

Mental health, coping and related risk factors during the first 2 years of the COVID-19 pandemic in children: Nationally representative, multi-wave, cross-sectional results from 12 countries from the global COH-FIT study

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ABSTRACT

Few multinational studies have assessed risk factors and coping strategies associated with the impact of the COVID-19 pandemic on children's mental health over time. The Collaborative Outcomes study on Health and Functioning during Infection Times (COH-FIT) is the largest transcontinental, multi-wave, cross-sectional survey collecting multi-nation data on well-being and psychopathology during the pandemic. We analyzed country-specific, general-population-based, representative COH-FIT data of 6067 children aged 6–13 years from 12 countries across repeated cross-sectional waves over a period of >2 years (Apr/2020–May/2022), addressing through current and retrospective assessment pre- to intra-pandemic changes in well-being (WHO-5) and general psychopathology scores (P_C) (0–100) in relation to COVID-related deaths, stringency index, eight a priori risk factors, and 16 coping strategies in different responders at each wave. From pre- to intra-pandemic, WHO-5 scores decreased (−4.59, 95%CI=−6.18 to −2.99, $p < 0.001$), while PC-scores increased (+6.68, 95%CI=4.48–8.88, $p < 0.001$) significantly, following distinct time patterns but both returning to near pre-pandemic levels. Changes in both scores varied by country. WHO-5 scores correlated strongly with P_C and subdomain scores. Both score changes were significantly but minimally associated to COVID-19 deaths/stringency index. The proportion of children screening positive for depression increased from 3.9% to 8.3% ($\chi^2=145.70$, $p <$

Equal contribution (Joint first authors).

0.001) and for major depression from 0.6 % to 2.2 % ($\chi^2=68.64$, $p < 0.001$) intrapandemic. WHO-5 and P_C-score changes were significantly associated with female gender, school closure, and pre-existing physical and mental conditions, with cumulative effects. The five most frequently endorsed coping strategies were family contact (85.2 %), friends (67.3 %), outdoor play (54.0 %), pet interaction (51.5 %), and internet use (50.9 %). Identified risk groups and coping strategies can inform targeted interventions and global public health policy.

Trial Registration: ClinicalTrials.gov; Identifier: NCT04383470

1. Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic emerged as a global crisis with unprecedented ramifications transcending geographical, cultural, and socioeconomic boundaries (Fauci et al., 2020). Apart from its public-health-related toll, the related restrictive measures posed immense challenges to every personal, societal, economical and professional aspect of life worldwide, especially in certain risk subgroups (GBD Demographics Collaborators, 2024). Children represent a particularly vulnerable societal group that requires special consideration (Singh et al., 2020), due to several age-specific biological and psychosocial risk factors. Children are particularly vulnerable to neurodevelopmental disruption due to the combination of a heightened biological plasticity and altered stress-response system reactivity during this critical developmental phase (Agorastos et al., 2019, 2018) together with increased exposure to subjective stress, dependency on social interactions, familial stressors (e.g., higher parental stress among pre-schoolers), undiagnosed neurodiversity concerns, restricted access to social and educational activities or entertainment, and limited coping abilities (Loades et al., 2020; Marques de Miranda et al., 2020; Samji et al., 2022; Tso et al., 2022), as well as specific pandemic-related stressors, such as social and physical activity disruptions, reduced access to supportive services, and unsupervised use of electronic media. Moreover, over 50 % of those with a mental disorder develop it by age 18 (Solmi et al., 2022c).

Since the beginning of the pandemic, a growing body of high-quality, cohort-based research has examined its impact on children's mental health. Recent meta-analytic evidence suggests a moderate detrimental pandemic influence on mental health of children around the world, with higher prevalences of emotional and behavioral problems than pre-pandemic (Dragioti et al., 2022; Jing et al., 2024; Miao et al., 2023), especially in children of specific risk groups [e.g., pre-existing somatic conditions (Vasquez et al., 2020) and mental health problems (Cortese et al., 2020)]. A large meta-analysis of 53 longitudinal cohort studies from 12 countries including 40,807 children and adolescents identified additional risk factors, including female gender, low income-class and lower socioeconomic country of residence (Madigan et al., 2023). Families with children at risk struggled even harder to cope with pandemic-related restrictions on top of additional child-related obstacles affecting daily routines (e.g., home schooling) (Becker et al., 2020).

However, mental health studies in children often resulted in mixed or even contradictory findings, due to high cross-study heterogeneity of study design, setting, outcomes, assessment tools, timing, geographical and cultural factors (Dragioti et al., 2022). Most studies have important limitations, such as a focus on isolated psychopathology domains, small sample sizes, data collection restricted to one country/language or population subgroup, combined reporting of children/adolescents as well as non-representative sampling (Dragioti et al., 2022). Moreover, most studies are either cross-sectional, single time-point studies or longitudinal studies that did not account for variation in COVID-related parameters (e.g., death rates, restrictive measures) over time. These facts limit the generalizability of many findings, posing methodological barriers to the synthesis of current evidence. Although the large meta-analysis of Madigan et al. offers some comparison and evidence on international variations in psychopathology in children and adolescents (Madigan et al., 2023), no individual study has offered simultaneous transcontinental assessments. Finally, most studies focused on

psychopathology only, neglecting the important area of helpful coping strategies.

The “Collaborative Outcomes study on Health and Functioning during Infection Times” (COH-FIT) is the largest international, multi-language (30 languages) online study worldwide measuring the impact of COVID-19 pandemic on health and functioning in representative and weighted, convenience samples of adults, adolescents, and children across 5 continents over a period of >2 years, cross-sectionally assessing different responders in different waves (Solmi et al., 2022a, b). Leveraging current, intra-pandemic and retrospective, pre-pandemic COH-FIT data of minors, this report aims to provide comprehensive transcontinental insights into mental health trajectories amidst the evolving pandemic landscape in children. COH-FIT results on adults (Solmi et al., 2024a, 2024c) and adolescents (Solmi et al., 2024b) have been previously published, as well as the validation of both a composite psychopathology P-score and the multi-language translation (Solmi et al., 2023). In this article, we report nationally representative global and country-related findings on pre- to intra-pandemic changes in well-being and overall psychopathology in children over a period of >2 years, hypothesizing worsened well-being and increased psychopathology globally, enhanced impairment in vulnerable subgroups with cumulative effects across multiple risk factors, and a negative relationship to current death rates and stringency measures over time. We also report on the subjectively endorsed coping strategies for dealing with the pandemic.

2. Experimental procedures

2.1. Study design

The COH-FIT design has been described in detail previously (Solmi et al., 2022a, b). This article presents an analysis of COH-FIT Children (COH-FIT-C) data in association to COVID-related deaths, stringency measures and several other related factors, from a large, transcontinental, representative child sample (age: 6–13 years) collected over a period of >2 years from 12 different countries (Table 1). Nationally representative data were collected cross-sectionally through polling institutes at distinct wave periods, including different participants at each wave (Suppl. Methods). Each child participated at one time point, but reported through current and retrospective assessment on intra- and pre-pandemic well-being and other data, enabling reconstruction of pre-vs. intra-pandemic differences.

2.2. COH-FIT questionnaire for children

For children, the COH-FIT-C, a condensed content survey instrument (compared to the adult/adolescent version) with developmentally appropriate language was applied after parental consent, as previously described (Solmi et al., 2022b) (see also Suppl. Methods, Table S1).

2.3. Primary and secondary outcomes

The two co-primary outcomes were the pre- to intra-pandemic changes in overall well-being [assessed by the World Health Organization 5-item Well-being Questionnaire, WHO-5 (Topp et al., 2015)], and general psychopathology (assessed by a four-dimensional composite psychopathology score, P_C-Score). For details on the P_C-Score

Table 1
Basic (raw/unweighted) participant characteristics.

Variable	Value	N	%
Age	6	112	1.8
	7	156	2.6
	8	126	2.1
	9	126	2.1
	10	1627	26.8
	11	1399	23.1
	12	1324	21.8
	13	1197	19.7
Gender	Boy	3308	54.5
	Girl	2753	45.4
	Other	6	0.1
Income Country Classification	High income	5345	88.1
	Middle income	722	11.9
	Low income	0	0.0
Stringency index	0–24	600	9.9
	25–49	1403	23.1
	50–74	3032	50.0
	75–100	1032	17.0
	No	5620	92.6
COVID-19-related loss	Yes	447	7.4
	Not reported	0	0.0
Month of survey completion	Apr-2020	268	4.4
	Jul-2020	2	0.0
	Oct - Nov 2020	1811	29.9
	Jan 2021	513	8.5
	Apr 2021	899	14.8
	Jun - Jul 2021	216	3.6
	Sept - Oct 2021	33	0.5
	Jan - Febr 2022	560	9.2
	Mar - May 2022	1765	29.1

development, see Suppl. Methods. Secondary outcomes were the subjective effectiveness of 16 specific coping strategies to deal with the pandemic. Covariates were selected risk factors, time-/country-specific COVID-related daily deaths and stringency measures.

2.4. Risk factors

Eight risk factors for poor well-being and mental health in children were selected *a priori* based on clinical judgement, available COH-FIT-C questionnaire items, prior publications (Solmi et al., 2024a,b,c) and targeted literature review (Panchal et al., 2023; Samji et al., 2022; Singh et al., 2020): COVID-19 positive test status, COVID-19-related loss, female gender, school closure, pre-existing physical condition, pre-existing mental disorder, low country income and immigrant status. Low country income was excluded as a risk factor, as this did not apply to the assessed countries.

2.5. Coping strategies

Sixteen specific coping strategies were identified *a priori* based on clinical judgment, prior publications (Solmi et al., 2024a, 2024b, 2024c), and a targeted literature review (Cauberghe et al., 2022; Raudenska et al., 2023; Solmi et al., 2020) and were ranked by the respondents by importance (very/somewhat/not) for successfully dealing with the pandemic: internet use, sport/exercise, school work/home schooling, watching TV, contact with family, contact with friends, playing outside, walking outside, playing inside, spending time with pet, listening to music, hobby/playing instrument, gaming, reading, COVID-related information, religion/meditation/spirituality, and “other”.

2.6. COVID-19-related deaths and restrictive measures

Time-/region-specific COVID-related daily deaths, as well as a country-specific stringency index for restrictive measures were considered as provided from the Johns Hopkins University repository (<https://coronavirus.jhu.edu/data>) and the University of Oxford stringency metric (<https://covidtracker.bsg.ox.ac.uk/>), providing country-specific current daily ratings for severity of government-imposed restrictions (0–100) based on nine comprehensive metrics (e.g., school closures, facial coverings). All reporting followed the Consensus-Based Checklist for Reporting of Survey Studies (CROSS) eChecklist (Sharma et al., 2021).

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2.7. P_C-score validation

The P-score has been previously validated in adults/adolescents as a five-dimensional factor of overall psychopathology (Solmi et al., 2023). Here, we performed an internal psychometric validation of the slightly modified, four-dimensional P_C-score in children following same structure and based on the same items as the validated P-score in adults/adolescents (excluding the psychosis item): anxiety, depression, posttraumatic and psychophysiological symptoms (sleep, concentration difficulties, stress). Further details on P_C-score's structure and validation are described in Suppl. Methods.

2.8. Data analysis

For this paper, only nationally-representative data of at least 250 children aged 6–12 years old per country/wave, collected by standardized procedures of CAWI interviews by professional polling agencies and with a strict missingness and outlier threshold were included in further analyses (Suppl. Methods). Missing data input handling is described also in Suppl. Methods. WHO-5 and P_C scores were both rated on a visual analog scale (VAS) 0–100, with higher values indicating better well-being and poorer mental health, respectively. Each rating was matched with the respective daily country-specific stringency index and COVID-related death rate data. Descriptive time trends in well-being and P_C-score changes were explored with cubic regression splines (Suppl. Methods). Pre- vs. intra-pandemic outcome changes across time were examined through mixed-effects linear regression including country as a random-effect, as time impact across different nations is likely to vary, with sampling weights applied to correct for any minor imbalances across gender. We have also computed binary WHO-5 variables based on two clinical thresholds (<50 and <29 points), indicative of depression screening and clinical major depression accordingly (Topp et al., 2015). Paired *t*-test and McNemar's χ^2 test were used to compare pre- to intra-pandemic WHO-5/P_C raw score changes and category proportion changes with WHO-5 score <50/<29, respectively. A correlation analysis among co-primary outcomes was conducted. Independent *t*-tests were used to measure pre vs. intra-pandemic changes in subjects with vs. without each risk factor. An *a priori* derived cumulative risk score (sum of at-risk group memberships which each participant was identified to belong to; 0–8) was used to assess the effect of multiple concomitant risk factors on WHO-5/P_C-scores by regression analyses. Recall bias was assessed by examining associations between pre-pandemic ratings and time-interval between pre-pandemic baseline and time of survey administration, through polynomial regression analyses assessing any linear or quadratic trends (Suppl. Methods). R was used for all analyses, using the MICE (van Buuren and Groothuis-Oudshoorn, 2011), ggplot2 (Wickham, 2016), psych (Revelle and Revelle, 2015) and lavaan (Lavaan, 2012) packages. Statistical significance was set at $p < 0.05$ (two-sided). We followed the EQUATOR reporting guidelines for observational studies (STROBE checklist for cross-sectional studies) (von Elm et al., 2007).

3. Results

3.1. Survey sample

Between April 27th, 2020 and May 30th, 2022, valid country-representative survey responses were collected from 6067 children

(mean age: 11.1 ± 1.6 years; range: 6–13; gender distribution: 45.4 % girls). General participant characteristics are provided in Table 1 and country-specific results in Suppl. Results. For data screening/missingness and recall bias analyses see Suppl. Results and Figure S1.

3.2. P_C -score model structure and psychometrics

Results of model testing are presented in Suppl. Results, Figure S2 and Table S2. The second-order and correlated-factors model both met established model fit thresholds, with the first exhibiting marginally more favorable fit indices for RMSEA and BIC. All factor-item loadings except for one were >0.70 (Figure S2) demonstrating good convergent validity. The General Factor-subdomain loadings ranged from 0.83–0.93 indicating a strong degree of commonality in males and females (Table S3). Reliability was high for both the total P_C -score ($\omega=0.94$) and separate subdomains ($\omega=0.85$ –0.88) (Table S4). Measure invariance was satisfactory across different country, language and gender groups (Suppl. Results, Table S5). WHO-5 and P_C -scores showed moderate correlations for both the overall ($r=-0.46$, $p < 0.001$) and the domain scores ($r=-0.30$ to -0.52 , $p < 0.001$) respectively (Table S6).

3.3. Changes in well-being

Weighted mixed-effects regression analyses indicated an overall decrease (worsening) in WHO-5 well-being during the pandemic of 4.59 (95 % CI: 2.99–6.18) points ($t = 5.85$, $p < 0.001$) from a pre-pandemic baseline of 81.66 (standardized mean difference, $SMD=0.28$) (Figure S3). The proportion of children scoring WHO-5 < 50 increased from 3.9 % pre-pandemic to 8.3 % intra-pandemic ($\chi^2=145.70$, $N=6067$, $p < 0.001$), while the proportion of children scoring WHO-5 < 29 increased from 0.6 % pre-pandemic to 2.2 % intra-pandemic ($\chi^2=68.64$, $N=6067$, $p < 0.001$). The random-effects intercept term showed a WHO-5 score change magnitude variation across countries ($SD=2.64$) (Figure S5). Follow-up individual country-wide comparisons indicated significant worsening in all assessed countries, except Canada, Russia and USA (Table 2).

3.4. Changes in P_C -score

The P_C -score increased (worsened) by 6.68 (95 % CI 4.48–8.88) points ($t = 5.96$, $p < 0.001$) from the pre-pandemic baseline of 33.67 ($SMD=0.28$) (Figure S4), with a notable variation in P_C -score change size ($SD=3.80$) across countries (Figure S6). Individual country-wide comparisons indicated significant worsening of psychopathology in all countries except France and Canada (Table 2). Additionally, the proportion of children, whose P_C -scores increased relative to pre-pandemic levels by at least 20 %, 30 %, 40 % and 50 % were 46 %, 40 %, 35 % and 32 %, respectively.

3.5. Change trajectories in well-being, P_C -score, COVID-19 deaths and restrictions

Fig. 2 shows regression splines fitted to WHO-5 scores [$F = 21.03$, $p < 0.001$] and P_C -scores [$F = 10.04$, $p < 0.001$] across time, along with daily stringency index and COVID-related death rates rescaled to a similar metric to facilitate visual comparison. The WHO-5 score appeared to be relatively stable in the first survey phase, followed by a distinct fall between Dec 2020 and April 2021 and a subsequent continuous improvement towards normalization at survey end (June 2022) (Fig. 1A). The P_C -score showed a different pattern with subsequent sharp rises and falls, and a final improvement towards normalization at survey end (Fig. 1B). There was a very small but significant association of WHO-5 score changes with COVID-related deaths ($r=-0.06$, $p < 0.001$) and stringency index ($r=-0.11$, $p < 0.001$), respectively. P_C -score changes correlated significantly only with the stringency index ($r=-0.04$, $p < 0.001$) but not with COVID-related

Table 2

Changes in well-being (WHO-5) and overall psychopathology (P_C -score) in children across countries, sorted by magnitude of change.

Country	N	Pre-pandemic		Intra-pandemic		Weighted change	
		M	SD	M	SD	M	p
WHO-5 score							
Germany	771	80.89	15.88	72.68	21.04	−8.22	<0.001
Poland	391	83.49	14.04	75.53	19.50	−7.96	<0.001
Brazil	504	84.14	15.26	77.48	19.65	−6.61	<0.001
Greece	242	77.53	20.82	71.27	21.32	−6.26	0.001
France	246	80.59	16.54	75.09	18.43	−5.51	0.001
United Kingdom	585	78.58	15.19	73.24	18.75	−5.38	<0.001
Austria	532	83.12	15.22	78.45	18.43	−4.67	<0.001
Spain	1250	83.21	14.47	78.89	16.18	−4.39	<0.001
Italy	488	82.38	14.07	78.12	16.82	−4.27	<0.001
United States of America	515	77.57	18.37	76.78	17.98	−0.92	0.415
Canada	325	81.43	14.80	80.93	14.82	−0.49	0.671
Russia	218	85.51	14.42	85.34	14.70	−0.17	0.904
P _C -score							
Brazil	504	33.95	23.16	46.62	23.11	12.66	<0.001
Poland	391	33.50	21.35	44.63	22.43	11.13	<0.001
Russia	218	19.88	19.76	30.11	20.24	10.23	<0.001
Germany	771	26.32	21.39	35.75	23.50	9.44	<0.001
Austria	532	24.95	21.78	33.15	22.18	8.21	<0.001
Greece	242	35.92	20.95	42.28	20.87	6.36	0.001
United Kingdom	585	33.56	22.02	39.80	24.14	6.33	<0.001
Italy	488	34.10	20.88	39.90	22.62	5.82	<0.001
Spain	1250	35.16	21.72	40.12	22.69	5.13	<0.001
United States of America	515	55.60	27.35	59.33	26.67	3.79	0.024
France	246	37.26	20.64	38.37	23.51	1.17	0.559
Canada	325	29.14	21.47	28.90	21.57	−0.24	0.888

deaths ($r = 0.00$, $p = 0.937$).

3.6. Risk factors

Following risk factors were statistically significantly associated with greater reductions of WHO-5 scores intra- vs. pre-pandemic: female gender, school closure, pre-existing mental disorder, and pre-existing physical condition (Fig. 2, Table S7). Following risk factors were statistically significantly associated with greater increases of P_C scores intra- vs. pre-pandemic: COVID-19 positive test status, female gender, school closure, pre-existing mental disorder and pre-existing physical condition. Presence of more concomitant risk factors was associated in regression analyses with larger decreases in WHO-5 well-being ($\beta=-0.07$, $p < 0.001$) and greater increases in P_C -scores ($\beta=0.09$, $p < 0.001$).

3.7. Coping strategies

The five coping strategies most frequently rated as “very important” to deal with the COVID-19 pandemic were: “contact with family” (85.2 %), “contact with friends” (67.3 %), “playing outside” (54.0 %), “spending time with pet” (51.5 %) and “internet use” (50.9 %) (Fig. 3, Table S8).

4. Discussion

COH-FIT-C aimed to comprehensively capture the global impact of the COVID-19 pandemic on well-being and overall mental health in children, aged 6–13, continuously over 2 years from its beginning and to identify significant risk factors and subjectively-rated helpful coping strategies. To the best of our knowledge, this is the first transcontinental study to simultaneously assess pre- to intra-pandemic changes in well-being and overall psychopathology, as well as coping strategies, in such a large representative sample of children in 12 countries around the

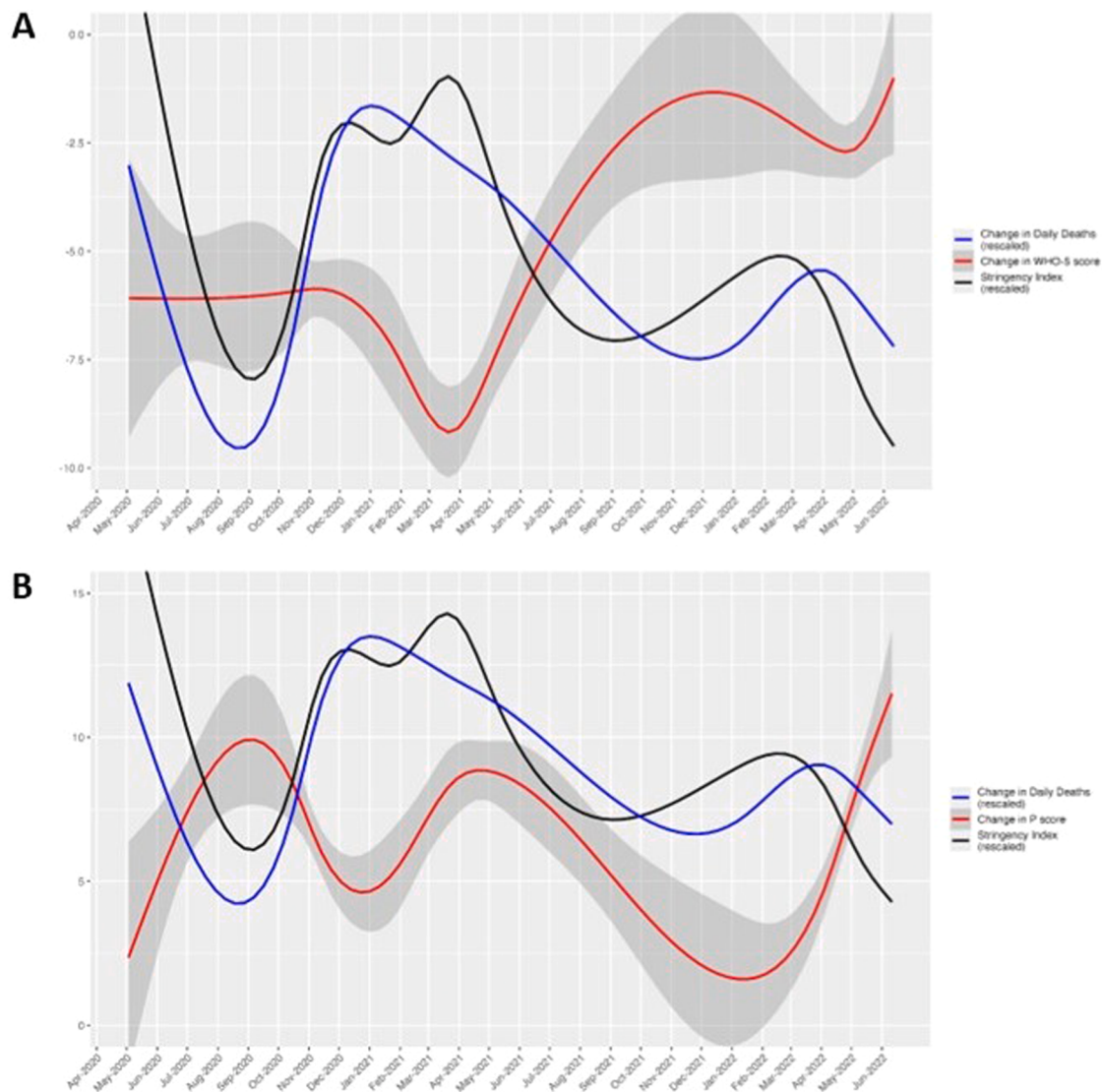


Fig. 1. Trajectory of change in (A) WHO-5 well-being score and (B) composite overall psychopathology P_C -score, stringency index and COVID-related daily death rate in children.

Legend: Stringency and daily death rate rescaled to same metric as WHO/ P_C -score outcome to facilitate comparison.

world for >2 years. First, we validated the four-dimensional P_C -score of overall psychopathology in children, showing a good fit and very satisfactory psychometric properties. P_C total and its domain scores, showed highly significant negative associations with the WHO-5 total score, as did the five-dimensional P-scores in prior COH-FIT reports in adults (Solmi et al., 2023) and adolescents (Solmi et al., 2024b), suggesting a very similar psychometric structure.

Our main results suggested an overall pre- to intra-pandemic worsening in both well-being and overall psychopathology, yet heterogeneously across risk factor subgroups and countries. Regression splines revealed that WHO-5 and P_C -score reacted differently over time, both showing only a small association to stringency index and COVID-related death rates. However, both the WHO-5 and P_C -score showed an improvement towards normalization to pre-pandemic levels by summer 2022. These findings are in accordance with our previously published COH-FIT findings in 8115 adolescents (Solmi et al., 2024b), where very similar patterns emerged, as well as with meta-analytic evidence from longitudinal studies in children suggesting a distinct decline in mental health around April/May 2020, which subsequently normalized (Deng et al., 2023; Miao et al., 2023). However, previously conducted and meta-analyzed studies employed less comprehensive assessments than

included in this study (using both WHO-5 and the 4-factor, 6-item P_C -score), and did not extensively assess risk factors or detailed temporal relationships with stringency of imposed restrictions or COVID-death rates.

Consistent with previous meta-analyses in children/adolescents (Deng et al., 2023; Miao et al., 2023), we found an overall deterioration of well-being and psychopathology across many countries, but not in all. Children's well-being did not significantly worsen in Canada, Russia, and USA, while no significant increases in P_C -score were apparent in Canada and France. These findings could rely on several different possible reasons, such as specific measures/policies, geographic distribution, time of data collection, cultural reporting biases, unmeasured factors, etc. Interestingly, these country-specific results in children were very similar with our prior results in adolescents (Solmi et al., 2024b), suggesting country-based/cultural differences or data collection effects rather than young age effects on response reliability.

While well-being and psychopathology deterioration in our whole sample featured small effect sizes consistent with previous findings in adolescents (Dragioti et al., 2022; Jing et al., 2024; Miao et al., 2023), specific subgroups showed particularly distinct pre- to intra-pandemic differences. A larger degree of both well-being and P_C -score

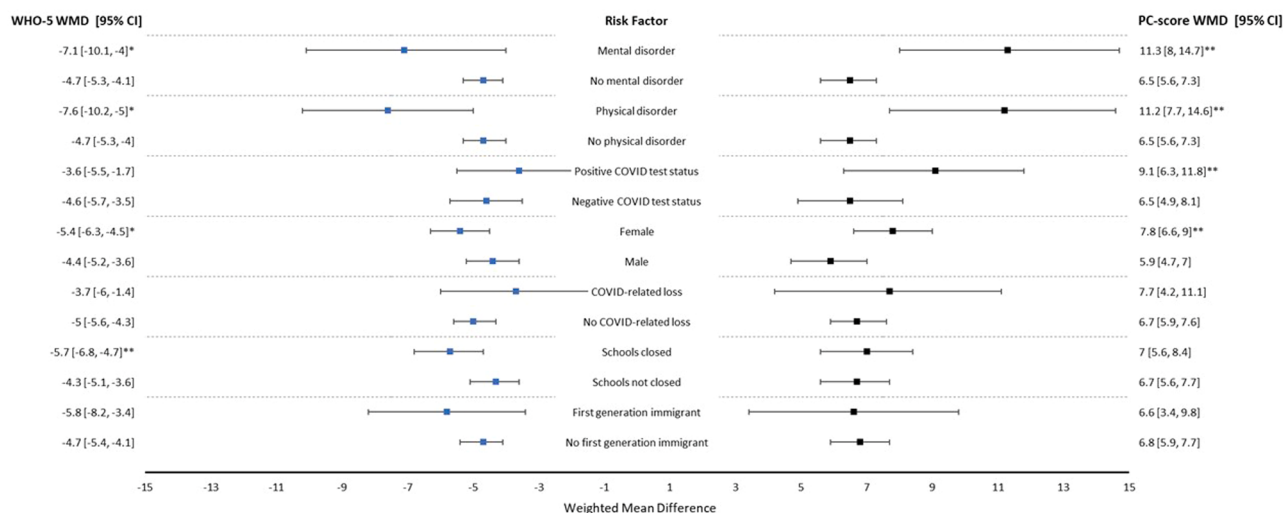


Fig. 2. Forest plot of changes in WHO-5 well-being and PC-scores across risk groups in children.

Legend: WMD: weighted mean difference. *, $p < 0.05$, significant difference with vs. without risk factor; **, $p < 0.001$, significant difference with vs. without risk factor.

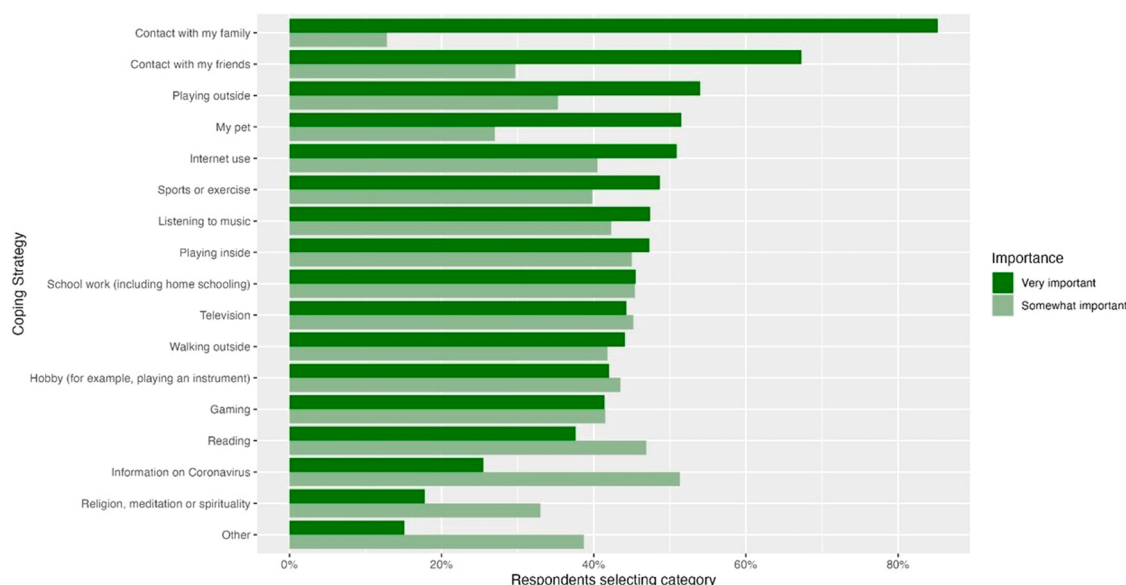


Fig. 3. Most important coping strategies during COVID-19 pandemic in children.

deterioration was significantly associated with female gender, school closure, pre-existing physical condition and pre-existing mental disorder. PC-score changes were additionally associated to COVID-19 positive test status, while COVID-related loss and immigrant status were not associated with higher risk. These findings show several similarities to our findings in adolescents (Solmi et al., 2024b), but are of overall lower magnitude to our findings in adults (Solmi et al., 2023), which may partly rely on insufficient capturing of well-being in children by WHO-5 items, which are mainly related to depressed mood. Concomitant presence of multiple risk factors was associated with larger deterioration in well-being and psychopathology, similarly to our previously published findings in adolescents (Solmi et al., 2024b) and relevant prior literature (Samji et al., 2022; Theberath et al., 2022). These child risk groups should be considered by clinicians and governmental policies when allocating resources to protect mental health (Arrondo et al., 2022), while children with multiple risk factors should be prioritized. Additionally, our results suggest that school closures seem to affect only well-being but not psychopathology, although its precise impact likely

depends on exact timing and duration, among other factors (Christie et al., 2022). Finally, results on coping suggest that the subjectively as “most important” rated strategies in children are mainly focused inside the bounds of the family, in contrast to the ones previously reported in adolescents (Solmi et al., 2024b), where internet use, social contacts and exercise were rated as most important/helpful.

COH-FIT-C has several strengths that compensate limitations of other studies (Dragioti et al., 2022; Newlove-Delgado et al., 2023). First, the vast majority of similar studies (94 %) were based on convenience samples (Newlove-Delgado et al., 2023), introducing significant selection bias (Pierce et al., 2021), while COH-FIT-C relies only on country-representative sampling. Second, most previous studies in children/adolescents have focused overwhelmingly on isolated domains of psychopathology (e.g., internalizing behaviors), while COH-FIT-C assessed overall well-being, four-dimensional psychopathology and preferred coping strategies. Third, contrary to most studies based in one/few countries, COH-FIT-C's transcontinental results provide a unique overview on well-being and psychopathology changes across 12

countries, finding mostly consistent, but also divergent results. Fourth, most previous reports have not accounted for local death rates or extent of restrictive policies. Our data suggest a small but significant association of well-being changes with COVID-related deaths and stringency index, while P_c -score changes were slightly associated with COVID-related deaths, but not stringency index, similar to our adolescent findings (Solmi et al., 2024b). Fifth, most previous children surveys investigated either relatively small samples, mixed samples with adolescents, or only brief time periods. Our large sample size of 6067 children with data covering >2 years, allowed not only the detection of pre- to intra-pandemic changes and exploration of temporal trends early in the pandemic's course, but also the investigation of specific risk-factors' impact on main outcomes across time. Sixth, our study did not use parental ratings of child well-being and behavior as many others, but instead focused on self-ratings in children-appropriate language.

Notwithstanding the above strengths of our study, a number of limitations should be mentioned. As our findings are based on repeated cross-sectional rather than longitudinal data, they do not capture changes over time directly. However, the pattern of changes observed in our study is consistent with large-scale meta-analytic evidence from longitudinal data (Deng et al., 2023; Miao et al., 2023; Salanti et al., 2022). The retrospective pre-pandemic rating represents another limitation *per se* and may introduce systematic recall bias, associated with over- or underestimation of findings, although no relevant drift in the retrospective recall of pre-pandemic WHO-5 or P_c -score was detected. In addition, mood-congruent recall bias cannot be ruled out, especially through same-session assessment of pre- and intra-pandemic ratings, whereby children experiencing poorer current well-being may retrospectively evaluate the pre-pandemic period less positively. Moreover, the data were collected in waves and not continuously, while not all countries could be addressed at the same time or with the same number of waves due to differences in local feasibility, ethics approval timelines or available funding and resources, leading to uneven temporal coverage across nations. Country-specific results may, thus, have been influenced by wave design and time of data collection, which additionally influence cross-country comparability and generalizability, noting that countries with fewer waves contribute less temporal resolution, while it is also important to note that no low-income countries were included in the representative data collection, affecting global representativeness. Additionally, cultural differences exist across countries which might also partially explain differences in the results. While we acknowledge language is different from culture to culture and that subtle cultural response tendencies can never be fully excluded in large multinational surveys, our extensive translation processes by native-speaking experts, as well as the multiple questionnaire validation and invariance testing across countries and languages substantially reduces the likelihood that such factors materially influenced our observed findings. Finally, digital barriers could have precluded a larger participation of child populations.

Despite these limitations, COH-FIT-C provides long-term, trans-continental representative data on the mental health impact of the pandemic in children across 12 countries during 2 years of the pandemic. Our unique data on the influence of stringency measures, COVID-related deaths and specific risk factors on overall well-being and general psychopathology, as well as on favorable coping strategies in children can guide individuals, clinicians and public health policies towards better mental health prevention strategies in the event of future pandemics/other crises, tailored to the needs of specific at-risk subpopulations.

Funding statement

All the institutions and funding agencies are listed in Table S9. COH-

FIT PIs and collaborators have applied/are actively applying for several national and international grants to cover expenses related to the coordination of the study, website, nationally representative samples, advertisement of the study, and future dissemination of study findings.

Author contribution statement

For the overall COH-FIT project, MS & CUC wrote the study protocol and drafted the first version of the CPH-FIT-C questionnaire that was then further adapted and revised incorporating input from all COH-FIT collaborators. Conceptualization: MS and CUC, data curation: CUC, MS, TT, AE, ED, FL, AK; formal analysis: MS, CUC, TT, AA, DM; funding acquisition: please see funding list; investigation: all authors; methodology: MS, CC, AA, TT; project administration: all authors; resources: all authors; software: CUC, MS, EA, TT, AA; supervision: MS, CUC; visualization: TT, MS, CUC, AA; writing – original draft: AA, TT; writing – review & editing: MS, CUC. All authors read, contributed to the critical revision of the first draft and approved the final version of the manuscript. All local researchers contributed to and approved translations of the COH-FIT survey in their respective language.

Role of funding source

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Declaration of competing interest

Conflict of interest statements of all authors are detailed in Table S10.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.euroneuro.2025.112741](https://doi.org/10.1016/j.euroneuro.2025.112741).

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