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Global Changes in Child and Adolescent Physical Activity During the COVID-19 Pandemic
A Systematic Review and Meta-analysis

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IMPORTANCE Numerous physical distancing measures were implemented to mitigate the spread of the COVID-19 virus, which could have negatively affected child and adolescent physical activity levels.

OBJECTIVES To conduct a systematic review and meta-analysis of the literature that used validated measures to document changes in child and adolescent physical activity during the COVID-19 pandemic and to estimate whether changes in physical activity differed between participant-level, contextual, and methodological moderators.

DATA SOURCES PubMed, PsycInfo, SPORTDiscus, Web of Science, Scopus, CINAHL, and MEDLINE were searched (from January 1, 2020, to January 1, 2022). A total of 1085 nonduplicate records were retrieved.

STUDY SELECTION Studies were included if they reported (1) changes in the duration of physical activity at any intensity for children or adolescents (age ≤18 years) comparing before and during the COVID-19 pandemic using validated physical activity measurement tools and were (2) from general population samples, (3) peer-reviewed, and (4) published in English.

DATA EXTRACTION AND SYNTHESIS A total of 126 articles underwent full-text review. Data were analyzed using a random-effects meta-analysis, which was conducted in January 2022.

MAIN OUTCOMES AND MEASURES Change in the duration of engagement in physical activity at any intensity comparing before and during COVID-19.

RESULTS Twenty-two studies including 46 independent samples and 79 effect sizes from 14 216 participants (median age, 10.5 years; range, 3-18 years) were included. The percentage change in the duration of engagement in total daily physical activity from before to during COVID-19 was −20% (90% CI, −34% to −4%). Moderation analyses revealed that changes were larger for higher-intensity activities (−32%; 90% CI, −44% to −16%), corresponding to a 17-minute reduction in children's daily moderate-to-vigorous physical activity levels. The reduction in physical activity was also larger for samples located at higher latitudes (37%; 90% CI, −1% to 89%) and for studies with a longer duration between physical activity assessments (25%; 90% CI, −0.5% to 58%).

CONCLUSIONS AND RELEVANCE Children and adolescents have experienced measurable reductions in physical activity during the COVID-19 pandemic. Findings underscore the need to provide bolstered access to support and resources related to physical activity to ensure good health and social functioning among children and adolescents during pandemic recovery efforts.

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Supplemental content

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It is well documented that physical activity confers numerous physical and mental health benefits for children and adolescents.[1,2] Prominent among these include motor development, cardiorespiratory and muscular fitness, maintenance of a healthy weight and level of adiposity, bone health, enhanced cognition, brain health, emotional regulation, mood, and quality of life.[3,4] Moreover, stable levels of physical activity during childhood and adolescence are known to predict engagement across the life course.[5] During the COVID-19 pandemic, however, government-mandated social distancing restrictions were imposed across many countries, and this severely limited children's access to regular physical activity opportunities.[6] Major outlets for accessing physical activity (eg, sports clubs, swimming pools, gyms, community centers) were closed, cancelled, or repeatedly interrupted.[7,8] Global school closures affecting 1.5 billion youth worldwide[9,10] led to an increased reliance on digital media devices for learning activities,[11] and early signs suggest that sedentary screen time doubled compared with prepandemic estimates.[12] Naturally enough, school closures also meant a reduction in active commuting, as well as a lack of access to recess play and physical education lessons, both of which provide viable opportunities to meet daily physical activity guidelines.[13,14] Playground and other nature-based recreational facility closures also severely restricted access to outdoor and green spaces, which are key settings for childhood physical activity promoting play and socialization.[15]

While it is accepted that imposing restrictions was critical to halting the community transmission of COVID-19,[16] these restrictions may have had the unintended consequence of negatively affecting physical and, likely by extension, mental health.[17,18] Within the framework of life-course theory, developmental scientists have begun to express concerns that sociohistorical events like the pandemic can be "developmental turning points, setting into motion accumulating advantages or disadvantages that can deflect long-term trajectories of well-being."[19] A critical question, therefore, is to what extent has the COVID-19 pandemic affected the global physical activity levels of children and adolescents?

The prevailing discourse and preliminary evidence indicate that child and adolescent physical activity behaviors changed during the pandemic.[20-22] However, the direction and magnitude of this change differ substantially across studies. Published estimates range from a reduction of 90 minutes[23,24] to an increase of 60 minutes of physical activity per day[25,26] during the pandemic. When such heterogeneity is observed, there is a need to consider potential moderators of changes in physical activity. For example, different physical activity recommendations are currently provided for different age groups[1,27,28]; therefore, understanding the changes in physical activity at different developmental stages (preprimary [aged <5 years], primary [5-12 years], and secondary [13-18 years] school children) is necessary. Additionally, children and adolescents in different geographical regions were exposed to physical distancing restrictions at differing seasonal junctures, representing a potential confounder.[29-31] For example, a child entering a lockdown period during the summer months could have their physical activity trajectory curtailed to a greater degree. Methodological shortcomings, such as poorly validated physical activity measures, could also explain between-study variation.[32]

Key Points

Question To what extent has the COVID-19 pandemic affected the global physical activity levels of children and adolescents?

Findings In this systematic review and meta-analysis of 22 international longitudinal studies that included 14 216 children 18 years and younger, pooled estimates revealed a decrease of 17 minutes per day in children's moderate-to-vigorous physical activity from prepandemic to during the COVID-19 pandemic.

Meaning Restrictions implemented during the COVID-19 pandemic have affected children's levels of physical activity, particularly moderate-to-vigorous physical activity; children's movement behaviors should be at the forefront of pandemic recovery efforts.

Multiple discussion articles[20-22]; rapid, scoping, and systematic reviews[33-35]; and narrative syntheses[36] of the research evidence base on physical activity during the COVID-19 pandemic exist. However, to our knowledge, no meta-analysis has been conducted to precisely estimate whether, and to what extent, child and adolescent physical activity levels have changed on account of the onset of the pandemic. As such, the objectives of this study were to (1) conduct a systematic review and meta-analysis of the literature that used validated measures to ascertain more precise estimates of the degree to which child and adolescent physical activity has changed during the COVID-19 pandemic and (2) address existing between-study heterogeneity by estimating the extent to which these changes in physical activity differed between participant-level (age, sex, physical activity intensity, baseline physical activity), contextual (geographical region), and methodological moderators (study duration, quality, respondent). Together, these objectives seek to inform public health initiatives and policy making aiming to promote good health and social functioning among children and adolescents during pandemic recovery efforts.

Methods

Search Strategy and Selection Criteria

This systematic review was registered as a protocol with PROSPERO (CRD42021243032) and conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[37] Seven electronic databases (PubMed, PsycInfo, SPORTDiscus, Web of Science, Scopus, CINAHL, MEDLINE) were searched for articles published between January 1, 2020, and January 1, 2022. The search strategy combined concepts from (1) physical activity, (2) children and adolescents (age ≤18 years), and (3) COVID-19 (eTable 1 in the Supplement). The records yielded by the search strategy were imported into Covidence software (Covidence Inc), and duplicates were automatically removed.

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Articles yielded by the search strategy were deemed eligible for inclusion if they (1) reported changes in the duration of physical activity at any intensity for children or adolescents (age ≤18 years) from prepandemic to during the COVID-19 pandemic using validated physical activity measurement tools and were (2) from general population samples, (3) peer-reviewed, and (4) published in English. The following exclusion criteria were applied: (1) samples of data from adults (age >18 years), (2) participants with preexisting medical conditions, (3) elite athletes or athletic samples, (4) cross-sectional assessments of physical activity, (5) case studies or reports and qualitative analyses, and (6) non-peer-reviewed studies published in (7) languages other than English. Two authors independently reviewed the titles and abstracts in Covidence to determine whether studies met the inclusion criteria. Proportionate agreement for title and abstract screening among authors was 91%. Two authors also reviewed full-text articles to determine if they met the inclusion criteria. Proportionate agreement for full-text screening was 80%. Discrepancies were resolved via consensus.

Data Extraction

Two authors (R.D.N., W.G.H.) extracted and coded the relevant quantitative data from each study. Changes in the duration of daily physical activity in minutes per day before and during the pandemic (at any intensity) were extracted from (or calculated for) each study, along with inferential statistics (*P* value, *z* score, *t* value, CI) for calculation of the standard error of the changes. Where studies included boys and girls, separate data for boys and girls were extracted, where possible (to properly account for heterogeneity arising from real differences in mean changes in physical activity between the sexes). Because physical activity has a log-normal distribution,[38] the extracted mean changes in physical activity and their standard errors were expressed as factors of baseline mean physical activity and then log-transformed (eg, for mean changes: 100 × log[1 + change in physical activity/baseline physical activity]). Back-transformed meta-analyzed means, results of moderation analyses, and random-effects solutions were therefore expressed in percentages.

Moderators

Continuous fixed-effect moderators were sex (proportion of males in the sample), study quality, baseline (prepandemic) physical activity levels, intensity of physical activity (metabolic equivalent of the task), duration between assessments of physical activity, and geographic latitude (on the assumption that physical activity was assessed at a regional and seasonal minimum and maximum in the Northern and Southern hemispheres, respectively). Categorical fixed-effect moderators were age group (preprimary schoolers aged ≤5 years, primary schoolers aged >5 to ≤12 years, and secondary schoolers aged >12 to ≤18 years) and informant (parent- or child-report).

Study Quality

Study quality was evaluated using an adapted version of the National Institutes of Health quality assessment tool for observation cohort and cross-sectional studies.[39] Studies were scored 1 (criterion met) or 0 (criterion unmet) for 7 criteria and summed to give a total score for each study ranging between 0 and 7 (higher scores indicating higher quality). When insufficient data were reported to enable authors to score a criterion, it was marked 0 (ie, criterion unmet). eTables 2 and 3 in the Supplement summarize the quality assessment criteria and study scores.

Data Analysis

The mixed-model procedure in version 9.4 of SAS OnDemand for Academics (SAS Institute) was used to perform a random-effects meta-analysis of changes in the duration of engagement in physical activity comparing estimates of physical activity before and during the pandemic. Random effects representing study identity and estimate identity within studies were estimated as variances to account for between-sample heterogeneity (with unique variances estimated for each of the 3 age groups). Sample estimates were weighted by the inverse square of their standard errors, and the residual variance was set to unity to apply the weighting.[40] Heterogeneity was assessed as the magnitude of the τ statistic (the square root of the sum of the between- and within-study variances), which represents typical differences in the predicted meta-analyzed mean between samples.

Choice of thresholds for evaluating the magnitudes of effect sizes was guided by the principle of standardization.[41,42] Ten percent was chosen for the smallest important increase in physical activity because it corresponded to 0.2 units[41,42] of the baseline log-transformed between-participant factor standard deviation across physical activity intensities. The resulting thresholds for small, moderate, large, and very large mean changes were respectively 10%, 33%, 77%, and 159% for increases and −9%, −25%, −44%, and −61%, respectively, for decreases. Sampling uncertainty is represented as 90% CIs. Precision of estimation was therefore deemed inadequate, or unclear, when the 90% CI included both substantial positive and negative values (ie, values greater and less than 10% and −9%, respectively).[43] Publication bias was assessed with a scatter plot of the random-effect solution (τ) against the log of the factor standard error for each study estimate. Outliers were identified as study estimates where the *P* value for the τ was less than a threshold given by .05 divided by the degrees of freedom of the solution value.

Results

Our electronic search yielded 1085 nonduplicate records. A total of 126 full-text articles were retrieved to examine against inclusion criteria, and 22 nonoverlapping studies met full inclusion criteria (**Figure 1**). These studies reported data from 46 independent samples, which resulted in 79 effect sizes.

Study Characteristics

Of the 22 studies included in the meta-analysis, k = 12 had child- and adolescent-reported data (median age, 16 years; range, 4-18), whereas the remaining (k = 10) were based on parental reports (median age, 4.5 years; range, 3-16). As shown

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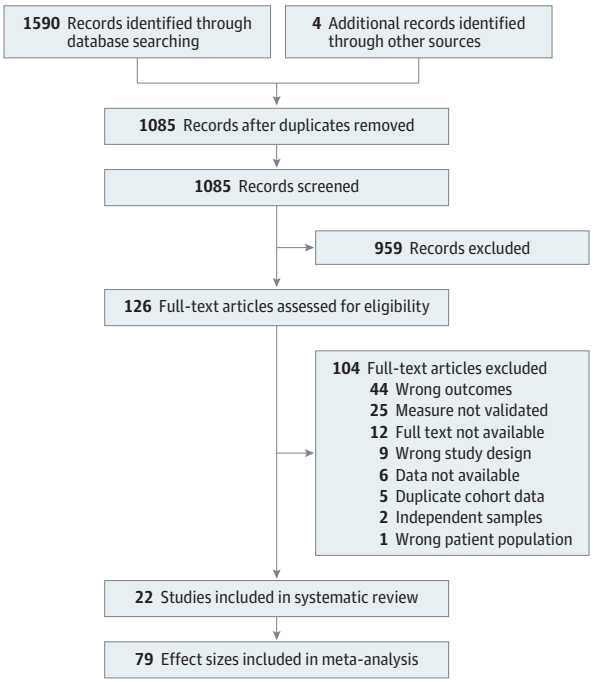
Figure 1. PRISMA Flow Diagram Detailing Search Strategy



in **Table 1**, across 22 studies, 14 216 participants were included (51% male; median age, 10.5 years; range, 3-18 years). Of the 46 independent samples, there were 22 from Europe (48%),[24-26,44,48,51,52,57,59] 8 from North America (18%),[54,58,60] 7 from South America (15%),[46,48,53] 5 from Asia (11%),[55,56,61] and 1 each from the Middle East (2%),[45] Central America (2%),[47] and Australia/New Zealand (2%),[49] and 1 sample reported data across regions.[50] The average study quality score was 5.8 (range, 3.5-7.0) (eTable 3 in the Supplement).

Meta-analysis

The grand mean representing changes in the duration of engagement in total physical activity before and during COVID-19 was −20% (90% CI, −34% to −4%). That is, child and adolescent engagement in total daily physical activity decreased by 20% during the pandemic. Between-study heterogeneity was moderate to large (τ = 36%; 90% CI, 21% to 61%), as shown in **Figure 2**.

Moderation analysis showed that the size of the change in physical activity before and during the pandemic differed between intensity levels (**Table 2**) and was larger for higher-intensity activities (−32%; 90% CI, −44% to −16%) (**Table 3**). Notably, the predicted mean representing the change in the duration of engagement in moderate-to-vigorous physical activity before and during the pandemic was −28% (90% CI, −41%

Table 1. Characteristics of Included Studies

Source	Country	Study sample size, No.[a]	Female, No. (%)	Age, mean (SD), y[b]	Physical activity measure
Greier et al,[44] 2021	Austria	221	108 (49)	16 (1)	IPAQ-SF
Shneor et al,[45] 2021	Israel	19	0	9-12	Accelerometer
Aguilar-Farias et al,[46] 2021	Chile	3157	1560 (49)	3 (1)	SUNRISE
Jáuregui et al,[47] 2021	Mexico	631	295 (47)	3 (2)	SUNRISE
López-Gil et al,[48] 2021	Spain and Brazil	1099	573 (52)	12 (5)	PASM
Medrano et al,[24] 2020	Spain	106	52 (49)	12 (3)	YAP
Nathan et al,[49] 2021	Australia	121	56 (46)	7 (2)	PLAYCE
Okely et al,[50] 2021	Multiple countries[c]	852	417 (49)	4 (1)	SUNRISE
Bronikowska et al,[51] 2021	Poland	127	66 (52)	15 (1)	PASM
Carrillo-Diaz et al,[52] 2021	Spain	213	116 (54)	14 (2)	IPAQ-SF
Hossain et al,[23] 2021	Bangladesh	35	15 (44)	5 (1)	SUNRISE
Puccinelli et al,[53] 2021	Brazil	18	11 (61)	18	IPAQ-SF
Ostermeier et al,[54] 2021	Canada	95	47 (49)	11	CHMS
Schmidt et al,[25] 2021	Germany	1711	852 (50)	12 (4)	Mo-Mo-PAQ
Jia et al,[55] 2020	China	2824	2156 (76)	18 (1)	IPAQ
Hyunshik et al,[56] 2021	Japan	290	139 (48)	5 (0.3)	Accelerometer
Alonso-Martínez et al,[57] 2021	Spain	21	11 (54)	4 (1)	Accelerometer
Moore et al,[58] 2021	Canada	1526	733 (48)	12 (4)	CHMS
López-Bueno et al,[59] 2020	Italy	860	422 (49)	10 (4)	SIPAM
Delisle Nyström et al,[26] 2020	Sweden	100	42 (42)	4 (1)	SUNRISE
Burkart et al,[60] 2021	United States	70	33 (47)	10 (2)	Accelerometer
Ng et al,[61] 2021	Hong Kong	64	NR	4 (0.3)	SUNRISE

Abbreviations: CHMS, Canadian Health Measures Survey; IPAQ, International Physical Activity Questionnaire; IPAQ-SF, International Physical Activity Questionnaire–Short Form; Mo-Mo-PAQ, Motorik-Modul Physical Activity Questionnaire; NR, not reported; PASM, Physical Activity Screening Measure; PLAYCE, validated questionnaire from the PLAY Spaces & Environments for Children's Physical Activity study; SIPAM, validated single-item physical activity measure; SUNRISE, validated questionnaire from the International Study of Movement Behaviors in the Early Years; YAP, Youth Activity Profile.

[a] No. represents the sample sizes for data extracted from studies. This does not always correspond to the number reported for the study as a whole.

[b] Age ranges were reported in 6 studies.

[c] Okely et al[50] combined and reported on data from 14 countries: Australia, Bangladesh, China, Hong Kong, India, Indonesia, Malaysia, Morocco, Pakistan, Spain, Sri Lanka, Sweden, United States, and Vietnam.

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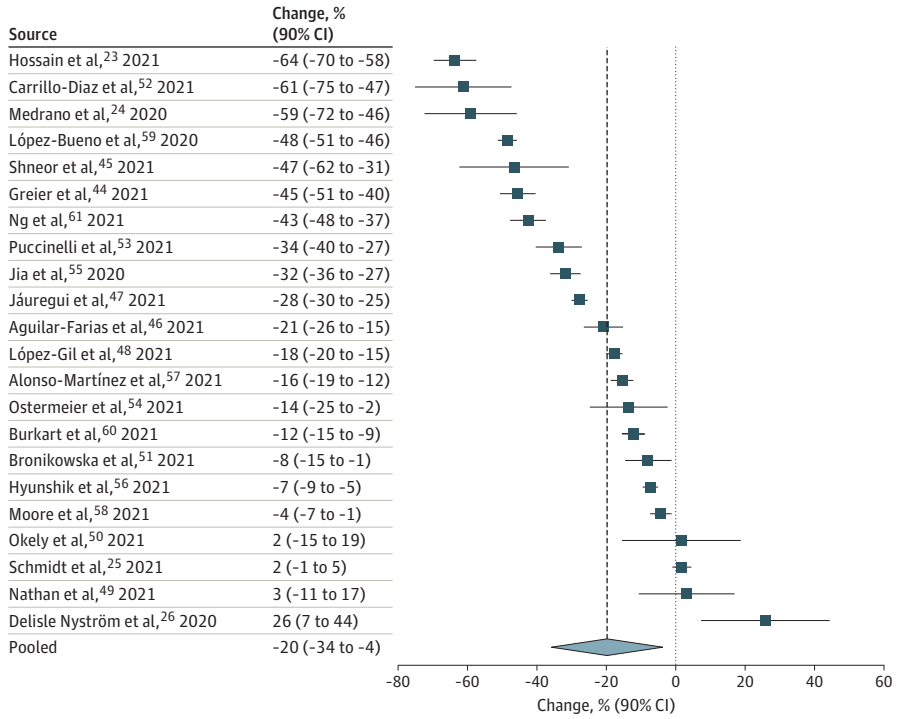
Figure 2. Forest Plot of Changes in Child and Adolescent Physical Activity Comparing Before and During the COVID-19 Pandemic



Study-by-study changes in the duration of engagement in physical activity are presented on the forest plot in descending order. The square data markers represent percentage changes in the durations of engagement in physical activity before and during COVID-19 for each individual study. The error bars represent the corresponding 90% CIs. The diamond data marker at the bottom of the forest plot represents the grand mean change in physical activity, which was derived by pooling the percentage effect sizes across included studies.

to −13%). This change corresponded to a 17-minute reduction in children's daily moderate-to-vigorous physical activity levels. The predicted mean change in the duration of light physical activity before and during the pandemic was unclear (−3%; 90% CI, −21% to 19%).

Moderation analysis showed that the size of the reduction in physical activity before and during the pandemic was larger for samples located at higher latitudes (37%; 90% CI, −1% to 89%) and larger for samples with longer durations between assessments of physical activity (25%; 90% CI, −0.5% to 58%). Differences in the changes in physical activity before and during the pandemic between different levels of the remaining moderators were either trivial (baseline physical activity) or unclear (sex, age group, study quality) (Table 3).

Publication Bias and Outliers

The slope of the regression line representing publication bias was small (β = 9.5%; 90% CI, 2.2% to 16.8%) (eFigure in the Supplement). One outlier was identified against the weighted threshold of $P < .002$. Sensitivity analysis resulting in the removal of this study did not substantively affect the direction or the effect sizes of study outcomes.

Discussion

This meta-analysis provides timely estimates of changes in child and adolescent physical activity during the COVID-19 pandemic. By pooling estimates across 22 studies from a range of global settings that included 14 216 participants, we demonstrated that the duration of engagement in total daily physical activity decreased by 20%, irrespective of prepandemic baseline levels. Through moderation analysis, we showed that this reduction was larger for physical activity at higher intensities. Specifically, the average reduction in moderate-to-vigorous physical activity per day during COVID-19 (17 minutes) represents a reduction of almost one-third of the daily dose of moderate-to-vigorous physical activity recommended for young children (~3-5 years) and school-going children and adolescents (~5-18 years) to promote good physical health and psychosocial functioning.[1,2,27,28]

We found that longer durations between pre- and post-assessment were associated with larger reductions in physical activity. It is possible that the cumulative toll of the pandemic has compounded over time to negatively affect children and adolescents,[63] including their levels of physical activity. This aligns with a recent meta-analysis on youth mental health,[18] which found that the prevalence of depressive and anxiety symptoms increased across time during the pandemic. The temporal aspect of our findings is also broadly in line with research on the psychology of habit,[64,65] which suggests that habits are contingent on the types of stability cues that have been significantly disrupted during the pandemic. Most of the known multicomponent, family, social, and community support mechanisms of child and adolescent physical activity[66] were unavailable during COVID-19. This undoubtedly created a "perfect storm" for habit discontinuity[65] in the context of child and adolescent physical activity.[67] Research has also shown that young children with consistent access and permission to use outdoor spaces during COVID-19 had bet-

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Table 2. Changes in the Duration of Child and Adolescent Engagement in Physical Activity Before and During COVID-19 at Different Intensities

Predicted means	k	% Change (90% CI)
Total physical activity	26	−20 (−34 to −4)[a]
Light physical activity	22	−3 (−21 to 19)
Moderate-to-vigorous physical activity	31	−28 (−41 to −13)[a]

Abbreviation: k, No. of independent samples included in the calculation of predicted mean values.

[a] Clear point estimates and uncertainties.

Table 3. Moderators of Differences in Durations of Child and Adolescent Engagement in Physical Activity Before and During COVID-19

Moderator	k	% Difference (90% CI)
Continuous moderators[a]		
Study quality	22	−13 (−32 to 11)
Physical activity intensity	79	−32 (−44 to −16)[b]
Baseline physical activity	79	1 (−7 to 9)[b]
Latitude	22	37 (−1 to 89)[b]
Duration	22	25 (−1 to 58)[b]
Categorical moderators		
Sex[c]	74	−1 (−11 to 11)
Informant[d]	79	11 (−15 to 43)
Comparisons between age groups[e]		
Secondary school and preschool children	57	−30 (−68 to 54)
Secondary and primary school children	55	−24 (−61 to 47)
Primary school and preschool children	46	−8 (−53 to 82)

Abbreviation: k, number of independent samples included in the moderation analysis.

[a] Continuous moderators were evaluated by estimating the difference in the changes in physical activity between samples on the upper (mean + 1 SD) and lower (mean − 1 SD) distribution of effect sizes for the given moderator.[62]

[b] Clear point estimates and uncertainties.

[c] This estimate represents the percentage difference in the changes in physical activity for samples with a higher proportion of males (ie, femaleness as the reference group).

[d] Informant was coded as a dummy variable. Children and adolescent informants were the reference group (k = 36). As such, the estimate represents the percentage difference in the changes in physical activity for samples based on parent report (k = 43).

[e] Differences in the predicted mean changes in physical activity between age groups were calculated with the remaining moderators held constant at their mean values. The number of independent samples for each age group was as follows: secondary school, k = 33; primary school, k = 22; preschool, k = 24.

ter physical activity outcomes.[50] These children exhibited smaller reductions in moderate-to-vigorous physical activity and were approximately 2 times more likely to meet physical activity guidelines during COVID-19. Taken together, changes in restrictions and the unpredictability of access to typical physical activity outlets for children and adolescents have likely contributed to changes in their physical activity levels and to greater engagement in displacement activities (eg, screen time[12]) that risk promoting an increasingly sedentary "new normal."[68]

Our moderation analysis also provides evidence of the region-specific associations between COVID-19 and physical activity. Specifically, we found that reductions in physical activity during the pandemic were larger for samples at higher latitudes, corresponding to regions of the globe where restrictions coincided with a seasonal transition into the summer months. This finding is consistent with prepandemic data showing that unstructured summer days during school holidays can have negative associations with both academic and physical health behaviors,[69-71] often referred to as the "summer slide."[72] A recent estimate of such a summertime reduction of moderate-to-vigorous physical activity of 11.4 minutes[69] is substantially lower (~ 50%) than the pooled estimate from our meta-analysis, however. This suggests a substantial intensification during the pandemic of the usual summer slide into physical inactivity,[70] which warrants particular attention from policy makers seeking to help children "sit less and play more,"[73] as targeted initiatives will be needed as children emerge into the summer months.

Global data pooled in this meta-analysis revealed that boys and girls of all ages and baseline activity levels experienced reductions in daily physical activity during COVID-19. Such is the immediate opportunity cost of imposing physical and social distancing restrictions to halt the community transmission of COVID-19. The longer-term opportunity costs of imposing these restrictions on child and adolescent health at different ages and developmental stages also need to be considered. These include the loss of accrued benefits from regularly engaging in physical activity that would have otherwise carried favorable behavioral and biopsychosocial consequences forward into periods later in life. There is an urgent need for public health initiatives to revive young people's interest in, and support their demand for, physical activity during and beyond the COVID-19 pandemic. In terms of practice implications, research on physical activity promotion and maintenance during childhood consistently shows that multicomponent, multimodal, and multioutcome interventions work best.[7,66] Therefore, public health campaigns can have greater effect if they are child-centered, target a variety of physical activity modalities, and incorporate the family unit and wider community as co-constructors of lasting physical activity behavior change.

Limitations

First, while this meta-analysis examines global estimates of changes in physical activity, we only included studies published in English. Second, this meta-analysis did not contain any samples from Africa, thereby limiting generalization to that continent. A study of primary school-aged children was conducted in Tunisia[74]; however, changes in the duration of physical activity before and during the pandemic were not reported, thereby resulting in that study's exclusion. Third, given the restrictions on research practices during the COVID-19 pandemic, most studies relied on (validated) self-reports of physical activity, which can be associated with recall and social desirability bias when compared with objective assessments of physical activity. Fourth, the studies included in this meta-analysis did not report sufficient data to enable conclusions

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to be made about changes in physical activity timing and domains. Perhaps the quality and quantity of physical activity decreased during COVID-19, with physical distancing restrictions particularly negatively affecting opportunities for young children to engage in social play and opportunities for older adolescents to engage in higher-order and routinized physical activity modalities. Fifth, few studies reported changes in physical activity between different household-level, socioeconomic, racial, ethnic, and geographical profiles, which precluded further moderator analyses. Future research studies should consider using multivariate meta-analytic models to estimate mediating relationships between changes in physical activity, screen time, and sleep during COVID-19 (if and when sufficiently high-quality longitudinal data become available).

Conclusions

This meta-analysis capitalizes on the wealth of longitudinal data collected to date to estimate changes in child and adolescent physical activity during the COVID-19 pandemic and shows that a considerable reduction in physical activity has occurred. Unfortunately, newly established levels of physical inactivity will be difficult to change. The gradual lifting of public health restrictions will likely be insufficient to facilitate increases in child and adolescent physical activity. Thus, targeted public health initiatives are urgently needed. As UNICEF[75] recognized in the early stages of the pandemic, formal reactivation strategies are required to avert the potentially irreversible harms that are being caused to a lost generation of youth.

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