings, primary care services, hospital discharge samples or university clinics. Participant ages spanned childhood to older adulthood. Samples were predominantly female. Of the seven studies that utilised a control group, the type of control included: individual psychotherapy (N=1), no intervention received (N=4), waiting list control (N=1) and self-help booklet combined with treatment as usual (N=1).

Outcome Measures

Outcomes were most commonly assessed using validated self-report measures. Ten studies used a measure that is specific to COVID-19 anxiety: the Fear of COVID-19 Scale (Ahorsu et al., 2022) (N=2); The Obsession with COVID-19 Scale (Lee, 2020) (N=1); Coronavirus Anxiety Scale (Lee, 2020) (N=2); the COVID-19 Anxiety Questionnaire (Taylor et al., 2020) (N=2); Corona Disease Anxiety Scale (Alipour et al., 2020) (N=2); Parent proxy-rated COVID-Thoughts and behavioural symptoms scale (Schneider et al., 2020) (N=1). Studies that used outcome measures that were not specific to COVID-19 (N=3) utilised Whiteley Index 6-item revised version (Carstensen et al., 2020) (N=1), GAD-7 (Spitzer et al., 2006) adapted to

assess worry related to COVID-19 (N=1), and SCARED (Birmaher er al., 1997) (N=1). Several studies (Zepeda et al., 2023; Frydendal et al., 2025) implemented initial screening procedures to ensure that participants' anxiety was primarily attributable to COVID-19–related concerns before inclusion in the intervention. Assessments were typically conducted at baseline and post intervention, with over half of studies (N=7) including follow-up assessments ranging from one to six months.

Table 1: Study Characteristics & Participants

Author (Year), Country	Study Design	Demographics		Recruitment Source	Screening and/or Outcome Measures; Timepoints Assessed
		Baseline (sample size, age mean and SD/%/IQR, % female per group)	Post-intervention Sample Size		
Alavi et al. (2023) Iran	RCT	Experimental N=60, Mean=40.1 and SD=11.7, 80%. Control N=60 Mean = 45.1, SD = Not reported 73.3%	Experimental N=60 Control N=60	Community and primary care clinics	Fear of COVID-19 Scale (FCV-19S) (7-item scale) Baseline, Completion, Two months follow-up
Barimani et al. (2024) Iran	RCT	Experimental with ACT N=20 Not reported 100% Experimental without ACT N=20 Not reported 100% Control N=20 Not reported 100%	Not reported	Community	The Obsession with COVID-19 Scale (OCS); Pretest, Posttest, Two months follow-up
Crawford et al. (2024) UK	Uncontrolled Pre-post	N=285, Not reported, Not reported	N=201	Community and primary care clinics	Coronavirus Anxiety Scale (CAS)

					Baseline, 3 months FU, 6 months FU
Renganathan et al. (2023) Oman	Uncontrolled Pre-post	N=95, 18-30 years (N=32, 22.6%), 31-60 years (N=56, 58.8%), 60+ years (N=7, 7.4%), Not reported	N=95	Community	CAS Pre and Post
Esmaeili and Salehi (2023) Iran	RCT	Control N=20 Not reported 60% Experimental N=20 Not reported 55%	Not reported	Community	Corona Disease Anxiety Scale (CDAS) Pre, post and one-month follow-up
Farzin et al. (2024) Iran	RCT	Control N=15, Mean=29 and SD=3.42, 66.67% Experimental Guided imagery N=15, Mean=32 and SD=2.67, 60% Experimental multimodal therapy N=15, Mean=29 and SD=3.42,	Control N=15 Experimental Guided imagery N=15 Experimental multimodal therapy N=15	Adults discharged from hospital after being treated for COVID-19	CDAS Pre, post, follow-up

		73.33%.			
Frydendal et al. (2025) Denmark	Uncontrolled Pre-post	N=98, Not reported, Not reported	N=67	Primary care referred by GP or self-referral	Initial screening for COVID-19 related Health Anxiety, Whiteley Index 6-item revised version (WI-6R); Pre and Post
Guzick et al. (2022) USA	Uncontrolled Pre-post	N=129, Mean=8.7 and SD=2.5, 50%	N=102	Community	Parent proxy-rated COVID-Thoughts and behavioral symptoms scale (COV-TaBS) Pre and Post
Joharifard et al. (2022) Iran	RCT	Experimental=10, Not reported, Not reported Control=10 Not reported, Not reported	Not reported	Participants who had previously contacted counselling centres in Ahvaz	CDAS Pre and Post
Ludlow et al. (2023) Australia	Uncontrolled Pre-post	N=15, Range=13-18, Mean=16.07, SD = 1.75, 86.67%	N=12	University psychology clinic	FCV-19S Pre, Post, 3 months follow-up
Shabahang et al. (2021) Iran	RCT	Intervention, N=75 Not reported, Not reported	Not reported	College student social network	COVID-19 Anxiety Questionnaire (CVAQ) Pre and Post

		Control N=75 Not reported, Not reported			
Wahlund et al. (2021) Sweden	RCT	Intervention N=335 Mean=45, SD=13 83% Control N=335 Mean=47, SD=14 77%	Intervention N=285 Control N=314	Community	GAD7 (adapted to assess worry related to COVID-19 Baseline, Week 2, Endpoint, One month follow-up.
Zepeda et al. (2023) Canada	Uncontrolled Pre-post	N=27 Mean=9.56, SD=1.50 67%	Not reported	Community	Initial exclusion for presenting concerns not related to COVID-19 anxiety; SCARED Baseline, post intervention

Overview of Evidence and Study Quality

Study quality scores for the thirteen included studies are shown in Table 2 and ranged from 25 to 38 out of 40 (mean=33). Ten studies were categorised as 'high' quality and the remaining three studies were rated as 'moderate' quality (Joharifard et al., 2022; Esmaeili and Salehi, 2023; Barimani et al., 2024). No study was rated as 'low' quality. No individual study was weighted more heavily than others and all studies were considered equally within their quality groups.

Across the included studies, quality appraisal scores were generally lower within the 'design' domain as many trials did not provide a clear rationale for why a particular design was chosen, or why CBT was selected over alternative modalities (e.g. Alavi et al. 2023; Esmaeili and Salehi, 2023; Barimani, et al. 2024). Joharifard et al. (2022), Renganathan et al. (2023) and Farzin et al. (2024) detailed their designs and rationales but did not provide detailed information about alternative approaches nor the randomisation procedures employed. Many studies also used convenience sampling with limited or lacking description of recruitment details, sample size calculations, and randomisation where relevant, which impacted on their design quality score as well.

Table 2: CCAT Appraisal

Author	Preliminaries	Introduction	Design	Sampling	Data Collection	Ethical Matters	Results	Discussion	Total	Overall
Alavi et al. (2023)	5	5	4	4	3	4	4	4	32/40	H
Barimani et al. (2024)	4	5	3	1	3	3	3	4	26/40	M
Crawford et al. (2024)	5	5	5	5	4	5	4	4	37/40	H
Renganathan et al. (2023)	5	5	4	3	4	5	4	4	34/40	H
Esmaeili and Salehi (2023)	4	4	3	3	3	3	3	4	27/40	M
Farzin et al. (2024)	4	5	3	4	4	4	4	5	33/40	H
Frydendal et al. (2025)	5	5	3	4	4	3	4	5	33/40	H
Guzick et al. (2022)	5	5	4	4	4	5	3	5	35/40	H
Joharifard et al. (2022)	4	5	3	3	3	2	3	2	25/40	M
Ludlow et al. (2023)	5	5	5	4	4	4	5	4	36/40	H
Shabahang et al. (2021)	5	5	4	4	3	4	4	5	34/40	H
Wahlund et al. (2021)	4	5	4	5	4	4	4	5	35/40	H
Zepeda et al. (2023)	3	4	3	3	3	4	3	4	27/40	M

Three of the studies did not clearly describe who delivered the intervention. Barimani et al. (2024) described their transdiagnostic and ACT intervention and did not provide any information on who facilitated the sessions, their training or the role of supervision. Frydendal et al. (2025) similarly described that participants "communicated with their therapist in an embedded message-system" and did not provide information about the therapist's qualifications nor involvement beyond responding to messages. Joharifard et al. (2022) similarly described an eight-session weekly intervention and did not share who led the sessions.

Information on attrition and post-intervention sample size was inconsistently reported across studies. Several studies reported baseline samples only (N=5: Shabahang et al., 2021; Joharifard et al., 2022; Esmaeili and Salehi, 2023; Zepeda et al., 2023; Barimani et al., 2024) without clearly stating how many participants completed the intervention or were included in final analyses. This limited the ability to fully appraise attrition bias and contributed to lower quality ratings in sampling or data collection domains (e.g. Barimani et al., 2024 scored 1/5 on Sampling and 3/5 on data collection, all papers scored less than 5/5 on both domains).

Intervention characteristics

Table 3 summarises the characteristics of the interventions included in the review. Most interventions were based on cognitive-behavioural approaches, including CBT (N=8), acceptance and commitment therapy (ACT; N=3), transdiagnostic interventions with or without ACT (N=1), and combined approaches such as guided imagery and multimodal therapy (N=1). Additional information about the intervention modality is provided in supplementary materials (see Appendix 8, page 115). Interventions were delivered in a variety of formats, most commonly individual therapy (N=7), followed by group-based interventions (N=4), with several studies employing self-guided (N=3) or parent-led formats (N=1). Two studies did not describe the intervention format (N=2). Delivery modes included in-person (n=3), online or videoconferencing platforms (N=7), virtual or messaging based platforms (N=1), while the remaining did not describe the delivery mode (N=2). Intervention duration ranged from programmes lasting two weeks to interventions delivered flexibly over a period of 12 weeks, with the number of sessions offered ranging from 3 to twelve. Session

length, where reported, varied from 15-20 minutes for self-guided video content, to 90-minute therapist-led sessions. Facilitators included registered psychologists, clinical psychologists, trained counsellors, health professionals with experience of delivering psychological treatment, and advanced doctoral trainees. Several studies did not specify the session length, facilitator type or their qualifications.

Table 3: Description of Interventions

Study	Modality	Intervention Format; Delivery Mode	Frequency; Total Sessions; Session Length	Facilitator Type	Type of Control Group
Alavi et al. (2023)	CBT	Individual therapy; In-person	Weekly; 8 sessions; 45 minutes	PhD Clinical Psychologists	Individual Psychotherapy
Barimani et al. (2024)	Transdiagnostic with ACT and Transdiagnostic without ACT	Group therapy; Not described	Twice-weekly session; 12 sessions; 90 minutes	Not described	No intervention received
Crawford et al. (2024)	CBT	Individual therapy; Online videoconferencing	Weekly or fortnightly; 5-10 sessions; 30–50 minutes	Health-related degree therapists with experience in psychological treatments	Self-help booklet and treatment as usual (e.g. access to NHS primary care and referral to secondary care if required)
Renganathan et al. (2023)	CBT	Individual therapy; Virtual meeting	Intensive*; 3 sessions, 30–50 minutes	Professionally trained counsellors	No control group
Esmaeili and Salehi (2023)	CBT	Group therapy; Not described	Weekly; Eight sessions; 90 minutes	Psychotherapist	No intervention received

Farzin et al. (2024)	Guided imagery and Lazarus Multimodal Therapy	Group therapy; In-person	Weekly; 10 sessions; 90 minutes	Researcher with relevant training	No intervention received
Frydendal et al. (2025)	ACT	Individual therapy; Online platform with messaging system for therapist communication	Flexibly**; Seven modules; Not reported	Not described	No control group
Guzick et al. (2022)	Parent-led CBT	Not described; Videoconferencing	Weekly; Six sessions; Not reported	Advanced doctoral students in training	No control group
Joharifard et al. (2022)	ACT	Group therapy; In-person	Weekly; 8 sessions; 90-minutes	Not described	No intervention received
Ludlow et al. (2023)	CBT	Not described; Video-based telehealth	Weekly; 6 sessions; Not reported	Registered psychologists	No control group
Shabahang et al. (2021)	CBT	Self-guided; video-based cognitive-behavioural program	Intensive; 9 self-guided video sessions; 15-20 minute video clips and reading time	No facilitator	No control group
Wahlund et al. (2021)	CBT	Self-guided programme;	Intensive; 5 modules; Not reported	No facilitator	Waiting-list control

		Accessed via online website			
Zepeda et al. (2023)	CBT, Dialectical Behaviour Therapy (DBT	Individual therapy; Remotely	Weekly; 3 sessions; Across three weeks; Not reported	Registered doctoral-level clinical psychologists	No control group

Synthesis of intervention effects

As shown in Table 4, all studies showed a positive direction of effect which indicated reductions in pandemic-related anxiety post-intervention. The effect direction plot is coded based on study sample size and direction of effect (e.g. positive, negative or no change). In line with guidance authored by Thomas and Thomas (2013), superscripts were used to indicate the type of statistical comparison underpinning the reported direction of effect.

Table 4: Effect Direction Plot for Pandemic-Related Anxiety Symptom Severity

Study	Study Design	Symptom Severity
Alavi et al. (2023)	RCT[b]	▲
Barimani et al. (2024)	RCT[b]	▲
Crawford et al. (2024)	UPP[c]	▲
Renganathan et al. (2023)	UPP[c]	▲
Esmaeili and Salehi (2023)	RCT[b]	▲
Farzin et al. (2024)	RCT[b]	▲
Frydendal et al. (2025)	UPP[c]	▲
Guzick et al. (2022)	UPP[c]	▲
Joharifard et al. (2022)	RCT[b]	▲
Ludlow et al. (2023)	UPP[c]	▲
Shabahang et al. (2021)	RCT[b]	▲
Wahlund et al. (2021)	RCT[b]	▲
Zepeda et al. (2023)	UPP[c]	▲

Note:
Study design: RCT: Randomised Controlled Trial; UPP: Uncontrolled Pre-Post
Effect direction: upward arrow ▲= positive health impact, downward arrow ▼= negative health impact, sideways arrow ◄►= no change/mixed effects/conflicting findings
Sample size: Sample size in intervention group
Large arrow ▲ >300; medium arrow ▲ 50-300; small arrow ▲ <50
Study quality: denoted by row colour: green = high quality; amber = medium quality; red = low quality
Superscripts indicate the statistical comparison used to assess direction of effect.
[a]: difference between intervention and control groups at follow up; [b:] difference in change between intervention and control group over time; [c]: change from baseline within the intervention group only

All 13 studies included in this review reported statistically significant reductions in pandemic-related anxiety at post-intervention, with effect sizes ranging from medium to large. Significant findings were consistent across intervention modalities (CBT, ACT,

transdiagnostic, guided imagery), delivery formats (individual, group, online, self-guided) and populations (adults, older adults, children and adolescents). No study reported an increase of symptom severity at post-intervention. The consistency of positive findings suggests that psychological interventions are beneficial for reducing COVID-19-related anxiety.

Across the seven RCTS included in this review (Wahlund et al., 2021; Shabahang et al. 2021; Joharifard et al., 2022; Alavi et al., 2023; Esmaeili and Salehi, 2023; Barimani et al., 2024; Farzin et al. 2024), all studies reported statistically significant improvements in pandemic-related anxiety. The direction of effects were consistently positive which demonstrated reductions in symptoms of anxiety including distress, fear, worries, and/or obsessive thoughts following implementation of psychological intervention. Four of seven RCTs evaluated CBT-based interventions (Alavi et al., 2023; Esmaeili and Salehi, 2023; Shabahang et al., 2021; Wahlund et al., 2021) while the remaining utilised ACT or multimodal approaches (Joharifard et al., 2022; Barimani et al., 2024; Farzin et al., 2024). Of the six RCTs that reported partial eta squared or Cohen's d, effect sizes ranged from medium (Wahlund et al., 2021) to large (Shabahang et al., 2021; Alavi et al., 2023; Barimani et al., 2024; Farzin et al., 2024; Joharifard et al., 2024). Most RCTs that were rated as 'high' in regards to study quality using the CCAT, also reported large effect sizes (e.g. Wahlund et al., 2021; Shabahang et al., 2021; Alavi et al., 2023; Farzin et al., 2024).

The remaining six uncontrolled studies utilised a pre-post design and explored changes in psychological outcomes following interventions that targeted pandemic-related anxiety (Guzick et al., 2022; Ludlow et al., 2023; Renganathan et al., 2023; Zepeda et al., 2023; Crawford et al., 2024; Frydendal et al., 2025). All studies reported reductions in anxiety or distress from baseline to study completion and/or follow-up demonstrating improvements overtime. In three studies, reported effect sizes ranged from moderate (Ludlow et al., 2023 reported Hedges *g)* to large (Guzick et al., 2023; Frydendal et al., 2025 reported Cohen's *d)*. Three of the six studies did not report effect sizes (Renganathan et al., 2023; Zepeda et al., 2023; Crawford et al., 2024). The consistency of reductions in symptom severity highlights the possible benefits of CBT and ACT interventions in alleviating pandemic related distress, although effectiveness cannot be determined based on the study design.

When examining any reported differences in findings within individual studies, only two studies examined whether demographic factors were associated with outcomes. Renganathan et al. (2023) found that improvements in outcomes were associated with participants who were younger, married and highly educated (individuals with postgraduate education versus individuals with secondary education). Crawford et al. (2024) established conflicting findings where participants who completed the follow-up assessments tended to be female and older compared to individuals who dropped out.

Discussion

This review examined the characteristics and effectiveness of psychological interventions targeting pandemic-related anxiety with samples across various age groups, from childhood to adulthood. Thirteen studies were included which reported on psychological interventions delivered during the COVID-19 pandemic. Overall, findings across all studies consistently reported reductions in pandemic-related anxiety with improvements to symptoms reported in intervention groups as compared to control groups in controlled trials and in post intervention scores as compared to pre-intervention scores in uncontrolled trials. As noted in the results, findings from six uncontrolled pre-post designs rely on within-group comparisons which can only indicate potential benefits. The findings suggest that psychological interventions may be effective in targeting pandemic-related anxiety across different settings and populations, which holds promise for implementing such interventions in response to public health crises. While conclusions drawn from uncontrolled studies should be interpreted with caution, the consistency of findings across both controlled and uncontrolled studies provides some confidence in the overall pattern of results. This consistency across studies is a key strength of the review, as synthesising findings across multiple designs allows for identification of patterns that may not be evident in individual studies alone. In line with SWiM recommendations, a structured narrative synthesis was undertaken and studies were grouped according to study design (RCTs compared to uncontrolled pre-post studies), intervention type (CBT-based, ACT, transdiagnostic, and multimodal approaches) and methodological quality as assessed by the CCAT ratings.

Most reviewed studies (Wahlund et al. 2021; Shabahang et al., 2021; Alavi et al. 2023; Esmaeili & Salehi, 2023, Renganathan et al. 2023; Zepeda et al. 2023; Ludlow et al. 2024) used CBT as the intervention whether in an individual, group or self-guided format. CBT targets maladaptive thoughts and behaviours through the following techniques: cognitive restructuring, exposure, problem solving and relaxation (Beck, 2020). In the studies included, CBT interventions aimed to reduce COVID-19 fear and anxiety by: exploring beliefs about possible impact of COVID infection (Crawford et al. 2024); identifying behaviours that might be maintaining anxiety such as searching the internet for information about COVID (Crawford et al. 2004); response prevention following COVID-19 related push notification (Wahlund et al., 2020); guided discovery concerning COVID-19 fears (Renganathan et al. 2023).

Our findings broadly align with and extend the existing evidence base that shows CBT to be an effective approach to reducing anxiety symptoms and improving quality of life within the context of generalised anxiety (Papola et al., 2024) and health specific anxiety (Axelsson & Hedman-Lagerlöf, 2019; Newby et al. 2020). CBT for health anxiety specifically targets interpretations of health-related information, excessive monitoring of bodily sensations and reassurance-seeking behaviours which are all processes that align to those observed in pandemic-related anxiety. Interventions reviewed targeted information seeking, avoidance, safety behaviours and threat appraisals, leading to a reduction of pandemic-related anxiety, which could be contextualised as a context-specific presentation of health anxiety (Crawford et al., 2024).

Comparatively, ACT interventions were used by three studies (Joharifard et al., 2022; Barimani et al. 2024; Frydendal et al. 2025). ACT is centred on psychological flexibility, defined as the ability to accept distressing thoughts and emotions without avoidance and behave in ways that are aligned to personal values (Strosahl & Wilson, 1999). Barimani et al.'s (2024) ACT intervention looked to combine mindfulness, acceptance and values to reduce obsessive thoughts about COVID-19. ACT in the studies with adult samples was used to target health anxiety and worry through self-guided and group sessions respectively (Joharifard et al. 2022; Frydendal et al. 2025). Frydendal and colleagues (2025) adapted the

treatment programme for COVID-19 related health anxiety by adjusting identification of maintaining behaviours to reflect COVID (e.g. excessive use of hand sanitizer, social distancing beyond current recommendations). Barimani et al.'s (2024) study included delivery of a transdiagnostic ACT programme that targeted children's anxiety and depression alongside mothers' obsessive/anxious thoughts about COVID-19. Similarly, Zepeda et al. (2023) used the iCOPE with COVID-19 protocol which combines CBT with elements of Dialectical Behaviour Therapy (DBT) to enhance emotional regulation, distress tolerance and mindfulness. The mechanism of change relevant to ACT across these interventions was the reduction of avoidance and moving focus from uncontrollable pandemic-related worries to values-driven actions.

Evidence from the broader literature suggests that ACT is an effective intervention for anxiety disorders with meta-analyses demonstrating reductions in anxiety symptoms and avoidance behaviours resulting in improvements to symptom severity and daily functioning (A-Tjak et al., 2015; Gloster et al., 2020). ACT targets changes made to avoidance and unhelpful behaviours with an acceptance approach that is values-based (Hayes et al., 2012). This is consistent with the way in which ACT was implemented across studies included in the present review. Across presentations of pandemic-related anxiety, the feared threat can be uncontrollable and attempts to reduce worry through reassurance-seeking or avoidance would be ineffective. ACT directly targets these processes by focusing on acceptance of uncertainty, reducing behavioural restriction and engaging in values activities.

Farzin et al. (2024) held two intervention approaches: guided imagery and Lazarus' (1993) multimodal therapeutic framework. The multimodal approach is a framework that is founded in social cognitive learning theory and the intervention approach is based on different dimensions of affect, behaviour, sensation, imagery, cognition, interpersonal relationships and drugs/biology (Lazarus, 1993).These dimensions aim to provide a comprehensive understanding of a client's presenting difficulties to which treatment can be tailored. Farzin et al. (2024) was the only study to use a multimodal therapeutic approach based on Lazarus' (1993) model. It is therefore difficult to ascertain the robustness and generalisability of the observed effects across different samples and settings. The findings

suggest promise for this type of intervention and future research could look to examine the feasibility and effectiveness of multimodal interventions.

In summary, the reviewed interventions vary in their underlying mechanisms: ranging from emphasis on cognitive restructuring and behavioural change (CBT), to a focus on acceptance and value-based techniques (ACT), while others incorporate relaxation and imagery, and transdiagnostic approaches. Considering these mechanisms in the context of participant characteristics that are known to influence the effectiveness of psychological therapies can provide an understanding for why particular approaches may be more effective for different groups of individuals. Sociodemographic factors which may be related to how well individuals engage with CBT interventions (Sextl-Plötz et al., 2024) include: age, relationship status and educational attainment. These individual factors were not consistently examined across studies reviewed. Nonetheless, when considered there were important observations to highlight. For example, Renganathan et al. (2023) observed greater improvements to outcomes post intervention among younger, married and highly educated participants. However, Crawford et al. (2024) established conflicting findings where participants who completed the follow-up assessments tended to be female and older compared to individuals who dropped out, indicating that older age could influence capacity to continue psychological intervention (Cuijpers et al., 2018; Saunders et al., 2021). This should be contextualised within the pandemic's demands and unique circumstance that imposed severe restrictions and high caring demands, which were experienced by and impactful on young mothers (Power et al., 2020; Racine et al., 2021; Racine et al., 2022). Taken together, these findings highlight that sociodemographic influences on intervention engagement and outcomes are likely complex and potentially context-dependent and should be considered alongside individuals' and families' needs at times of increased stress.

In addition, the effectiveness and replicability of an intervention can be dictated by who has delivered the intervention and their training experiences. A review of therapist training reported that a lack of effective training and supervision is a significant barrier to delivering evidence-based interventions (Herschell et al., 2010). In the current review, nine out of 13 studies reported on who provided the intervention (e.g., clinical psychologists or trained researchers), while the remaining four studies did not specify who delivered the

intervention. Nonetheless, in our synthesis, there was no clear pattern of results associated with the type of therapist or intervention facilitator. In addition, some of the studies included reported on self-guided interventions, with positive effects as well (Shabahang et al., 2021; Wahlund et al., 2021).

Strengths, Limitations, and Future directions

This review focuses on a novel area of psychological concern and therefore offers a valuable summary and synthesis of a young area of research, psychological interventions for pandemic-related anxiety. In this work, we adhered to rigorous reporting and synthesis guidance.

An important limitation of the present synthesis approach includes the introduction of bias through interpretive judgement required to complete the CCAT appraisal. The CCAT provides a structured framework to evaluate study quality across the domains, however, scoring decisions involve subjective interpretation, particularly when considering the weight of each study's feature in terms of how it is scored. This may have influenced study quality decision-making. While a consistent approach was adopted by the lead researcher and second reviewer, alternative interpretations could lead to different scores and interpretations. Nonetheless, the agreement across independent reviewers speaks to the robustness of the quality ratings. It is also acknowledged that while most studies received moderate to strong ratings on the CCAT, these ratings may differ if a more specialised tool were applied, such as the Cochrane RoB-2. Additionally, the use of global quality scores may obscure specific sources of bias. Nonetheless, the studies were considered to be of sufficient quality to be included in the synthesis.

A further limitation concerns the presentation of the effect direction plot which was developed due to the absence of sufficient data to conduct a meta-analysis. It should be noted that the effect direction plot was based on baseline sample sizes where post-intervention sample sizes were not reported. This could bias the perceived strength of effects, as this approach does not account for attrition or final sample sizes at post-intervention.

A notable strength across the studies reviewed was the level of detail provided for the intervention's content. Several papers offered session-by-session descriptions which enhanced the transparency and reproducibility of the intervention. For example, Renganathan et al. (2023) detailed a three-session virtual CBT programme with specific steps such as cognitive restructuring, behavioural activation and relaxation strategies. Similarly, studies such as Garzin et al. and Alavi et al. (2023) presented descriptive intervention schedules which provided a clear understanding of how the intervention was delivered. Nonetheless, most studies did not report on fidelity rating and some did not mention type of treatment facilitator, facilitator qualifications nor the session length. Non-disclosure of the session length and individuals who delivered the sessions presents a challenge when exploring therapist competence, adherence to intervention manuals and potential bias, in addition to presenting challenges concerning the replicability of the study (Perepletchikova et al., 2007 & Hoffmann et al., 2014). Future research specific to pandemic-related anxiety should report facilitator training, incorporate treatment fidelity monitoring, and examine how delivery mode influences adherence and outcomes. Future research may also benefit from examining how psychological interventions can be adapted to respond to sudden and distressing new information about public health crises. The COVID-19 pandemic was characterised by evolving public health guidance and unprecedented social restriction which may have contributed to heightened anxiety and uncertainty. Future trials could explore whether interventions that target flexibility, uncertainty tolerance and adaptive coping in response to evolving, sudden, ambiguous or threatening information are effective. This may include evaluating strategies that help individuals tolerate uncertainty and process new or conflicting information without engaging with maladaptive behaviours. Adaptations such as these could increase the relevance of psychological interventions in the context of future pandemics or other large-scale disruptions.

A consistent feature of the reviewed papers is the geographical concentration of studies where almost half (6 of 13) were conducted in Iran, although the remaining studies were in different countries. As the intervention research on pandemic-related anxiety grows, we may see increased geographical dispersion. Further, several studies had very small sample sizes (e.g., Joharifard et al. had 20 participants in total) and most studies utilised a

convenience sampling approach with little description of randomisation or allocation procedures, which limits the quality of the design of the studies reviewed. Nonetheless, overall quality ratings were still for the most part within moderate to high.

Finally, many of the included studies were conducted during the early phases of the COVID-19 pandemic when understanding of transmission risk, public health guidance and psychological impact were rapidly evolving. This contextual uncertainty may have influenced both intervention design and outcome measurement as interventions were developed in response to a global crisis that was broadly not yet understood in terms of long-term consequences, how it was transmitted and the risk of becoming infected. As the scientific community's understanding and public health messaging progressed over time, the nature of pandemic-related anxiety and mechanisms maintaining it may have shifted. This could mean that future interventions' effects may vary and that content and focus may require adaption to respond to changing needs. It will also be important to assess how well these interventions work based on time since the COVID-19 pandemic, which can be assessed in future reviews that cover a longer timeframe.

Conclusion

This review synthesised findings from thirteen studies to address the primary objective of the review by evaluating psychological interventions for pandemic-related anxiety across a range of populations, settings and countries. Using a structured narrative synthesis approach, we show promising and positive effects of interventions on pandemic-related anxiety from both controlled and uncontrolled studies. Despite interventions varying in their use of modality (e.g. ACT, CBT, Transdiagnostic) and intervention format (online, face to face) and delivery mode (group, individual, self-guided), interventions appeared effective and beneficial when targeting the perpetuating and maintaining mechanisms associated with pandemic-related anxiety including avoidance and maladaptive thinking. The findings support the use of psychological interventions for reducing pandemic-related anxiety. These promising findings increase our confidence in psychological interventions for health-related anxieties and for their potential to be implemented at times of public health crises.

Author contributions

SA developed the project, search strategy and analysis plan under the supervision of JR and with support from the University of Glasgow's resources and librarian team. SA conducted the literature search, study selection, data extraction, quality appraisal with support from the second reviewer. SA performed the narrative synthesis and data interpretation with input from JR. SA wrote the first draft of the manuscript. All authors contributed to reviewing and editing the manuscript and approving the final version.

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Chapter 2

Changes in child and youth stress during COVID-19: A Short-term longitudinal examination of stress responses

Short title: Changes in child and youth stress during COVID-19

Authors

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A version of this chapter is currently under review at the Journal of Development and Psychopathology. This chapter has therefore been written in accordance with the author requirements: https://www.cambridge.org/core/journals/development-and-psychopathology/information/author-instructions/preparing-your-materials

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This study was not pre-registered. A protocol was prepared and submitted to the research team for review and approval ahead of processing data. Additional pre-registration was not deemed necessary.

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Data Availability Statement

The data in this study are not publicly available. Reasonable requests are subject to review and approval from the research team.

Competing Interests Statement

EA has received consultation fees from Roche and Quadrant, grant funding from Roche and in-kind support from Amo Pharma. She holds a patent for the device, “Tully” (formally “Anxiety Meter”). She has received royalties from APPI and Springer, and editorial honoraria from Wiley. The authors have no competing commercial interests related to this study.

AI Statement

AI was not used in this research or in the writing of the manuscript.

Plain Language Summary

Background

The COVID-19 pandemic brought sudden and repeated changes to children's lives through school closures, cancelled activities and social distancing. These changes created extra pressures for families that could increase stress in children and young people. Furthermore, some children are more vulnerable to stressful changes because of pre-existing mental health problems or neurodevelopmental diagnoses. Equally, other children may be more protected because of psychological resilience or family resources. Understanding how stress changed over the pandemic and which factors made things better or worse for children can help to support future crises.

Aims and Questions

This project asked: 1) did children and young people's stress related to COVID-19 restrictions change over time?) and 2) how did mental health vulnerability, psychological resilience, and pandemic related deprivation influence that change over time?

Methods

Design

This was a longitudinal observational study that used online surveys collected by the wider research team between April 2020 to February 2021.

Recruitment

Participant data had been collected by three existing child and family research cohorts in Ontario, Canada. Parents had consented to be contacted for research and were emailed invitations to complete surveys across different timepoints that reflected meaningful phases of the pandemic.

Participants

Parent reported data included 1,036 children aged 6-18. Youth self-report data included 393 young people aged 10 to 18 years old. The sample included children with and without pre existing mental health and neurodevelopmental diagnoses.

Main Findings

- Stress levels changed over time and closely mirrored the pandemic restrictions (e.g. stress decreased when restrictions eased, increased when restrictions returned).
- Higher deprivation and pre-existing mental health/neurodevelopmental diagnoses were linked to higher initial stress.
- Resilience was linked to slightly lower initial stress but did not predict change over time.
- Youth self-report findings showed the same overall pattern.

Conclusion

Children's stress followed the pattern of public health restrictions but those with depression symptoms or other vulnerability were more affected. These findings highlight the importance of targeted mental health and social support for vulnerable young people during public health crises.

Abstract

This study explored changes in stress due to COVID-19 restrictions in children and youth and the influence of psychological resilience, mental health vulnerability and pandemic-related material deprivation on stress. Parent reported and youth reported data collected between April 2020 and February 2021 from three Canadian children and family research cohorts were used (parent reported N=1036, age range = 6 to 18 years (mean = 10.94, SD = 3.32), 43.73% female, 58% of European, North American ancestry; youth reported N=393, age range 10-18 years (mean = 13.23, SD = 2.5)). Latent growth curve modelling was used to estimate stress trajectories over five timepoints. Stress levels showed non-linear change over time, mirroring fluctuations in level of restrictions imposed. Sociodemographic, mental health, and resilience factors were associated with initial levels of stress, and only depression symptoms predicted rate of change in stress over time. Although the sample overall showed changes in stress levels mirroring pandemic restriction patterns, some children and youth were more vulnerable to heightened stress levels and showed increased stress responsivity to changes in restrictions. These insights advance our understanding of stress responses and can be used to inform supportive interventions at times of public health crises.

Keywords

Stress; vulnerability; COVID-19; psychopathology; family

Introduction

The COVID-19 global pandemic presented unprecedented challenges through health restrictions, school closures, and disruptions to daily life for communities, families, and youth. To preserve public health and safety, the lives of children and youth shifted profoundly with changes to routines and structure, including limited activities and opportunities for growth and development, increased screen time and time spent in the home environment, and varied access to education and healthcare provision (Segre et al., 2021; Whaley & Pfefferbaum, 2023). For caregivers and their families, employment uncertainty coupled with the shift in education towards remote learning further intensified the stressful experience universally (Shah et al., 2020; Sacco et al., 2021). Generally, experiences of stress involve the interplay between environmental demands and an individual's perceived resources and coping ability (Lazarus & Folkman, 1984; Rice, 2012). Characterising stress levels is highly relevant to understanding experiences within the pandemic which introduced exceptional demands on individuals and families, such as health concerns and economic uncertainties. It is important to understand stress in the context of factors such as psychological resilience and mental health vulnerability which are known to impact on stress responses (Gayatri & Irawaty, 2022). The COVID-19 pandemic offers a crucial learning opportunity to understanding children and youth's stress responsivity in light of public health restrictions and as a function of individual differences and family factors known to impact stress.

Multiple systematic, meta-analytic and literature reviews have been conducted and offer a comprehensive overview of children and youth's mental health and wellbeing during the pandemic. The research highlights increasing and consistently high rates of anxiety and depression during COVID-19 (e.g. see review: Nearchou et al., 2020; Korczak et al., 2024), with higher prevalence rates in older children and youth (Racine et al. 2021; Samji et al., 2022), high behavioural difficulties for children with neurodevelopmental disorders including Autism and attention deficit hyperactivity disorder (ADHD; Panda et al., 2021), and the importance of protective factors for anxiety and depression, such as parent-child communication (Panchal et al., 2023). Singh et al.'s (2020) literature review emphasises the importance of considering vulnerability factors, including economic underprivilege and pre-existing mental health conditions, to understand experiences of COVID-19.

Pre-existing mental health difficulties can shape a person's response to stress. Children and youth with mental health difficulties and disorders, such as anxiety and depression, can face challenges with managing everyday demands (Beckman et al., 2023), which may make it difficult for those individuals to handle additional demands or stress. These challenges can be exacerbated with the addition of further stressors and may present overall as higher levels of stress for individuals vulnerable to mental health difficulties (Manchia et al., 2022). Within the context of COVID-19, higher mental health difficulties predicted higher levels of pandemic-related stress at a later timepoint in children and youth (Rizeq et al., 2021).

Another key factor that can impact stress responses is psychological resilience, which is characterised by individuals' ability to draw on psychological, social, cultural, and physical resources, in a culturally meaningful manner to support their well-being and achieve positive outcomes while faced with challenges (Ungar, 2008). Although a multifarious construct with various definitions, here, psychological resilience is conceptualised as a protective trait that influences coping mechanisms and is highly relevant to understanding how individuals navigate stress in the face of adversity (Masten, 2018). This factor has been largely unexamined within the context of children and youth's psychological experiences of COVID-19.

At a family level, socioeconomic privilege can further impact stress responses. Specifically, family level material deprivation due to pandemic-related disruptions and restrictions can indirectly impact the behaviour and mental health of children and youth via interparental conflict and emotional distress of caregivers (Ponnet, 2014; Neppl et al., 2016). Researchers also established an association between increased material deprivation due to the pandemic and both increased stress levels and mental health difficulties in children, youth, and parents (Rizeq et al., 2021).

Longitudinal examinations are needed to provide insight into stress responsivity as a function of level of restrictions and to identify key individual differences or family factors that may make some children and youth more vulnerable than others when responding to the same stressors (i.e., COVID-19 restrictions in this instance). Further, it is highlighted that additional research is needed to understand the impact of protective factors on children

and youth's wellbeing during and following the pandemic (Rizeq et al., 2021). To fully understand variation of perceived stress levels in children and youth over time, we need to consider both individual and family level factors that can impact on stress responses. The current study focuses on three such factors: mental health vulnerability, psychological resilience, and pandemic-related material deprivation. This study elucidates important factors that we can target and support in children and youth's recovery at times of heightened stress. This study could provide valuable insights to public policy and community planning that can support family coping generally and with future public health crises specifically.

Aims and Research Questions

This study looked to provide insight to the complex dynamics of stress experiences during a global crisis and to further understand the factors shaping the psychological well-being of children and youth. The research questions were as follows:

1) Did perceived stress levels due to COVID-19 restrictions change over time in children and youth?
2) What was the role of mental health vulnerability, psychological resilience, and pandemic-related deprivation in the trajectory of child and youth stress levels due to the COVID-19 pandemic restrictions?

Method

Design

The data used were collected online between April/May 2020 and February 2021. The selected timepoints reflected influential transition points in children's lives (e.g. returning to school from summer holidays) and pandemic-related public restrictions in Ontario, Canada (see description of time points below). This study was reported in alignment with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (see Appendix 1, page 94).

Participants and Procedures

Child mental health cohorts with pre-existing and established participant bases collaborated in 2020 to investigate the impact of the COVID-19 pandemic on children, youth, and families. Participants from these existing cohorts of children, youth, and families throughout Ontario, Canada, were invited to participate in a province-wide study on the mental health implications of COVID-19. In the current study, data from three of the four cohorts with school aged children and youth were utilised. Two cohorts consist of clinical populations recruited through outpatient clinics (SickKids Psychiatry) and Province of Ontario Neurodevelopmental Disorders Network (POND Network, 2021) and one community cohort recruited at a science museum (Spit for Science, 2021). Details about these cohorts are described and documented in the study protocol (Korczak et al., 2022).

Email invitations to participate in online surveys hosted by the survey application REDcap were sent to parents who had previously consented to contact regarding research participation opportunities. Parents and youth were invited to complete the surveys starting in April 2020 and separate invites were sent out for follow up timepoints. The email included a further link to send to their child if they met the age inclusion criteria for self-report (i.e., 10-18 years).

For this study, inclusion criteria included parents of children aged 6 to 18 years and youth aged 10 to 18 years. Data for the current study were collected between April 2020 and February 2021. Five timepoints based on their collection dates and data availability were created (see table 5). To be included in this study, participants needed to have completed stress outcome measures on at least two timepoints.

Table 5: Ontario School Closures and Reopenings during COVID-19

Timepoint	Dates	School Status
T1	April/May 2020	Province-wide lockdown; schools closed to in-person learning
T2	June/July 2020	No in-person classes, transition to summer break; restrictions easing
T3	August/September 2020	Schools reopened with health and safety measures
T4	October/November 2020	Schools remained open
T5	February 2021	Province-wide shut down; schools closed to in-person learning

Parent reported data for 1036 children (Mean age = 10.94, SD = 3.32) were utilised and data for a sample of 393 youth with self-report were included (Mean age = 13.23, SD = 2.50). Table 6 below includes parent reported characteristics of participants included in this study. Originally, there were 1,254 participants with available parent reported data. Participants who provided only one or less responses to parent reported child and youth stress, were removed (N=40) resulting in 1,214. Data associated with children aged 5 or below were also excluded (N=40) resulting in 1,174 participants. To ensure the sample included only one child per family, the oldest siblings were identified and retained for each family group, resulting in the removal of younger sibling entries (N=138) and resulting in a final sample size of 1,036.

Table 6: Participant Characteristics for Parent Reported Data at Baseline

		% (n)	Mean (SD)	N
Child age (in years)			10.94 (3.32)	1036
Sex				1036
	Male	55.79% (578)		
	Female	43.73% (453)		
	Prefer not to respond	0.48% (5)		
Ancestry of the child			-	1036
	European, North American	58.10% (602)	-	
	Non-European, Non North American	16.12% (167)	-	
	Multiple ancestries	24.13% (250)	-	
	Did not disclose	1.64% (17)	-	
MH/psychiatric diagnosis		43.73% (453)	-	1036
Neurodevelopmental diagnosis		40.06% (415)		1036
Both MH/psychiatric and neurodevelopmental diagnosis		61.39% (636)		1036

Measures

Parent Reported Variables

Demographics. Information regarding child age, ancestry, sex at timepoint 1 were included in this study. Questions were adapted from The CoRonavIruS Health Impact Survey (CRISIS) questionnaire (Merikangas, et al., 2020).

Material Deprivation Due to COVID-19. Five items from CRISIS questionnaire (Merikangas, et al., 2020) were used to assess food insecurity, housing and income instability, job loss, and reduced ability to earn money at timepoint 1. An example item was: "During the PAST TWO WEEKS… did you worry whether your food would run out because of a lack of money?". Response options included binary choices "Yes/No" and five-point likert-scale response options "0=Not at all; 5=Extremely" based on the question asked. Responses on all five items were summed to provide an overall score of material deprivation due to COVID-19 restrictions, with higher scores indicative of higher deprivation (omega = .82). The reliability of material deprivation index score has been established in previous research (Rizeq et al., 2021).

Parent Reported Child Mental Health Vulnerability. This variable was assessed using two measures assessing depression and anxiety at timepoint 1. Ten items were summed to create an overall score of child depression from the Revised Children's Anxiety and Depression Scale (RCADS: Chorpita et al., 2005). Parents rate items such as "My child feels sad or empty" using a four-point Likert Scale: "0=Never; 4=Always." The RCADS has been found to be reliable and valid (Chorpita et al., 2005; Ebesutani et al., 2010). The RCADS has demonstrated strong convergent validity, with correlations of r = .70 with established measures of depression and r = .65 with anxiety measures, as well as significant associations with clinical interview ratings (Chorpita et al., 2005). Nine items from the Generalised Anxiety Subscale of the Screen for Child Anxiety-Related Disorders (SCARED: Monga et al., 2000) were used to assess generalised anxiety symptoms in children. For example: " My child is nervous" with response options indicated from a three-point Likert Scale: "0=Not True or Hardly Ever True; 2=Very True or Often True". Higher scores on both the RCADS and SCARED scales indicate higher symptom severity for depression and anxiety

respectively. Research has established the Generalised Anxiety Subscale to have construct validity, predictive validity, and reliability (e.g. α = .86) (Monga et al., 2000).

Parent Reported Child Psychological Resilience. Sixteen items from the Parent version of the Revised Child and Youth Resilience Measure Person Most Knowledgeable ((PMK)-CYRM-RL: Resilience Research Centre, 2018) were used to assess resilience at timepoint 1. For example: "they feel supported by their friends". Responses were provided using a five-point Likert Scale "0=Not at all; 5=A lot". Higher scores reflect greater psychological resilience. The authors have presented good internal reliability (α = .82-.87).

Parent Reported Child Stress. Three items concerning restrictions, friendships and cancellations were used from the CoRonavIruS Health Impact Survey (CRISIS) questionnaire (Merikangas, et al., 2020) to explore stress. Items assessed parent reported child stress in the context of restrictions, friendships and cancellations e.g. "How stressful have the restrictions on leaving home been for your child?" with response options of "Not at all; Slightly; Moderately; Very; Extremely" assessed at all timepoints. Higher scores support greater perceived stress. Research has established the CRISIS questionnaire to have construct validity, predictive validity and reliability (e.g. Omega > 0.9; Intraclass Correlation Coefficient between 0.79 and 0.87) (Nikolaidis et al., 2021).

Child Reported Variables

Child & Youth Reported. Psychological Resilience: Seventeen items from the Child and Youth Resilience Measure (CYRM-r: Resilience Research Centre, 2018) assessed psychological resilience in children and youth at timepoint 1, e.g. "My family/caregiver(s) care about me when times are hard (for example if I am sick or have done something wrong)". Higher scores demonstrate greater resilience. Research has found the CYRM-r to be a valid and internally consistent (α=.82) measure (Resilience Research Centre, 2018). Child & Youth Reported Mental Health Vulnerability. Nine items were used from the Generalised Anxiety Subscale of the Screen for Child Anxiety-Related Disorders (SCARED: Monga et al., 2000), as described above, to assess generalised anxiety symptoms in children and youth at timepoint 1. Higher scores on the SCARED indicate higher anxiety symptom severity. The 20-item Centre for Epidemiological Studies Depression Scale for Children (CES-

DC) (Fendrich et al., 1990) was used to assess symptoms of child and youth depression, using a scale of 0 to 3. Higher scores on the CES-DC indicate higher depression symptom severity. Studies have found this scale to be a valid and reliable measure of depression (Zhao et al., 2023).

Child & Youth Reported Stress Due to COVID-19 Restrictions. Four items concerning restrictions, family relationships, friendships and cancellations were adapted from The CoRonavIruS Health Impact Survey (CRISIS) questionnaire (Merikangas, et al., 2020) which assessed child and youth reported stress in relation to restrictions, as described above. Higher scores indicate a higher severity of perceived stress due to COVID-19 restrictions.

Data Analysis

Data cleaning and statistical analysis were conducted in R Studio (2020). Descriptive statistics were calculated to summarise the data and view the distribution of each variable. Pearson's correlation coefficient was used to examine associations among variables within and across timepoints. A latent growth curve model was conducted using the Lavaan package to examine the trajectory of stress across the five timepoints, specifically to determine the type of trajectory (linear vs quadratic). Model fit was evaluated using Comparative Fit Index (CFI), Tucket-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Square Residual (SRMR). Higher CFI and TLI values and lower RMSEA and SRMR values indicate better fit. Once the type of trajectory was confirmed, the impact of time-invariant predictors was examined by running three separate conditional models. In the first model, sociodemographic covariates were included (sex, age, pre-pandemic mental health or neurodevelopmental diagnosis, pandemic deprivation). In the second model, sociodemographic covariates and resilience at T1 were included. In the third and final model, the sociodemographic covariates and the mental health symptoms (anxiety and depression) at T1 were included. Analyses were carried out separately for parent reported and youth reported stress.

Results

Descriptive Statistics and Correlations

Descriptive statistics for parent and youth reported variables are reported in the supplementary materials (see Appendix 8, page 106). These tables summarise the means, standard deviations, and ranges for key study variables across the five timepoints. Figure 2 and Figure 3 display the trajectory of mean stress scores across time.

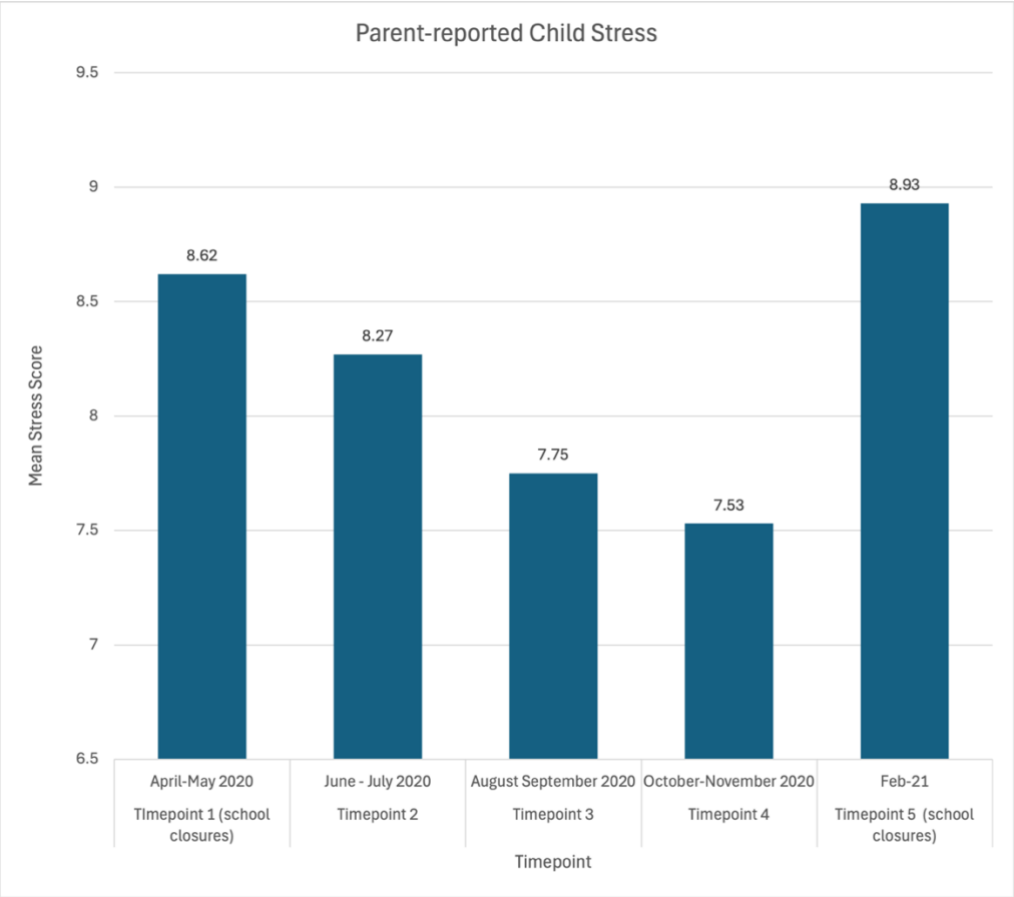

Figure 2: Parent Reported Child Stress across Time with Mean Scores

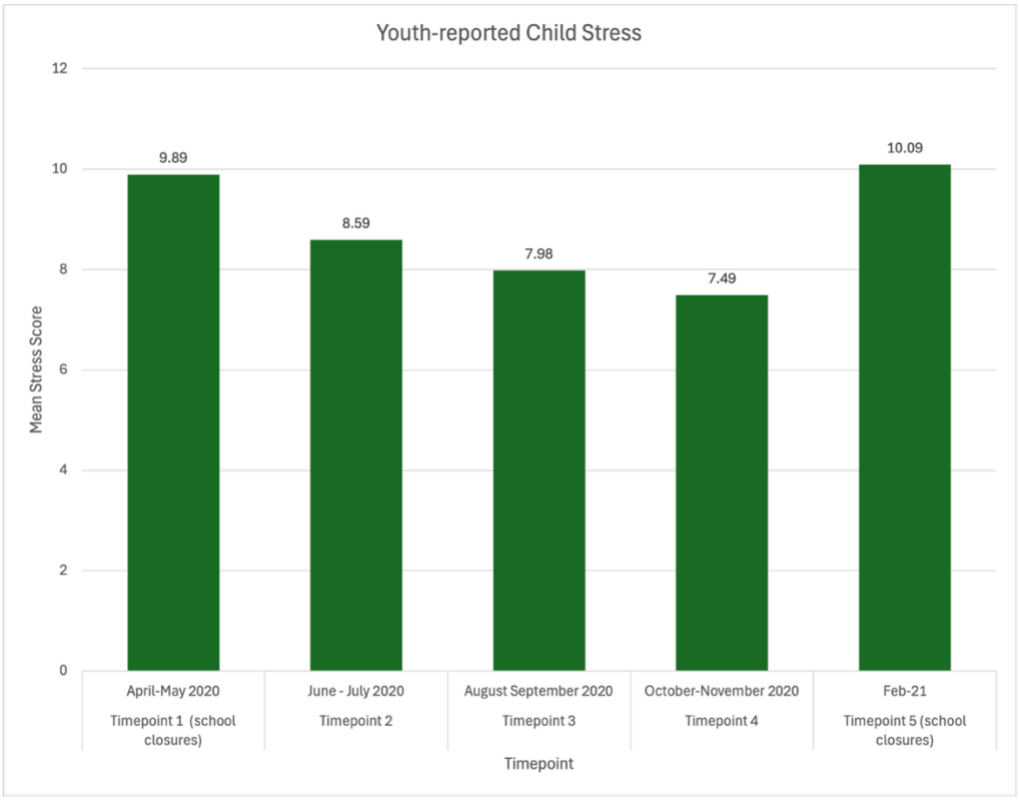

Figure 3: Youth Reported Stress across Time with Mean Scores

Parent Reported Correlation Results

As shown in Table 7, pandemic related deprivation was correlated with parent reported child stress across all timepoints (*rs* ranged from 0.28 to 0.37, all *ps* < .05). Having a pre-existing mental health and neurodevelopmental diagnoses was positively correlated with parent reported child stress across timepoints 1, 2, 3 and 5 (*rs* ranged from 0.17 to 0.18, all *ps* < .05).

Table 7 Correlations among Parent Reported Variables Measured (r, correlation coefficient)

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Sex	1											
2. Age	0.04	1										
3. Pandemic-related deprivation	-0.01	0.01	1									
4. Pre-existing MH/psychiatric and Neurodevelopmental Diagnosis	-0.07*	0.31*	0.15*	1								
5. Child stress at timepoint 1	0.09*	-0.01	0.29*	0.17*	1							
6. Child stress at timepoint 2	0.10*	-0.02	0.28*	0.17*	0.63*	1						
7. Child stress at timepoint 3	0.05	-0.02	0.37*	0.18*	0.53*	0.66	1					
8. Child stress at timepoint 4	0.03	0.02	0.35*	0.17*	0.53*	0.59*	0.65*	1				
9. Child stress at timepoint 5	0.02	-0.02	0.33*	0.17*	0.59*	0.63*	0.68*	0.67*	1			
10. Child anxiety at timepoint 1	0.10*	0.18*	0.21*	0.39*	0.41*	0.38*	0.32*	0.31*	0.32*	1		
11. Child depression at timepoint 1	0.03	0.23*	0.23*	0.37*	0.50*	0.38*	0.37*	0.31*	0.36*	0.57*	1	
12. Child resilience at timepoint 1	0.12*	-0.06	-0.17*	-0.31*	-0.16*	-0.12	-0.22*	-0.19*	-0.13*	-0.20*	-0.34*	1

Note: Asterisks (*) indicate statistically significant correlations ($p < .05$).

Parent reported child anxiety and depression symptoms at timepoint 1 were positively correlated with parent reported child stress at all timepoints (*rs* ranged from 0.31 to 0.41 and from 0.31 to 0.50, respectively (all *ps* < .05). Resilience was negatively weakly correlated with child stress across all timepoints (all *ps* <0.05, *rs* between -0.13 and -0.22).

Pandemic-related deprivation was positively correlated with pre-existing mental health and neurodevelopmental diagnoses (r=0.15, p<0.01), child anxiety (r=0.21, p<0.01), and child depression (r=0.23, p<0.01).

Youth Reported Correlation Results

As seen in Table 8, parent reported deprivation at T1 was positively correlated with youth reported stress across most timepoints (*rs* range from 0.25 to 0.31, all *ps* < 0.05), suggesting that higher parent reported pandemic deprivation at T1 was associated with higher youth reported stress scores across timepoints

Table 8 Correlations Among Youth reported Variables Measured (r, correlation coefficient)

Variable	1	2	3	4	5	6	7	8
1. Stress at timepoint 1	1							
2. Stress at timepoint 2	0.66*	1						
3. Stress at timepoint 3	0.52*	0.50*	1					
4. Stress at timepoint 4	0.55*	0.54*	0.98*	1				
5. Stress at timepoint 5	0.53*	0.58*	0.61*	0.52*	1			
6. Anxiety at timepoint 1	0.33*	0.40*	0.30*	0.33*	0.33*	1		
7. Depression at timepoint 1	0.43*	0.44*	0.43*	0.52*	0.35*	0.64*	1	
8. Resilience at timepoint 1	-0.03	-0.04	-0.25*	-0.17	-0.08	-0.10	-0.14	1
9. Parent reported pandemic-related deprivation	0.31*	0.25*	0.31*	0.28	0.38*	0.14	0.14	-0.11

Note: Asterisks (*) indicate statistically significant correlations ($p < .05$).

Youth reported resilience demonstrated a small negative correlation with youth reported stress at Timepoint 3 (r =-0.25, p <0.05). All remaining timepoints were not statistically significant (all *ps* >.05).

Youth reported depression (*rs* range from 0.35 to 0.44) and anxiety (*rs* range from 0.30 to 0.40) at baseline were significantly positively correlated with stress reported by youth at every timepoint (all *ps* < .001).

Growth Curve Modelling Results

Parent reported data

Linear and quadratic models were fitted and the scaled chi-square difference test was used to test whether the models differed significantly. The quadratic model (CFI = 0.96, TLI = 0.93, RMSEA 0.09, SRMR = 0.06) provided a significantly better fit for the data compared to the linear model (CFI = 0.84, TLI = 0.84, RMSEA = 0.14, SRMR = 0.11). The scaled chi-square difference test showed the quadratic model to be a better fit, compared to the linear model (χ^2 (4) = 63.26, p < .001). Therefore, the quadratic model was used for subsequent analysis. A sensitivity analysis was run using data from participants with complete data across the five timepoints (n = 236), showing similar results with the quadratic model presenting with optimal fit (CFI = 0.95, TLI = 0.91, RMSEA 0.15, SRMR = 0.05) compared to the linear model (CFI = 0.84, TLI = 0.84, RMSEA = 0.14, SRMR = 0.11).

In the quadratic model, the mean estimates for the intercept, linear slope, and quadratic slope were all significant (*ps* < .001*).* Participants started with stress levels significantly higher than zero (intercept = 8.58), and the instantaneous linear change in stress levels showed significant initial reductions on average (linear slope = -0.83). The mean quadratic estimate showed significant deceleration in this linear change and substantial curvature that leads to eventual increase in stress level by T5 (quadratic slope = 0.23). In terms of intercept and slope correlations, the higher the starting point the slower the rate of instantaneous linear reduction

in stress levels (standardised estimate = -0.52) and the faster the turning point in the curvature to increased stress levels (standardised estimate = 0.51). Participants with higher stress levels at baseline tended to show smaller initial reductions followed by a faster return to higher stress levels over time.

Trajectory of stress with sociodemographic covariates: a quadratic growth model with sex, age, pandemic-related deprivation and pre-existing MH and/or psychiatric and neurodevelopmental diagnosis predicting intercept, slope and quadratic factors fit well (CFI = .967, TLI = .929, RMSEA = 0.06, SRMR = 0.35). Older child age was associated with lower initial stress (estimate = -0.07, p = .022). Higher initial child stress was associated with greater pandemic deprivation (estimate = 0.31, p < *.001),* pre-existing mental health or neurodevelopmental diagnosis (estimate = 0.95, *p* <.001), and being male (estimate = 0.55, p = 0.002). While the quadratic model demonstrated non-linear changes in stress over time, the sociodemographic factors did not significantly predict the linear (initial rate of change) or quadratic slopes (curvature).

Trajectory of stress with anxiety and depression covariates: With the addition of parent reported child anxiety and depression symptoms at timepoint 1 as covariates, the model still fit the data well (CFI = 0.96, TLI = 0.95, RMSEA = 0.05, SRMR = 0.04). The mean estimates for the intercept (5.97), linear slope (-0.36), and quadratic slope (0.15) remained significant (*ps* < .001*).* As shown in Table 9, Depression at T1 was significantly associated with initial levels of stress and predicted its change over time (all *ps* < .01). Specifically, higher depression was linked to a slower rate in the initial reduction in stress (estimate = -0.07, *p < .001)* and followed by a faster turning point in the curvature to increased stress levels (estimate = 0.01, *p* = 0.002). Anxiety symptoms were significantly associated with initial stress (estimate = 0.09, *p* < .001) but did not significantly influence the initial rate of change or the curvature of stress change over time (*ps > .05)* .

Table 9: Results for Quadratic Growth Curve Model Conditioned on Timepoint 1 Mental Health Covariates

Outcome	Predictor	Estimate	Z Value	p
Intercept	Sex	0.26	1.91	0.056
	Age	-0.10	-4.77	<.001
	Deprivation	0.25	8.83	<.001
	Mental Health & Neurodevelopmental Diagnosis	0.05	0.3	0.768
	Anxiety	0.10	4.96	<.001
	Depression	0.19	10.63	<.001
Linear Slope	Anxiety	0.01	0.45	0.65
	Depression	-0.07	-3.73	0.00
Quadratic Slope	Anxiety	0.00	-0.79	0.43
	Depression	0.01	3.11	0.002

Trajectory of stress with resilience as covariate: An additional model was estimated and examined the impact of resilience as a time invariant covariate which fit the data well (CFI = 0.96, TLI 0.94, RMSEA = 0.05, SRMR = 0.04). As shown in Table 10, higher resilience was associated with lower initial level of stress (estimate = -0.03, *p* = 0.008) but did not significantly influence the rate of change in stress (*ps* > .05).

Table 10: Results for Quadratic Growth Curve Model Conditioned on Timepoint 1 Resilience Covariate

Outcome	Predictor	Estimate	Z Value	p
Intercept	Sex	0.46	2.89	0.004
	Age	-0.06	-2.26	0.024
	Deprivation	0.32	9.27	<.001
	Mental Health & Neurodevelopmental Diagnosis	0.69	3.67	<0.001
	Resilience	-0.03	-2.64	0.008
Linear Slope	Resilience	0.00	-0.05	0.957
Quadratic Slope	Resilience	0.00	0.44	0.66

Youth Reported Data

Youth reported stress levels over time: Both the linear and quadratic growth models for the youth reported stress levels did not converge properly. Therefore, a repeated-measures ANOVA was conducted. The overall ANOVA omnibus test was significant ($F(2.34, 105.2) = 6.747$, $p < 0.001$). Pairwise t-test comparisons with Bonferroni correction were conducted and showed statistically significant differences (all *ps* < 0.001) between timepoint 1 (Mean = 9.89, SD = 3.41) and: timepoint 2 (Mean = 8.59, SD = 3.22); timepoint 3 (Mean = 7.89, SD = 2.98); and timepoint 4 (Mean = 7.49, SD = 3.15). Timepoint 2 and timepoint 5 (Mean = 10.09, SD = 3.75) were also significantly different. Finally, the difference between Timepoint 3 and timepoint 5 was statistically significant. There were no differences found between timepoints 1 and 5; timepoints 2 and 3; timepoints 3 and 4; and timepoints 4 and 5. These results match the trajectory based on parent reported data, such that stress levels showed significant initial reduction which then showed stability (i.e., no differences between middle timepoints 2 and 3) and then stress levels at timepoint 5 increased to levels comparable to initial stress (i.e., no differences between timepoints 1 and 5).

Multiple regression models were used to test the impact of timepoint 1 predictors (sociodemographic variables, depression, anxiety, and resilience) on stress across the five

timepoints. Depression was consistently and significantly associated with higher stress across all timepoints ($p < 0.05$) except timepoint 5, and the strongest effect established was at timepoint 4 (standardised regression coefficients ranged from 0.03 to 0.69). Results from the multiple regression models are reported in supplementary material (see Appendix 8, page 106).

Discussion

This study's findings confirmed that child and youth stress levels fluctuated over time in line with changes of COVID-19 restrictions from April 2020 to February 2021, in Ontario, Canada. Parent and child and youth reported stress decreased during periods where schools reopened and restrictions eased, and then increased as schools closed and high restrictions were reintroduced. Several important factors were associated with initial levels of stress, such as pre-existing mental health and/or neurodevelopmental diagnoses and pandemic-related deprivation, psychological resilience, and mental health symptoms. Only initial depression symptoms predicted the rate of change in stress over time. These findings have important implications for our understanding of stress responsivity, identification of vulnerable children and youth at times of increased stress, and planning of interventions.

Pandemic-related deprivation, pre-existing mental health and/or neurodevelopmental diagnoses, and mental health symptoms of depression and anxiety were all associated with higher initial stress levels, further exemplifying how families with high needs were disproportionately affected by pandemic restrictions (Abrams et al., 2022; Gayatri & Puspitasari, 2022). Initial depression symptoms predicted a slower rate of recovery of stress levels when restrictions were eased and an acceleration in the return to high stress when restrictions were re-imposed. This is consistent with the stress-vulnerability model, a framework wherein psychological distress occurs when an individual with an underlying vulnerability (e.g. biological, psychological, neurodevelopmental) is exposed to significant external pressures or life events (Goh & Agius, 2010). Applied to the pandemic context, children and youth with mental health vulnerabilities, especially depression, are likely to have had limited capacity to cope with prolonged or severe disruptions and restrictions, leading to higher stress responsivity to restrictions over time. These findings build on previous research from this

cohort (Korczak et al., 2024) which showed that children experienced elevated depression and anxiety throughout the pandemic regardless of pre-existing mental health and/or neurodevelopmental diagnoses. Specifically, they found that those with pre-existing conditions experienced higher symptom burden overall but that children with and without pre-existing diagnoses experienced symptoms increase (Korczak et al., 2024). In this study, we show that stress level fluctuations mirrored level of restrictions imposed and that these effects were observed in the overall sample, although children and youth with pre-existing diagnoses or with higher symptoms of depression and anxiety at baseline started at higher levels of stress. Although stress level fluctuations are normative considering the scale of the crisis and associated restrictions, our current findings and previous research suggest that the pandemic had widespread effects on young people's experience of stress, mental health and that pre-existing mental health difficulties may reduce a young person's ability to tolerate further stressors.

Pandemic-related deprivation as reported by parents was positively correlated with parent reported and youth reported stress across all timepoints but did not predict rate of change in stress levels. The consistent correlations suggest that families experiencing financial hardship, food insecurity or limited access to essential services were more likely to report higher stress throughout the study. This underscores the significant impact of social determinants on family well-being (Ravens-Sieberer et al., 2021). This is also consistent with findings by Waite and colleagues (2021) showing that UK-based children from low-income households and children with special educational needs and/or neurodevelopmental disorders experienced elevated severity of mental health symptoms across the pandemic. It is therefore important to recognise the influence of systemic social and economic factors to better understand child and youth's health-related outcomes (Abrams & Stanley, 2020).

Developmental differences were also noted, with older children reporting lower initial stress levels compared to younger children. This could reflect more advanced coping strategies and emotion regulation in older youth, which is consistent with findings by Soest et al. (2020) who

found that increases in depressive symptoms were larger in younger children than in older children. Younger children's greater reliance on caregivers for emotional and practical support, combined with elevated parental stress (Shorer & Leibovich, 2020) may have also contributed to younger children's higher stress levels. Indeed, the reciprocal effects between parent and child stress and mental health outcomes over time during COVID-19 and their negative impact on overall family functioning has been previously established (Rizeq et al., 2023). This highlights the importance of caregiver well-being and accessibility to children, in addition to stable routines to protect against child stress during times of crisis.

Surprisingly, resilience as measured in this study had small to negligible associations with both parent reported and self-reported child and youth stress and only predicted lower initial stress levels in the parent reported model, suggesting that it may be a weak protective factor during the early phase of the pandemic. In addition, it did not play a role in shaping stress responses over time. The potential protective effect of resilience on initial stress levels during the early stages of the pandemic suggests that resilience may have limited influence under prolonged and chronic stress conditions (Schetter & Dolbier, 2011; Maunder et al., 2023) such as those experienced within the pandemic. Critically, it should be noted that within the current study, resilience was measured as a trait grounded in a social-ecological framework which captures individual capacity as well as access to social and environmental resources (Renbarger et al., 2020). During the pandemic, opportunities to access social support and other external resources were severely limited, which may have constrained the possible protective effect of resilience. That is, trait resilience does not function in isolation (de Maat et al., 2002) and its protective role may be conditional and/or context dependent (Fritz et al., 2018), requiring continued positive life experiences or clinical interventions aimed at its specific development (Joyce et al., 2018; Martinez & Opalinski , 2019; Chbeir & Carrión, 2023). Importantly, resilience has also been conceptualised as a dynamic process of recovery in response to everyday stressors (Zietse et al., 2005). In their review, Ziestse and colleagues emphasise that this dynamic process of recovery is influenced by access to social support, sleep quality, and self-esteem, all of which were impacted by the pandemic. Daily positive resilience promoting

factors like supportive environments, family routines, consistent school engagement, and peer interactions were all significantly disrupted during the pandemic. The limited effect of trait resilience on stress levels observed in the current study could then reflect the restricted availability of the daily recovery resources during a long-running period of uncertainty, isolation and significant change instead of an absence of resilience generally.

The present study focused on a selection of time-invariant predictors including resilience and mental health vulnerability, as these were most closely aligned with the research aim of exploring individual factors associated with child and youth stress responses. However, it is important to note other factors are likely to play a role such as parental mental health, family functioning and broader environmental influencers that may shape a child's stress responses. Future research could look to incorporate a wider range of individual and contextual variables to understand their influence on child and youth stress trajectories.

Strengths and Limitations

The study design allowed for a careful examination of changes in child and youth stress due to restrictions across different pandemic phases. The use of both parent and youth reported data offered a strong perspective on stress experiences, highlighting consistency across parent and youth perspectives in relation to fluctuations in stress responses. Additionally, the representation of children with pre-existing mental health and/or neurodevelopmental diagnoses speaks to the clinical diversity of the sample. However, there are several limitations that should also be acknowledged. Recruitment employed a convenience sampling approach by drawing participants from existing research cohorts, which likely contributes to some level of selection bias. These factors limit generalisability, especially in relation to the broader population's diversity in socioeconomic status, health literacy, or willingness to participate in research. As expected in longitudinal studies, and especially during a time of public health crisis, attrition was observed across the five timepoints. Sensitivity analyses were conducted on the subsample with complete data across timepoints to explore whether differences emerge. However, the results remained similar with no substantial differences that would impact overall

findings. Finally, there was a heavier reliance on parent reported data compared to youth self-report, which may have influenced the interpretation of children's subjective stress experiences. Nonetheless, this study still included a substantive number of youth who self-reported on their stress over time, and the results were consistent with the conclusions drawn from the parent reported data.

Implications and Recommendations

These findings have several important implications. Mental health and neurodevelopmental vulnerability and pandemic-related deprivation were consistently associated with higher stress levels over time, underscoring the need for targeted identification and support for vulnerable groups. Depression was unique in its effect on both initial stress levels and rate of change, suggesting it may serve as a useful indicator for early identification and intervention during times of heightened stress. From a policy perspective, ensuring access to targeted mental health supports, particularly for children and youth with pre-existing vulnerabilities, should be prioritised during times of crises. In addition, addressing broader social and economic inequalities, such as financial hardship and access to essential resources, is critical in mitigating stress responses. Future research should explore the role of family and contextual factors, such as parental mental health, to better inform intervention development.

Conclusion

This study findings highlight how children and youth stress levels mirrored the changes made to Ontario's COVID-19 restrictions, demonstrating that public interventions and restrictions should consider young people's wellbeing in their decision making. Mental health and neurodevelopmental vulnerability and pandemic-related deprivation were consistently associated with higher stress levels over time, underscoring the need for wider efforts to address social, economic and health inequalities. Depression was unique in its effect on both initial stress levels and rate of change, which can be used as an index for early identification and targeted intervention during times of heightened stress to help young people cope and recover from enduring stress. Ensuring access to targeted supports and resources will be key to protecting child and youth mental health during future crises.

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Appendices

Appendices for the Systematic Review

Appendix A: PRISMA Checklist

Section and Topic	Item #	Checklist item	Yes/No, location
TITLE			
Title	1	Identify the report as a systematic review.	Pg 9
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	No – word count limitation. Included in methods instead.
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pg 12
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Pg 12
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Pg 12
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Pg 13
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Pg 13-14
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Pg 14
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if	Pg 14-15

Section and Topic	Item #	Checklist item	Yes/No, location
		applicable, details of automation tools used in the process.	
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Pg 14-15
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Pg 14-15
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Pg 15
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Pg 18
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Pg 17
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Pg 16
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Pg 16
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Pg 16
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Pg 16

Section and Topic	Item #	Checklist item	Yes/No, location
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesised results.	Pg 14
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Pg 15
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Pg 15
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Pg 17
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Pg 17
Study characteristics	17	Cite each included study and present its characteristics.	Pg 20
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Pg 25
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Pg 31
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Pg 18
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Pg 31
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Pg 32
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesised results.	No, sensitivity analyses not reported
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Pg 24

Section and Topic	Item #	Checklist item	Yes/No, location
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Pg 34
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pg 34
	23b	Discuss any limitations of the evidence included in the review.	Pg 37
	23c	Discuss any limitations of the review processes used.	Pg 37
	23d	Discuss implications of the results for practice, policy, and future research.	Pg 38
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Pg 12
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Pg 12
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Pg 12
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Pg 39
Competing interests	26	Declare any competing interests of review authors.	Pg 39
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Not reported

Appendix B: PICOS Framework for Systematic Review

Population	• General population, all ages. No geographical restrictions. • Individuals experiencing worry/anxiety/fear concerning COVID-19/pandemic.
Intervention	• Psychological interventions • Delivery modes: therapist-delivered, therapist-guided, self-help/guided • Primary focus of intervention: treating pandemic anxiety. Studies published from November 2019 onwards.
Comparators	None required (e.g. to include pilots and feasibility studies)
Outcomes	Quantitative outcome measure relevant to (pandemic-related) anxiety, such as GAD-7 or COVID-19 Anxiety Questionnaire (CVAQ), or Coronavirus Anxiety Scale (CAS) or the COVID-19 focus has been captured by screening/assessment to stablish that distress is due to COVID-19/pandemic.
Study Design	Quantitative design

Appendix C: Search Terms

Ran on 21st August 2025

Databases	Filters	Terms
MEDLINE (via EBSCOhost) and PsychInfo	Publication dates limited to **January 2019 onward**	1. ("pandemic*" OR "COVID-19*" OR "coronavirus") AND 2. ("anxiety" OR "health crisis anxiet*" OR "infectious disease anxiet*" OR "global health threat anxiet*" OR coronaphobia OR "pandemic distress*" OR "COVID-19 distress*" OR "coronavirus distress*" OR "epidemic* distress*" OR "health crisis distress*" OR "infectious disease distress*" OR "global health threat distress*" OR "pandemic* worry*" OR "COVID-19 worry*" OR "coronavirus worry*" OR "epidemic* worry*" OR "health crisis worry*" OR "infectious disease worry*" OR "global health threat worry*" OR "pandemic* fear*" OR "COVID-19 fear*" OR "coronavirus fear*" OR "epidemic* fear*" OR "health crisis fear*" OR "infectious disease fear*" OR "global health threat fear*") AND 3. ("psychological intervention*" OR therap* OR "cognitive therapy" OR "cognitive behavio#ral" OR "behavio#ral therapy" OR psychotherapy OR CBT OR "mindfulness-based intervent*" OR "acceptance and commitment therap*" OR "exposure therap*" OR "stress management techniqu*" OR "supportive psychotherap*" OR "psychodynamic therap*")
Scopus	Publication dates limited to **January 2019 onward**	1. ("pandemic*" OR "COVID-19*" OR "coronavirus") AND 2. ("anxiety" OR "health crisis anxiet*" OR "infectious disease anxiet*" OR "global health threat anxiet*" OR coronaphobia OR "pandemic distress*" OR "COVID-19 distress*" OR "coronavirus distress*" OR "epidemic* distress*" OR "health crisis distress*" OR "infectious disease distress*" OR "global health threat distress*" OR "pandemic* worry*" OR "COVID-19 worry*" OR "coronavirus worry*" OR "epidemic* worry*" OR "health crisis worry*" OR "infectious disease worry*" OR "global health threat worry*" OR

		"pandemic* fear*" OR "COVID-19 fear*" OR "coronavirus fear*" OR "epidemic* fear*" OR "health crisis fear*" OR "infectious disease fear*" OR "global health threat fear*") 3. **AND** ("psychological intervention*" OR therap* OR "cognitive therapy" OR "cognitive behavio?ral" OR "behavio?ral therapy" OR psychotherapy OR CBT OR "mindfulness-based intervent*" OR "acceptance and commitment therap*" OR "exposure therap*" OR "stress management techniqu*" OR "supportive psychotherap*" OR "psychodynamic therap*")

Appendices Major Research Project

Appendix 1: STROBE Checklist

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2	This longitudinal study explored changes in perceived stress due to COVID-19 restrictions and the influence of psychological resilience, mental health vulnerability and pandemic-related material deprivation in shaping stress levels.
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2	See 'abstract'
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	2-6	See introductory pages across 2-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6	This study looked to provide insight to the complex dynamics of stress experiences during a global crisis and to further understand the factors shaping the psychological well-being of children and youth. The research questions were as follows: 1) Did perceived stress levels due to COVID-19 restrictions change over time in children and youth? 2)What was the role of mental health vulnerability, psychological resilience, and pandemic-related

				deprivation in the trajectory of child and youth stress levels due to the COVID-19 pandemic restrictions?
Methods				
Study design	4	Present key elements of study design early in the paper	7	The data used were collected online between May 2020 and February 2021. The selected timepoints reflected influential transition points in children's lives (e.g. returning to school from summer holidays) and pandemic-related public restrictions in Ontario, Canada (see description of time points below). This study was reported in alignment with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (see Appendix 1 in supplementary materials).
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7	Details about these cohorts are described and documented in the study protocol (Korczak et al., 2022).
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	7	Details about these cohorts are described and documented in the study protocol (Korczak et al., 2022).
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed		

		Case-control study—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	12-15	See 'Measures' section from page 12 onwards.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	12-15	See 'Measures' section from page 12 onwards.
Bias	9	Describe any efforts to address potential sources of bias	20	Sensitivity analysis.
Study size	10	Explain how the study size was arrived at	7	Details about these cohorts are described and documented in the study protocol (Korczak et al., 2022).

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	14	See 'data analysis' on page 14.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	15 and 7	Details about these cohorts are described and documented in the study protocol (Korczak et al., 2022).
		(*b*) Describe any methods used to examine subgroups and interactions	15 and 7	Details about these cohorts are described and documented in the study protocol (Korczak et al., 2022).
		(*c*) Explain how missing data were addressed	32	Attrition observed across the five timepoints. Those who completed measures across all timepoints were included in this study.
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy		
		(*e*) Describe any sensitivity analyses	32	Sensitivity analyses explored the impact of excluding those with incomplete data was measured and showed no

				substantial change or affect to the overall findings.
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7	Details about these cohorts are described and documented in the study protocol (Korczak et al., 2022).
		(b) Give reasons for non-participation at each stage	-	
		(c) Consider use of a flow diagram	-	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11	
		(b) Indicate number of participants with missing data for each variable of interest	-	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)		
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	10 and 17	
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures		
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	22, 24, supplementary material	
		(*b*) Report category boundaries when continuous variables were categorized	-	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-	

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	21
Discussion			
Key results	18	Summarise key results with reference to study objectives	27
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	31
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	27-33
Generalisability	21	Discuss the generalisability (external validity) of the study results	32
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	33

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Appendix 2: Major Research Project Proposal

Available at: https://osf.io/esn6f/files/rtqzx

Appendix 3: Proceed to Ethics Email

University of Glasgow
School of Health & Wellbeing

HM/PR

9th November 2024

Sanna Adams
@student.gla.ac.uk

Dear Sanna,

Major Research Project Proposal

Changes in child and youth stress during COVID-19: A longitudinal examination of resilience

The above project has been reviewed by your University Research Supervisor and by a member of staff not involved in your project and has now been deemed fit to proceed to ethics.

Congratulations and good luck with the study.

Yours sincerely

Prof Hamish McLeod
Professor of Clinical Psychology
DClinPsy Research Director

School of Health & Wellbeing
College of Medical, Veterinary and Life Sciences
University of Glasgow
Mental Health and Wellbeing, Clarice Pears Building
90 Byres Road, Glasgow G12 8TB
Email: dclinpsy@glasgow.ac.uk

Appendix 4: Ethical Approval Details and University Email Documentation

This study is covered under the ethical approval by the institutional research ethics board at the lead research site, SickKids (REB #1000070222). Additional approvals were obtained from St. Michael's Hospital (REB #20-080), Holland-Bloorview Rehabilitation Hospital (REB #0086), McMaster Children's Hospital (REB #10948), Queen's University (REB #6005107), and The Lawson Research Institute (REB #115934). Access to existing data was facilitated through primary investigator and field supervisor on the current project.

Monday, January 5, 2026 at 5:21:07 PM Greenwich Mean Time

Subject: MRP proposal
Date: Tuesday, 3 December 2024 at 18:56:01 Greenwich Mean Time
From: Heather Mcclelland
To: Sanna Adams (PGR)
CC: mhwb-dclinpsy-students

Evening Sanna

I have reviewed your MRP proposal and confirm that all required documents have been included.

Although you do not require ethical approval for your project, a proceed to ethics letter will still be provided to you in due course as proof that your proposal was reviewed by one of the academic team.

Good luck with the project
Heather McCelland

Clinical Psychology Lecturer

Appendix 5: Detailed Analysis Plan

Available at: https://osf.io/esn6f/files/9mr6s

Appendix 6: Data Analysis Process

Available at: https://osf.io/esn6f/files/pyct6

Appendix 7: Data Availability Statement

This study's data is not publicly available. Reasonable requests are subject to review and approval from the research team.

Appendix 8: Supplementary Information

Supplementary Table 1: Descriptive Statistics for Parent Reported Variables Over Timepoints

Variable		n	Mean	SD	Range (min, max)
Timepoint 1	Depression	1031	7.33	5.64	0, 27
	Anxiety	1025	7.26	5.19	0, 18
	Deprivation	999	4.67	2.54	2, 13
	Resilience	781	64.22	9.24	30, 80
	Stress	1030	8.62	3.07	3, 18
Timepoint *2*	Stress	653	8.27	2.87	3,15
Timepoint *3*	Stress	517	7.75	2.8	3,15
Timepoint *4*	Stress	295	7.753	2.77	3,15
Timepoint *5*	Stress	783	8.93	2.95	3,15

Note: Stress variable due to COVID-19 restrictions.

Supplementary Table 2: Descriptive Statistics for Youth Reported Variables Over Timepoints

Variable		N	Mean	SD	Range (min, max)
Timepoint 1	Depression	385	22.65	10.18	0, 51
	Anxiety	385	8.36	5.25	0, 18
	Resilience	143	64.45	10.21	16, 80
	Stress	385	9.89	3.41	4, 19
Timepoint 2	Stress	303	8.59	3.22	4, 18
Timepoint 3	Stress	203	7.98	2.98	4, 18
Timepoint 4	Stress	99	7.49	3.15	4, 17
Timepoint 5	Stress	179	10.09	3.75	4, 20

Supplementary Table 3. Standardised Regression Coefficients (β) Predicting Youth Stress Across Timepoint 1

Predictor	B	SE	β	p
Intercept	5.13	2.92	-	0.08
Sex	0.22	0.46	0.04	0.63
Age	-0.18	0.16	-0.09	0.25
Pandemic Deprivation	0.29	0.11	0.21	0.01*
Mental Health & Neurodevelopmental Diagnosis	0.14	0.18	0.06	0.46
Depression	0.14	0.03	0.48	<.001*
Anxiety	0.05	0.06	0.08	0.45
Resilience	0.19	0.03	0.06	0.45

Note: Asterisks (*) indicate statistically significant correlations ($p < .05$).

Supplementary Table 4. Standardised Regression Coefficients (β) Predicting Youth Stress Across Timepoint 2

Predictor	B	SE	β	p
Intercept	4.41	2.90	-	0.13
Sex	0.17	0.45	0.03	0.70
Age	-0.14	0.16	-0.07	0.40
Pandemic Deprivation	0.30	0.10	0.22	0.00*
Mental Health & Neurodevelopmental Diagnosis	0.36	0.18	0.16	0.05*
Depression	0.11	0.03	0.41	0.00*
Anxiety	0.04	0.06	0.07	0.50
Resilience	0.00	0.03	0.02	0.79

Note: Asterisks (*) indicate statistically significant correlations ($p < .05$).

Supplementary Table 5. Standardised Regression Coefficients (β) Predicting Youth Stress Across Timepoint 3

Predictor	B	SE	β	p
Intercept	7.47	3.50	-	0.04*
Sex	-0.11	0.65	1.27	0.87
Age	-0.16	0.19	1.08	0.40
Pandemic Deprivation	0.26	0.15	1.04	0.08
Mental Health & Neurodevelopmental Diagnosis	0.37	0.21	1.11	0.08
Depression	0.09	0.03	1.77	0.01*
Anxiety	0.04	0.08	1.75	0.61
Resilience	-0.03	0.03	1.11	0.37

Note: Asterisks (*) indicate statistically significant correlations ($p < .05$).

Supplementary Table 6. Standardised Regression Coefficients (β) Predicting Youth Stress Across Timepoint 4

Predictor	B	SE	β	p
Intercept	5.58	4.74		0.25
Sex	-0.19	0.79	-0.03	0.81
Age	--0.24	0.25	-0.12	0.34
Pandemic Deprivation	0.05	0.17	0.04	0.78
Mental Health & Neurodevelopmental Diagnosis	0.14	0.25	0.08	0.58
Depression	0.17	0.05	0.70	0.00*
Anxiety	-0.03	0.10	-0.06	0.74
Resilience	0.02	0.04	0.07	0.61

Note: Asterisks (*) indicate statistically significant correlations ($p < .05$).

Supplementary Table 7. Standardised Regression Coefficients (β) Predicting Youth Stress Across Timepoint 5

Predictor	B	SE	β	p
Intercept	2.68	5.60	-	0.63
Sex	-0.53	0.95	-0.07	0.58
Age	0.42	0.29	0.17	0.16
Pandemic Deprivation	0.17	0.18	0.12	0.33
Mental Health & Neurodevelopmental Diagnosis	0.35	0.30	0.15	0.25
Depression	0.01	0.44	0.03	0.85
Anxiety	0.18	0.11	0.25	0.10
Resilience	-0.03	0.05	-0.09	0.49

Note: Asterisks (*) indicate statistically significant correlations ($p < .05$).

Supplementary Table 8. Intervention Modality Additional Information

Study	Intervention Name	Therapeutic Approach & Components
Alavi (2023)	CBT	1) Introduction & vicious cycle of thoughts, 2) Depression & anxiety management, 3) Relaxation training, 4) Lifestyle change, 5) Logical analysis of thoughts, 6) Problem-solving skills, 7) Cognitive errors management, 8) Relapse prevention. Techniques: cognitive restructuring, behavioural activation, relaxation, problem-solving, mindfulness, lifestyle modification.
Pezhman (2024)	Transdiagnostic Child-Parent Focused Intervention with ACT for the parent based on Eifert et al.'s (2017) approach.	Components: 1) Introduction to therapy and ACT, 2) Psychoeducation on emotional disorders and parental anxiety, 3) Mindfulness and present-moment exercises, 4) Cognitive diffusion and flexibility, 5) Values identification, 6) Committed action, 7) Emotional awareness and acceptance, 8) Exploring the self and compassion, 9) Parenting practices using ACT, 10) Problem-solving skills, 11) Building resilience, 12) Review and closure.
	Transdiagnostic Child-Focused Intervention without ACT for the Parent based on Ehrenreich-May et al.'s (2019) approach	Components: 1) Introduction and orientation, 2) Understanding emotions, 3) Mindfulness skills, 4) Identifying emotion triggers, 5) Cognitive flexibility, 6) Emotional regulation strategies, 7) Facing fears (graded exposure), 8) Problem-solving skills, 9) Building positive relationships, 10) Enhancing self-esteem, 11) Maintaining gains and coping with setbacks, 12) Review and future planning.
Crawford (2024)	CBT	CBT for health anxiety targeting COVID-related fears. Components: 1) Detailed assessment of thoughts and fears, 2) Identification of anxiety-maintaining behaviours (reassurance seeking, symptom monitoring, internet checking), 3) Use of Beck's Anxiety Equation, 4) Diary keeping, Socratic dialogue, behavioural experiments, 5) Graded exposure to re-engage with curtailed activities, 6) Tailoring of session content to individual difficulties, 7) Supplementary self-help booklet
Renganathan (2023)	CBT	Components included: 1) Cognitive conceptualisation (rapport building, mood check, CBT diary, identifying automatic thoughts, emotional and physical responses, deep breathing, relaxation, mindfulness); 2) Structuring & shifting thoughts (reviewing mood/diary, addressing beliefs and COVID-related fears, guided discovery, deactivation/neutralisation techniques, continued relaxation & mindfulness, spiritual discussion incorporating Quran/prayer as appropriate); 3) Termination session (review of goals, assessment of improvement, discussion of outcomes). Daily practice of techniques was emphasized; fears were explored (e.g., loss of loved ones, social media distress, vaccination

		concerns), avoidance of misinformation was encouraged, and grounding in the present was emphasized.
Esmaeili (2023)	CBT	1) CBT orientation and A-B-C model, 2) Identifying mental errors, 3) Identifying common cognitive distortions, 4) Thought injection (Ellis cycle) & reversed attention, 5) Rating thoughts/emotions & challenging spontaneous thoughts, 6) Jacobson muscle relaxation, 7) Problem-solving skills and cognitive restructuring, 8) Role-playing real/hypothetical problems & relapse preparation. Weekly assignments, discussion of thoughts/behaviours from prior week, replacement of dysfunctional thoughts, and practicing healthier behaviours emphasized.
Farzin (2024)	Guided imagery	(1) Orientation, rapport building, initial interview, explaining goals; (2) Foundational mental imagery exercises & identifying irrational beliefs; (3) Education on negative thoughts, anxiety, and imagery technique training with relaxation preparation; (4) Logic of intervention & practicing evoking and describing images; (5) Expanding and modifying mental images to develop adaptive skills; (6–9) Repeated guided imagery cycles (three 15-min rounds per session) using relaxation and previously learned steps; (10) Consolidation, reflection, interpretation, and planning continued use.
	Lazarus Multimodal Therapy	(1) Counselling orientation, disease education, expectations; (2) Multifaceted life-event checklist review; (3) Individual profile development; (4) Identifying logical vs illogical cognitions and emotional/behavioural effects; (5) Emotion-focused work & muscle relaxation training; (6) Behavioural techniques: self-expression, reinforcement, empty-chair; (7) Fostering positive ideas and resilience; (8) Training appropriate emotional expression (e.g., anger management); (9) Relaxing mental imagery practice; (10) Enhancing social relationships, self-care, and confidence, including family-related guidance.
Frydendal (2025)	ACT	Mainly text-based with video clips, audio exercises, e.g. mindfulness and values clarification, interactive exercises, values-based exposure and weekly homework assignments. The intervention focused on accepting fear of illness while changing maladaptive control and avoidance behaviours to more long-term goal-oriented behaviours in line with personal values. The treatment program was adapted for COVID-19-related health aniety by adding relevant examples.
Guzick (2022)	Parent-led CBT	1) Goal-setting and psychoeducation related to emotions from a cognitive-behavioural perspective (e.g., functional role of avoidance, breaking down emotional experiences into thoughts, physical sensations, and behaviours); 2) Psychoeducation and planning of transdiagnostic, parent-led emotion exposures (i.e., including traditional anxiety-focused exposure or exposures addressing irritability or low mood); 3) Continued exposure planning,

		psychoeducation regarding parenting behaviours; 4) Continued exposure, behavioural activation activity planning, and opposite parenting behaviour; 5) Continued exposure and included mindfulness/present-moment awareness exercises; 6) Guiding children to identify "thinking traps" or cognitive distortions and think more flexibly via cognitive reappraisal. Clinicians adapted exercises to ensure adherence to public health guidance related to the COVID-19 virus.
Joharifard (2022)	ACT	ACT protocol including: (1) Orientation, rapport-building, expectations, ethics, consent, intro to ACT; (2) Linking anxiety, illness, and mood; creative hopelessness; values introduction with metaphors; (3) Acceptance of anxiety, exploring mood–suffering relationships using personal examples; (4) Differentiating values vs. goals, values clarification, introducing "failure of control" over thoughts/feelings via metaphors; (5) Reviewing homework, mindfulness practice, distinguishing self-as-context vs. self-as-content; (6) Further values clarification using metaphors; (7) Commitment to value-based behaviour's through behavioural activation tasks; (8) Consolidating values work, training participants to self-manage ACT skills, addressing end-of-treatment concerns.
Ludlow (2023)	CBT	The intervention was developed by the lead author in April 2020 as a response to the anticipated impacts of the COVID-19 pandemic on adolescent mental health. Core components: (1) Program overview, goal development, psychometric feedback; (2) Behaviour activation to address low-reward lockdown environments, mood impact, parent involvement; (3) Cognitive biases psychoeducation, CBT formulation shared with adolescent and parents; (4) Cognitive restructuring using ABC-D model, behavioural experiments, challenging unhelpful pandemic thoughts; (5) Problem-solving skills training and psychoeducation; (6) Review of progress using psychometrics and relapse prevention planning.
Shabahang (2021)	Video-based CBT	Positive appraisal; non-catastrophic interpretations; alternative, less-threatening explanations; challenging automatic thoughts; reducing false safety-seeking behaviours; shared understanding; reducing intrusive images; addressing attentional biases, bodily hypervigilance, symptom amplification; and coping strategies for illness anxiety.
Wahlund et al. (2021)	CBT	(1) Psychoeducation on worry, functional vs. dysfunctional worries, and worry diary practice; (2) Problem-solving strategies for solvable worries (identify solvable problems, schedule problem-solving time, generate and evaluate solutions); (3) Reduction of unhelpful checking and reassurance-seeking (identify behaviours, decrease or postpone checking, assess

		impact on worry); (4) Cognitive detachment strategies (e.g., “flight controller” exercise comparing responding vs. not responding to worry thoughts); (5) Focus-shifting and engagement in alternative activities, plus summary and relapse prevention. Participants complete short readings (up to 8 pages per module) and practice tasks with digital worksheets.
Zepeda (2023)	iCOPE with COVID-19	1) Building rapport with the client, providing psychoeducation about COVID-19 and emotions, and practicing a relaxation strategy to manage anxiety; 2) Reviewing homework from Session 1 and identifying other strategies for emotion regulation; 3) Helping children develop strategies to manage emotions by using mind- fulness, present-moment strategies, and dialectical behavioural strategies.

Appendix 9: Reflexivity Statement

Reflexivity has been an ongoing and active process throughout this project. As I shared in my Module 9 (thesis proposal) reflexivity statement, I approached this research as a continuous cycle of self-reflection filled with supervisory discussions, protected time for personal reflection. This helped me to maintain a transparent, accountable and ethical mindset as I developed this research.

My interest in studying the trajectories of stress for children and young people, alongside interventions that are relevant to pandemic-related anxiety for the systematic review, arose from a combination of my own academic curiosity and clinical experience of working in the pandemic. I have a particular interest in the impact of prolonged uncertainty I believe it impacted every individual globally, and in different ways.

While I did not collect the data myself for the major research project component, I recognised that this did not stop me from being ethically responsible within and throughout my research activities. I remained actively mindful that the dataset was composed of children, young people and caregivers who contributed their time, personal experiences and vulnerabilities during a period of significant disruption. I sought to acknowledge their contribution by handling the data with care, respect and transparency, recognising the impact that analytic decisions can have on how their experiences are represented.

Throughout the statistical analyses of the major research project, I reflected on how each decision (e.g. cleaning the dataset to remove siblings) can impact the research, interpretation and discussion of the experiences of participants. I was aware of the power imbalance present for researchers when building an interpretation of resilience and vulnerability from a trajectory analysis. Regular and organised supervisory discussions helped me to consider these issues in more detail.

In my earlier reflective statement for module 9, I aimed for the research that I was developing to be a meaningful contribution to the academic landscape while being aware of its broader impact. My own experience of gaining professionally and

academically from this project and research work has been carefully balanced with ensuring that participants' time and experiences are treated with integrity and care.