

Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Search Strategy From Ovid MEDLINE

#	Terms	Records*
1	Child/exp	2,051,875
2	Adolescent/	2,160,037
3	(infan* OR newborn* OR new-born* OR neonat* OR baby* OR babies OR toddler* OR child* OR youth* OR kid* OR "young person" OR "young people" OR schoolchild* OR school-child* OR "school child*" OR boy* OR girl* OR teen* OR adolescen* OR juvenile* OR p?ediatric* OR preadolescen* OR pre-adolescen* OR "school age*" OR "school-age*" OR "preschool*" OR pre-school* OR kindergar?en OR prepubesc* OR pre-pubesc* OR "nursery school*" OR "grade school*" OR "elementary school*" OR "middle school*" OR "primary school*" OR "high school*" OR "secondary school*" OR (("day care*" or "daycare*") not adult*)).ti,ab,kw.	3,136,243
4	1 OR 2 OR 3	4,869,313
5	COVID-19/	141,824
6	(2019-ncov* OR 2019ncov* OR 2019n-cov* OR coronaviru* OR corona viru* OR covid OR covid-19 OR covid19* OR ncov* OR "novel covi*" OR covid-2019 OR covid2019 OR SARS-COV-2* OR SARS-COV2* OR SARSCOV-2* OR SARSCOV2* OR SARSCOV19 OR SARS-COV-2019 OR SARSCOV2019 OR "Wuhan pneumonia" OR "Wuhan virus" OR "severe acute respiratory syndrome" OR "severe acute respiratory disease" OR lockdown* OR lock-down OR "lock down" OR "social* distanc*" OR "stay* at home" OR "stay-at-home" OR "quarantin*").ti,ab,kw.	223,829
7	5 OR 6	229,735
8	Sedentary Behavior/	12,195
9	("sedentary behavi?r*" OR "sedentary lifestyle*").af.	18,475
10	Screen Time/	847
11	(screentime OR (screen* adj3 (time OR usage OR view* OR play* OR use* OR watch* OR media OR entertainment))).af.	64,532
12	Television/	13,876
13	(television OR TV OR DVD*).af.	37,290
14	Computers/ OR Video Games/exp OR Internet Access/ OR Internet Use	58,903
15	(computer* OR "computer gam*" OR "video gam*" OR videogam* OR (multiplayer adj2 gam*) OR gaming OR "electronic gam*" OR exergaming OR "internet games" or "internet gaming" or (internet adj3 (access* or using* or usage or use*))).af.	118,877
16	Cell Phone/exp OR Mobile Applications/ OR Computers, Handheld/exp	37,605
17	("mobile phone*" OR "smart phone*" OR "smartphone*" OR "text messag*" OR "mobile device*" OR "digital media" OR "digital technolog*" OR "media device*" OR "cell phone*" OR "cellphone*" OR iPhone* OR i-Phone* iPad* OR i-Pad* OR tablet* OR kindle OR "mobile app*" OR app OR apps OR laptop*).af.	145,172
18	Social Media/	12,648
19	"social media".af.	24,036
20	8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19	387,591
21	4 AND 7 AND 20	1,699
22	limit 21 to dt=20200101-20220303	1,654
23	limit 22 to "all child (0 to 18 years)"	1,117

*Note: Records also limited to English language sources.

eTable 2. Quality Assessment Criteria	
Criteria*	Question
1	Was the research question or objective clearly stated?
2	Was the study population clearly specified and defined?
3	Is the sample representative of a defined population?
4	Was the participation rate of eligible subjects \geq 50%?
5	Was a sample-size justification, power description or variance and effect estimates provided?
6	Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?
7	For outcomes that can vary in amount, type, or level, did the study report on such differences?
8	Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?
9	Were the outcomes (dependent variables) assessed using objective measures?
10	Was loss to follow-up after baseline measurement \leq 20%?
11	Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?
*For each criterion, studies were given a score of 0 (criterion unmet) or 1 (criteria met). When data was not reported in a study to score a criterion, it was marked as 0 (i.e., criterion unmet).	

eTable 3. Quality Assessment of Included Studies

Study Author, Year	Quality Criteria											Total (0-11)
	1	2	3	4	5	6	7	8	9	10	11	
Aguilar-Farias et al, 2021 ¹	1	1	0	0	0	0	0	1	0	0	1	4
Beck et al, 2021 ²	1	1	0	1	0	0	0	1	0	0	0	4
Brzęk et al, 2021 ³	1	1	1	0	0	1	1	0	0	0	1	6
Burkart et al, 2022 ⁴	1	1	1	0	0	1	1	1	1	1	1	9
Cardy et al, 2021 ⁵	1	1	1	1	0	1	1	1	0	1	1	9
Chen et al, 2021 ⁶	1	1	1	1	0	1	1	1	0	1	1	9
Cheng et al, 2021 ⁷	1	1	1	1	0	1	1	1	0	1	1	9
Eales et al, 2021 ⁸	1	1	1	1	0	1	0	1	0	1	1	8
Garcia et al, 2021 ⁹	1	0	0	0	0	0	1	1	0	0	1	4
Ghanamah et al, 2021 ¹⁰	1	1	1	1	0	1	0	1	0	1	1	8
Hossain et al, 2021 ¹¹	1	1	1	0	0	1	1	0	0	1	0	6
Hu et al, 2021 ¹²	1	1	1	0	0	1	1	1	0	0	1	7
Jáuregui et al, 2021 ¹³	1	0	0	0	0	0	1	1	0	0	1	4
Jia et al, 2021 ¹⁴	1	0	0	0	0	0	1	1	0	0	1	4
Kim et al, 2021a ¹⁵	1	1	1	0	0	1	1	1	1	1	0	8
Kim et al, 2021b ¹⁶	1	1	0	0	0	1	1	1	0	1	0	6
López Gil et al, 2021 ¹⁷	1	0	0	0	0	1	0	0	0	0	1	3
López-Bueno et al, 2020 ¹⁸	1	1	0	0	0	1	0	0	0	0	1	3
Ma et al, 2021 ¹⁹	1	1	1	1	0	1	1	1	0	1	1	9
Maheux et al, 2021 ²⁰	1	1	1	1	0	1	0	1	0	1	1	8
Maltoni et al, 2021 ²¹	1	1	0	1	0	1	1	1	0	1	1	8
McArthur et al, 2021 ²²	1	1	1	1	0	1	0	1	0	0	1	7
Medrano et al, 2021 ²³	1	1	1	1	1	1	0	1	0	0	1	8
Mirhajianmoghadam et al, 2021 ²⁴	1	1	0	0	0	1	1	1	1	0	1	7
Mohan et al, 2021 ²⁵	1	1	0	1	0	0	1	1	0	0	1	6
Moore et al, 2021 ²⁶	1	1	1	0	1	1	1	1	0	0	1	8
Morrison et al, 2021 ²⁷	1	1	1	0	0	1	0	1	0	1	1	7
Nathan et al, 2021 ²⁸	1	1	1	0	0	0	1	1	0	0	1	6
Ng et al, 2021 ²⁹	1	1	1	0	0	1	1	1	1	0	0	7
Nyström et al, 2020 ³⁰	1	1	1	1	0	1	0	1	0	1	0	7
Okely et al, 2021 ³¹	1	1	1	1	1	1	1	1	0	0	1	9
Ostermeier et al, 2021 ³²	1	1	1	0	0	1	1	1	0	0	1	7
Peddie et al, 2021 ³³	1	1	1	0	1	1	1	0	0	1	0	7

Pietrobelli et al, 2021 ³⁴	1	1	0	1	1	1	0	0	0	1	0	6
Rebelo et al, 2021 ³⁵	1	0	0	1	0	0	0	1	0	1	1	5
Ribner et al, 2021 ³⁶	1	1	1	1	0	1	1	1	0	1	1	9
Saxena et al, 2021 ³⁷	1	1	1	1	0	1	1	1	0	1	1	9
Schnaiderman et al, 2021 ³⁸	1	0	0	0	0	1	1	1	0	0	0	4
Schmidt et al, 2021 ³⁹	1	1	0	0	0	1	1	1	0	1	1	7
Seo et al, 2021 ⁴⁰	1	1	0	0	0	1	1	1	0	1	1	7
Shoshani et al, 2021 ⁴¹	1	1	1	1	0	1	1	1	0	1	1	9
ten Velde et al, 2021 ⁴²	1	1	1	0	0	1	1	1	1	1	0	8
Welling et al, 2022 ⁴³	1	1	1	0	0	1	0	1	0	1	1	7
Xiang et al, 2020 ⁴⁴	1	1	1	0	0	1	0	1	0	0	0	5
Yum et al, 2021 ⁴⁵	1	1	0	1	0	1	1	1	0	1	1	8
Zhang et al, 2021 ⁴⁶	1	1	0	1	0	1	1	1	0	1	1	8

eFigure. Assessment of Publication Bias Using a Scatterplot of the Random-Effect Solution and the SE for Each Sample Estimate



eReferences.

1. Aguilar-Farias N, Toledo-Vargas M, Miranda-Marquez S, et al. Sociodemographic predictors of changes in physical activity, screen time, and sleep among toddlers and preschoolers in Chile during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*. 2021;18(1):1-13.
2. Beck AL, Huang JC, Lenzion L, Fernandez A, Martinez S. Impact of the Coronavirus Disease 2019 Pandemic on Parents' Perception of Health Behaviors in Children With Overweight and Obesity. *Academic Pediatrics*. 2021;21(8):1434-1440.
3. Brzęk A, Strauss M, Sanchis-Gomar F, Leischik R. Physical activity, screen time, sedentary and sleeping habits of Polish preschoolers during the COVID-19 pandemic and WHO's recommendations: An observational cohort study. *International Journal of Environmental Research and Public Health*. 2021;18(21).
4. Burkart S, Parker H, Weaver RG, et al. Impact of the COVID-19 pandemic on elementary schoolers' physical activity, sleep, screen time and diet: A quasi-experimental interrupted time series study. *Pediatric Obesity*. 2022;17(1).
5. Cardy RE, Dupuis A, Anagnostou E, et al. Characterizing Changes in Screen Time During the COVID-19 Pandemic School Closures in Canada and Its Perceived Impact on Children With Autism Spectrum Disorder. *Frontiers in Psychiatry*. 2021;12.
6. Chen IH, Chen CY, Pakpour AH, et al. Problematic internet-related behaviors mediate the associations between levels of internet engagement and distress among schoolchildren during COVID-19 lockdown: A longitudinal structural equation modeling study. *Journal of Behavioral Addictions*. 2021;10(1):135-148.
7. Cheng HP, Wong JSL, Selveindran NM, Hong JYH. Impact of COVID-19 lockdown on glycaemic control and lifestyle changes in children and adolescents with type 1 and type 2 diabetes mellitus. *Endocrine*. 2021;73(3):499-506.
8. Eales L, Gillespie S, Alstat RA, Ferguson GM, Carlson SM. Children's screen and problematic media use in the United States before and during the COVID-19 pandemic. *Child development*. 2021;92(5):e866-e882.

9. Garcia JM, Lawrence S, Brazendale K, Leahy N, Fukuda D. Brief report: The impact of the COVID-19 pandemic on health behaviors in adolescents with Autism Spectrum Disorder. *Disability and Health Journal*. 2021;14(2).
10. Ghanamah R, Eghbaria-Ghanamah H. Impact of covid-19 pandemic on behavioral and emotional aspects and daily routines of Arab israeli children. *International Journal of Environmental Research and Public Health*. 2021;18(6):1-19.
11. Hossain MS, Deeba IM, Hasan M, et al. International study of 24-h movement behaviors of early years (SUNRISE): a pilot study from Bangladesh. *Pilot and Feasibility Studies*. 2021;7(1).
12. Hu P, Samuels S, Maciejewski KR, et al. Changes in Weight-Related Health Behaviors and Social Determinants of Health among Youth with Overweight/Obesity during the COVID-19 Pandemic. *Childhood Obesity*. 2021.
13. Jáuregui A, Argumedo G, Medina C, Bonvecchio-Arenas A, Romero-Martínez M, Okely AD. Factors associated with changes in movement behaviors in toddlers and preschoolers during the COVID-19 pandemic: A national cross-sectional study in Mexico. *Prev Med Rep*. 2021;24.
14. Jia P, Zhang L, Yu W, et al. Impact of COVID-19 lockdown on activity patterns and weight status among youths in China: the COVID-19 Impact on Lifestyle Change Survey (COINLICS). *International journal of obesity (2005)*. 2021;45(3):695-699.
15. Hyunshik K, Jiameng M, Sunkyoung L, Ying G. Change in Japanese children's 24-hour movement guidelines and mental health during the COVID-19 pandemic. *Scientific reports*. 2021;11(1):22972.
16. Kim H, Ma J, Kim J, Xu D, Lee S. Changes in Adherence to the 24-Hour Movement Guidelines and Overweight and Obesity among Children in Northeastern Japan: A Longitudinal Study before and during the COVID-19 Pandemic. *Obesities*. 2021;1(3):167-177.
17. López-Gil JF, Tremblay MS, Brazo-Sayavera J. Changes in Healthy Behaviors and Meeting 24-h Movement Guidelines in Spanish and Brazilian Preschoolers, Children and Adolescents during the COVID-19 Lockdown. *Children*. 2021;8(2).
18. López-Bueno R, López-Sánchez GF, Casajús JA, et al. Health-Related Behaviors Among School-Aged Children and Adolescents During the Spanish Covid-19 Confinement. *Frontiers in Pediatrics*. 2020;8.

19. Ma D, Wei S, Li SM, et al. Progression of myopia in a natural cohort of Chinese children during COVID-19 pandemic. *Graefe's Archive for Clinical and Experimental Ophthalmology*. 2021;259(9):2813-2820.
20. Maheux AJ, Nesi J, Galla BM, Roberts SR, Choukas-Bradley S. #Grateful: Longitudinal Associations Between Adolescents' Social Media Use and Gratitude During the COVID-19 Pandemic. *Journal of research on adolescence : the official journal of the Society for Research on Adolescence*. 2021;31(3):734-747.
21. Maltoni G, Zioutas M, Deiana G, Biserni GB, Pession A, Zucchini S. Gender differences in weight gain during lockdown due to COVID-19 pandemic in adolescents with obesity. *Nutrition, Metabolism and Cardiovascular Diseases*. 2021;31(7):2181-2185.
22. McArthur BA, Racine N, Browne D, McDonald S, Tough S, Madigan S. Recreational screen time before and during COVID-19 in school-aged children. *Acta Paediatrica*. 2021;110(10):2805-2807.
23. Medrano M, Cadenas-Sanchez C, Osés M, Arenaza L, Amasene M, Labayen I. Changes in lifestyle behaviours during the COVID-19 confinement in Spanish children: A longitudinal analysis from the MUGI project. *Pediatric Obesity*. 2021;16(4).
24. Mirhajianmoghadam H, Piña A, Ostrin LA. Objective and Subjective Behavioral Measures in Myopic and Non-Myopic Children During the COVID-19 Pandemic. *Translational Vision Science & Technology*. 2021;10(11):4-4.
25. Mohan A, Sen P, Shah C, Jain E, Jain S. Prevalence and risk factor assessment of digital eye strain among children using online e-learning during the COVID-19 pandemic: Digital eye strain among kids (DESK study-1). *Indian journal of ophthalmology*. 2021;69(1):140-144.
26. Moore SA, Faulkner G, Rhodes RE, et al. Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: A national survey. *International Journal of Behavioral Nutrition and Physical Activity*. 2020;17(1).
27. Morrison SA, Meh K, Sember V, Starc G, Jurak G. The Effect of Pandemic Movement Restriction Policies on Children's Physical Fitness, Activity, Screen Time, and Sleep. *Frontiers in public health*. 2021;9(101616579):785679.

28. Nathan A, George P, Ng M, et al. Impact of covid-19 restrictions on western Australian children's physical activity and screen time. *International Journal of Environmental Research and Public Health*. 2021;18(5):1-13.
29. Ng JYY, He Q, Chong KH, Okely AD, Chan CHS, Ha AS. The impact of covid-19 on preschool-aged children's movement behaviors in Hong Kong: A longitudinal analysis of accelerometer-measured data. *International Journal of Environmental Research and Public Health*. 2021;18(22).
30. Delisle Nyström C, Alexandrou C, Henström M, et al. International Study of Movement Behaviors in the Early Years (SUNRISE): Results from SUNRISE Sweden's Pilot and COVID-19 Study. *International Journal of Environmental Research and Public Health*. 2020;17(22).
31. Okely AD, Kariippanon KE, Guan H, et al. Global effect of COVID-19 pandemic on physical activity, sedentary behaviour and sleep among 3- to 5-year-old children: a longitudinal study of 14 countries. *BMC public health*. 2021;21(1):940.
32. Ostermeier E, Tucker P, Clark A, Seabrook JA, Gilliland J. Parents' report of canadian elementary school children's physical activity and screen time during the COVID-19 pandemic: A longitudinal study. *International Journal of Environmental Research and Public Health*. 2021;18(23).
33. Peddie MC, Scott T, Haszard JJ. Using a 24 h activity recall (Star-24) to describe activity in adolescent boys in new zealand: Comparisons between a sample collected before, and a sample collected during the covid-19 lockdown. *International Journal of Environmental Research and Public Health*. 2021;18(15).
34. Pietrobelli A, Fearnbach N, Ferruzzi A, et al. Effects of COVID-19 lockdown on lifestyle behaviors in children with obesity: Longitudinal study update. *Obesity Science and Practice*. 2021((Pietrobelli A.; Ferruzzi A.; Vrech M.; Pecoraro L.; Zoller T.; Antoniazzi F.; Piacentini G.) Department of Surgical Science, Dentistry, Gynecology and Pediatrics, Pediatric Unit, Verona University Medical School, Verona, Italy(Pietrobelli A.; Fearnbach N).
35. Rebelo AT, Pinto DH, Cunha R, et al. Impact of one-year pandemic on children with autism spectrum disorder. *Cogent Medicine*. 2021;8((Rebelo A.T.; Pinto D.H.; Cunha R.; Monteiro D.R.; Sá L.; Monteiro V.; Monteiro J.) Centro Hospitalar Entre O Douro e Vouga, Paediatrics, Santa Maria Da Feira, Portugal).

36. Ribner AD, Coulanges L, Friedman S, et al. Screen Time in the Coronavirus 2019 Era: International Trends of Increasing Use Among 3- to 7-Year-Old Children. *Journal of Pediatrics*. 2021;239:59-66.e51.
37. Saxena R, Gupta V, Rakheja V, Dhiman R, Bhardawaj A, Vashist P. Lifestyle modification in school-going children before and after COVID-19 lockdown. *Indian journal of ophthalmology*. 2021;69(12):3623-3629.
38. Schnaiderman D, Bailac M, Borak L, et al. Psychological impact of COVID-19 lockdown in children and adolescents from San Carlos de Bariloche, Argentina: Parents' perspective. *Archivos argentinos de pediatria*. 2021;119(3):170-176.
39. Schmidt SCE, Anedda B, Burchartz A, et al. Physical activity and screen time of children and adolescents before and during the COVID-19 lockdown in Germany: a natural experiment. *Scientific reports*. 2020;10(1):21780.
40. Seo HR, Jung HS, Jung DS, Choi JW, Jo SH. Acute impact of the coronavirus disease outbreak on behavioral patterns and emotional states of pediatric psychiatric patients and caregivers in Daegu, South Korea. *Psychiatry Investigation*. 2021;18(9):913-922.
41. Shoshani A, Kor A. The mental health effects of the COVID-19 pandemic on children and adolescents: Risk and protective factors. *Psychological Trauma: Theory, Research, Practice, and Policy*. 2021.
42. ten Velde G, Lubrecht J, Arayess L, et al. Physical activity behaviour and screen time in Dutch children during the COVID-19 pandemic: Pre-, during- and post-school closures. *Pediatric Obesity*. 2021;16(9).
43. Welling MS, Abawi O, Van Den Eynde E, et al. Impact of the COVID-19 pandemic and related lockdown measures on lifestyle behaviors and wellbeing in children and adolescents with severe obesity. *Obesity Facts*. 2021.
44. Xiang M, Zhang Z, Kuwahara K. Impact of COVID-19 pandemic on children and adolescents' lifestyle behavior larger than expected. *Progress in Cardiovascular Diseases*. 2020;63(4):531-532.
45. Yum HR, Park SH, Shin SY. Influence of coronavirus disease 2019 on myopic progression in children treated with low-concentration atropine. *PLoS ONE*. 2021;16(9 September 2021).

46. Zhang X, Cheung SSL, Chan HN, et al. Myopia incidence and lifestyle changes among school children during the COVID-19 pandemic: A population-based prospective study. *British Journal of Ophthalmology*. 2021.