



Deposited via The University of Sheffield.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/203557/>

Version: Published Version

Article:

Woodland, L., Smith, L., Brooks, S. et al. (2023) Parent-reported child's close contact with non-household family members and their well-being during the COVID-19 pandemic: a cross-sectional survey. PLoS ONE, 18 (10). e0292344. ISSN: 1932-6203

<https://doi.org/10.1371/journal.pone.0292344>

Reuse

This article is distributed under the terms of the Creative Commons Attribution (CC BY) licence. This licence allows you to distribute, remix, tweak, and build upon the work, even commercially, as long as you credit the authors for the original work. More information and the full terms of the licence here:

<https://creativecommons.org/licenses/>

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

RESEARCH ARTICLE

Parent-reported child's close contact with non-household family members and their well-being during the COVID-19 pandemic: A cross-sectional survey

Lisa Woodland^{1,2*}, Louise E. Smith^{1,2}, Samantha K. Brooks^{1,2}, Rebecca K. Webster³, Richard Amlôt^{2,4}, Antonia Rubin⁵, G. James Rubin^{1,2}

1 Department of Psychological Medicine, King's College London, London, United Kingdom, **2** NIHR Health Protection Research Unit in Emergency Preparedness and Response, Bristol, United Kingdom, **3** Department of Psychology, University of Sheffield, Sheffield, United Kingdom, **4** Behavioural Science and Insights Unit, UK Health Security Agency, Salisbury, United Kingdom, **5** Trustee at Weald of Kent Grammar School, Tonbridge, Kent, United Kingdom

* lisa.woodland@kcl.ac.uk



OPEN ACCESS

Citation: Woodland L, Smith LE, Brooks SK, Webster RK, Amlôt R, Rubin A, et al. (2023) Parent-reported child's close contact with non-household family members and their well-being during the COVID-19 pandemic: A cross-sectional survey. *PLoS ONE* 18(10): e0292344. <https://doi.org/10.1371/journal.pone.0292344>

Editor: Mduduzi Colani Shongwe, University of Eswatini, SWAZILAND

Received: January 12, 2023

Accepted: September 18, 2023

Published: October 19, 2023

Peer Review History: PLOS recognizes the benefits of transparency in the peer review process; therefore, we enable the publication of all of the content of peer review and author responses alongside final, published articles. The editorial history of this article is available here: <https://doi.org/10.1371/journal.pone.0292344>

Copyright: © 2023 Woodland et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: The data set and survey questions related to this study can be accessed via the King's College London research

Abstract

In England (UK), at the start of the COVID-19 pandemic the public were required to reduce their physical contacts to slow the spread of COVID-19. We investigated the factors associated with children having: 1) close contact with family members from outside their household ('non-adherent behaviour'); and 2) low well-being (Revised Child Anxiety and Depression Scale). We conducted an online cross-sectional survey, completed at any location of the participant's choice between 8 and 11 June 2020 in parents ($n = 2,010$) who were aged eighteen years or over and had a school-aged child (4–18 years old). Parents reported that 15% ($n = 309$) of children had non-adherent contact and that 26% ($n = 519$) had low well-being. We used a series of binary logistic regressions to investigate associations between outcomes and child and parent characteristics. Children had higher odds of having non-household contact when they had special educational needs [adjusted odds ratio, 2.19 (95% CI, 1.47 to 3.27)], lower well-being [2.65 (95% CI, 2.03 to 3.46)], were vulnerable to COVID-19 [2.17 (95% CI, 1.45 to 3.25)], lived with someone who was over 70 years old [2.56 (95% CI, 1.55 to 4.24)] and their parent had low well-being [1.94 (95% CI, 1.45 to 2.58)]. Children had higher odds of lower well-being when they had special educational needs [4.13 (95% CI, 2.90 to 5.87)], were vulnerable to COVID-19 [3.06 (95% CI, 2.15 to 4.36)], lived with someone else who was vulnerable to COVID-19 [2.08 (95% CI, 1.64 to 2.64)], or lived with someone who was over 70 years old [2.41 (95% CI, 1.51 to 3.83)]. Many children came into contact with non-household family members, mainly for childcare. Factors relating to COVID-19, children's well-being and education were also important. If school closures are needed in future, addressing these issues may help reduce contact.

data repository, KORDS (DOI [10.18742/21757232](https://doi.org/10.18742/21757232)). For further information contact: kcl-research.data@kcl.ac.uk.

Funding: Funding: This study was funded by the Economic and Social Research Council [grant number ES/P000703/1] and by the National Institute for Health and Care Research Health Protection Research Unit (NIHR HPRU) in Emergency Preparedness and Response [grant number NIHR200890], a partnership between the UK Health Security Agency, King's College London and the University of East Anglia. The views expressed are those of the author(s) and not necessarily those of the NIHR, UKHSA or the Department of Health and Social Care. For the purpose of open access, the author has applied a Creative Commons Attribution (CC BY) licence to any Author Accepted Manuscript version arising from the funding source: The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. The corresponding author had full access to all the data and had final responsibility for the decision to submit for publication.

Competing interests: I have read the journal's policy and the authors of this manuscript have the following competing interests: G.J.R., R.A. and L.S. participate in the UK's Scientific Advisory Group for Emergencies, or its subgroups. RA is an employee of the UK Health Security Agency, which is an arm of the UK Government. This does not alter our adherence to PLOS ONE policies on sharing data and materials. These groups did not fund the study or authors.

Introduction

On 23 March 2020, England went into 'lockdown,' with the public required to stay at home to slow the spread of COVID-19 [1]. The public were only allowed to leave home for a limited number of reasons, which included for medical attention, to buy necessities (as infrequently as possible), for exercise (only once a day outside their home) and to work if absolutely necessary and they were unable to work from home. Physical distancing guidelines were implemented: people from different households were not allowed to meet and individuals were asked to stay two meters away from people not in their household. Non-essential shops were closed, and schools were closed to most children. Children could attend school if they were on a 'health care plan' due to a specific medical or social need or if their parent(s) were employed in jobs that were essential to the COVID-19 response ('key workers'), such as doctors, teachers, and supermarket employees [2].

After two months of lockdown guidance, the restrictions started to ease. On 11 May it was announced that people could return to work, the restrictions on spending time outside were lifted, and individuals were allowed to arrange meetings with one person from another household as long as this happened outside and a two meter distance was maintained [3]. From 1 June 2020, the rules relaxed further: six people from different households were able to meet outside (though still at a two meter distance) and more children were eligible to attend school, including children in early years (four to five years), year one (five to six years) and year six (10 to 11 years) [4].

While all the restrictions caused strain within society, the closure of schools was particularly problematic. A systematic review suggested that between 18% and 60% of children scored above risk thresholds for distress, anxiety and depressive symptoms between February and July 2020 and increases in other adverse behaviours were also reported, such as an increase in suicidal ideation, worsening of mood, emotional difficulties and conduct problems in children [5]. In a qualitative study that we conducted in April 2020 we found that parent's and children's characteristics (e.g., parent's work status, children's age, access to resources for home-schooling and entertainment activities and space inside and outside the home to exercise) impacted how well families could cope with the COVID-19 school closures [6].

Determining, at the height of a crisis, whether the epidemiological benefits of school closures in terms of reducing disease transmission will exceed the psychological, physical, educational, and social costs is a daunting challenge for those who must make this decision. One question that must be factored into decision making is 'where do children go when their school is shut?'. In an ideal world (from an epidemiological perspective), parents would be able to ensure that children are placed under appropriate alternative supervision and remain apart from each other: continued mixing between children and other households would defeat the purpose of school closures. A systematic review of unplanned school closures prior to the COVID-19 pandemic found a 65% reduction in the mean total number of contacts for each student whilst schools were closed [7]. However, all 19 studies included in the review reported that children continued to meet with people from other households to some extent. A common reason for meeting others related to childcare. For example, one study found that children in households where special childcare arrangements were needed during the closure had significantly higher odds of leaving home than children who were more independent and able to take care of themselves [8]. Parental concerns about the school closure also commonly reflected the difficulties they would face in trying to arrange childcare as well as concerns about lost education [7]. Previous research about children's adherence to medical treatment and encouraging healthy eating behaviours and physical exercise follow a similar pattern; factors relating to social networks and family cohesiveness or conflict [9,10] and risk perceptions

(e.g., perceived severity and vulnerability) [11,12] are common in impacting adherence. These findings mirror a study that we conducted about family's adherence to England's COVID-19 guidelines. This study also found that parent's and children's characteristics, such as family income impacted adherence and that adherence may be more challenging for families with low psychological and physical ability [13].

In the context of the COVID-19 pandemic, issues around childcare while schools were closed were of particular concern because of a worry that grandparents might be called on to look after children in some families, putting older adults at increased risk of infection [14]. It was not just policy makers who worried about this, many children were themselves worried about their grandparents' vulnerability to COVID-19 [15] and of the risk that they themselves might infect their grandparents [16]. The extent to which these worries were borne out remains unclear.

Of course, while keeping children separate from each other and away from their grandparents might reduce disease transmission, it does present other risks. For example, a reduction in physical activity levels as a result of staying at home can affect physical and mental well-being [5]. While parents were advised to ensure their children engaged in physical activity during the initial lockdown, the extent to which this occurred, and the impact of that initial period of isolation and inactivity is uncertain. Some parents and children may also have been very cautious about the risks associated with COVID-19, engaging in additional protective behaviours that were not explicitly recommended by the Government and which may have exerted an additional toll on well-being [17,18].

In this study we investigated the factors associated with parents reporting that their children had: 1) close contact with family members from outside their household; and 2) low well-being during the first COVID-19 lockdown in the UK. Considering the evidence discussed above, we specifically explored whether close contact with non-household family members and low child well-being were associated with: parent's age, gender, and employment characteristics, children's age, gender and special educational needs status, and household's vulnerability to, perceptions about and behaviours in relation to COVID-19.

Materials and methods

Design

We commissioned a market research company, BMG Research [19] to administer an online cross-sectional survey between 8 and 11 June 2020. Data collection occurred after lockdown restrictions had begun to be eased. At this stage in the pandemic, schools had re-opened to children in early years (four to five years), year one (five to six years) and year six (1 to 11 years). However, physical distancing restrictions remained in place throughout society, and while up to six non-household members could meet, this had to be outside and at a two-meter distance.

We have previously published data from this survey relating to parental perceptions of the hygiene procedures within schools [20] and investigating why some parents did not send their eligible children back to school [21].

Participants

Participants ($n = 2,447$) were recruited from BMG Research's panel. To achieve a sample that was broadly representative of the population, BMG Research monitored region, child age, child gender, parent/guardian age, and parent/guardian gender. Participants were eligible for the study if they were aged eighteen years or over, lived in England, and were a parent or guardian to a school-aged child (4–18 years old) who usually lived with them. One-hundred

and eighty-three participants were screened out for non-eligibility by BMG, 226 participants dropped out after starting the survey and 28 completed but were removed for reasons related to quality control, such as completing the survey quickly compared to the average (14 minutes) and median (11 minutes) survey time or for 'straight-lining' (selecting the same option for every question) suggesting inattention to the questions. These issues are common in online surveys [22]. Two thousand and ten participants remained.

Quota sampling, as used in this study, is a non-probability based approach and we have therefore not reported the response rates as they are not helpful indicators of non-response bias. The response rates for each quota will differ, the denominator for each is essentially unknown, and the predominant source of bias is in the make-up of the underlying panels that are being recruited from, rather than whether the sample is representative of the panel [23].

The sample fell within five percentage points of the national population by the child's gender, key stage, and type of school attended against the known distribution for school children in England [24].

Participants were paid in points that could be accumulated by the participant and exchanged later for money. Our survey paid points equivalent to about £0.60.

The research was approved by the Psychiatry, Nursing and Midwifery Research Ethics Subcommittee at King's College London (LRS-19/20-18787). An information sheet was provided at the start of the survey, which described the purpose of the study. Participants were also informed of the study process, and they provided written consent before taking part.

Study materials

The full survey is available in the (S1 Text).

All participants answered questions referring to their child who had the most recent birthday. In rare cases where children shared a birthday, we asked the parent to select one child.

Outcome one: Child's physical close contact with non-household family members

We asked parents to choose from a list of seven options about people who the child had come into close contact with in the past 24 hours ("someone [child] lives with;" "friends or other children who [child] does not live with;" "a babysitter, nanny or childminder;" "family member aged under 70 who [child] does not live with;" "family member aged over 70 who [child] does not live with;" "other children, not already reported above"; and "other adults, not already reported above"). We made clear in the question that "by close contact we mean closer than 2 meters, for fifteen minutes or more," which was the UK Government's definition of close contact [25]. Parents were asked to report all the options that applied.

We created a binary variable to indicate whether the child had close contact with a family member from outside their household, defined as a "non-household close contact." This included children reported as having had close contact with either "a family member aged under 70 who [child] does not live with" or "a family member aged over 70 who [child] does not live with."

Outcome two: Child's well-being

We asked parents to report the child's well-being using two subscales from the Revised Child Anxiety and Depression Scale (RCADS): the generalised anxiety disorder (GAD) sub-scale and the major depressive disorder (MDD) sub-scale [26]. The GAD sub-scale asks parents to respond to six statements about their child (e.g., "my child worries about things"; and "my child worries that something awful will happen to someone in the family"). The MDD sub-

scale asks parents to respond to ten statements about their child (e.g., “my child feels sad or empty”; “nothing is much fun for my child”; and “my child has trouble sleeping”). Parents can respond “never,” “sometimes,” “often,” and “always.”

We created a binary variable to indicate well-being in the child. The variable was recoded using SPSS syntax supplied by the RCADS authors, which assigns a value against each answer from 0 (“never”) to 3 (“always”) on the GAD and MDD RCADS sub-scales and creates a total score for each sub-scale [26]. The total score is turned into a t-score, normalising the RCADS scores within the population, by child's age and gender. A t-score of 65 (approximately in the top 7% of un-referred young people of the same age) on either the GAD or MDD sub-scale was our well-being cut off. “Lower well-being” represents a child with a medium or severe risk of clinical mental illness and “higher well-being” represents a child with low risk of clinical mental illness.

Predictor variables: Parent and child personal characteristics

We asked parents to report their gender, age, region, household income, employment status, and if employed, whether they were working from home, level of education, marital status, ethnicity, and key worker status. We asked parents to report the child's gender, age, school year, and whether the child had special educational needs. We also asked whether anyone within the household was aged over 70 years old or had a health condition that made them vulnerable to COVID-19 and whether they had access to outside space.

We recoded household income (less than £5,000; £5,000-£9,999; £10,000-£14,999; £15,000-£19,999; £20,000-£24,999; £25,000-£29,999; £30,000-£34,999; £35,000-£39,999; £40,000-£44,999; £45,000-£49,999; £50,000-£59,999; £60,000-£69,999; £70,000-£84,999; £85,000-£99,999; more than £100,000), employment status (full time paid job (31+ hours); part time paid job (<31 hours); doing paid work on a self-employed basis or within your own business; employed, but currently furloughed; student / on a government training programme (Nation Traineeship/ Modern Apprenticeship); out of work (6 months or less); out of work (more than 6 months); looking after home / homemaker; retired; disabled OR long-term sick; unpaid work for a business, community or voluntary organisation), parent education level (PhD/Doctor; Master's; Bachelor's Degree or equivalent (such as a NVQ level 5); higher education (such as a HND or a NVQ level 4); A-level or equivalent (such as Scottish Highers or NVQ level 3); GCSE and below (such as O level or an RSA Diploma); Other qualifications (Such as NVQ level 1); No qualifications), marital status (single (i.e. never married and never registered as a same sex civil-partnership); co-habiting with partner (but never married or been in a civil partnership); civil partnership; married; separated, but still legally married / in a civil partnership; divorced / civil partnership legally dissolved; widowed / surviving partner from a same-sex civil partnership), and ethnicity (English/Welsh/Scottish/Northern Irish/British; Irish; Gypsy or Irish Traveller; White and Black Caribbean; White and Black African; White and Asian; Indian; Pakistani; Bangladeshi; Chinese; Caribbean; African; Arab; any other (please specify)) into binary variables.

We recoded parent age, key worker status, and access to outside space into categorical variables, as shown in the results tables. We recoded child school year into Key Stages as used in the English education system (Early years = ages 4 to 5; Key Stage 1 = ages 5 to 7; Key Stage 2 = ages 7 to 11; Key Stage 3 = ages 11 to 14; Key Stage 4 = ages 14 to 16; Years 12 and 13 = ages 16 to 18). We created two binary variables to indicate whether the child, and someone in the household (other than the child) had a health condition that might make them particularly vulnerable to COVID-19. The responses “yourself [participant]” and “anyone else you live with” were combined into one variable to indicate that the child lived with someone vulnerable to COVID-19.

Parent's well-being

We asked parents to report their well-being using the Patient-Health Questionnaire-4 (PHQ4) [27], which asks “over the last two weeks, how often have you been bothered by the following problems:” “feeling nervous, anxious or on the edge;” “not being able to stop or control worrying;” “little interest or pleasure in doing things;” and “feeling down, depressed, or hopeless.” Parents can respond “not at all,” “several days,” “more than half the days,” and “nearly every day.”

We created a binary variable to indicate low well-being in the parent. We assigned a value against each answer from 0 (“not at all”) to 3 (“nearly every day”) on the PHQ4 and summed responses (range 0 to 12). We used a cut off score of 5 or above to indicate low well-being in the parent, indicating moderate or severe risk of clinical anxiety or depression.

Child's activities outside the home

We asked parents how many times the child had left the home in the past seven days: “to go to the shops for groceries, toiletries, or medicines;” “to go to the shops for other items;” “for exercise;” “for a medical need (e.g., an outpatient appointment);” “to go to school;” “to provide help to someone else;” “to meet friends;” to meet family members who they did not live with; and “for another reason.”

Items about the child's activities outside the home were used as continuous variables.

Behaviours that parents and children had followed

We asked parents to report the behaviours that they or their children had followed in the past 7 days because of the risk of COVID-19 (e.g., “washed your hands thoroughly and regularly,” “stayed 2m (3 steps) away from people you do not live with when outside your home,” “washed your clothes when you have returned home and “washed [child]'s clothes when she/he has returned home”). Parents could respond “yes” or “no” to each statement. Out of the 11 statements that we asked about, two were recommended and nine were not recommended by UK Government at the time of the study.

We created a continuous variable to indicate the COVID-19 behaviours that parents and their child had followed by combining all 11 responses to the statements about what the parent or child had done in the past seven days because of the risk of COVID-19.

Statements about lockdown

We included 16 statements about lockdown, which included questions about COVID-19 (e.g., “if [child] goes out, she/he is likely to catch coronavirus”), schooling (e.g., “[child] is keeping up with his/her schoolwork”) and home environment (e.g., “in the past 7 days, [child] has been bored”). Parents responded to each statement using a five-point Likert-scale from “strongly agree” to “strongly disagree,” or “not applicable.”

Items about lockdown were used as continuous variables.

Missing data

We took the pragmatic approach to code the responses “don't know,” “not applicable,” “prefer not to say” and “prefer to self-describe” as missing data. We adopted this approach for outcome variables because it was not possible to categorise participants as adherent or not, or as having good well-being or not. For predictors we adopted this approach to provide a clearer understanding of the difference between endorsing, or not endorsing, each variable in terms of its impact on our outcomes.

Validity and reliability

Previous studies have used RCADS [28], and the PHQ-4 [29], and they have both demonstrated good validity and reliability. The survey questions that related to COVID-19 were designed for this study based on our previous research [6], they have face validity and we copied the wording of official Government guidance where applicable. Five parents and one school trustee (see public involvement section) piloted the survey. Beyond this we do not have psychometric data about the validity and reliability of the questions.

Public involvement

A school trustee contributed to the development of the survey materials and co-authored this paper. The survey questions were reviewed by five parents of school children who also piloted the survey before publication. The feedback we received resulted in minor changes to the wording of some survey questions for clarity.

Analysis

We ran a series of binary logistic regressions using SPSS [30,31] investigating the univariable associations between our two outcomes and each of our predictor variables. We ran a second set of binary logistic regressions controlling for child and parent characteristics (participant gender, age, region, household income, employment status, education level, marital status, ethnicity, and the child's gender and school year). These 'pre-exposure' variables were selected based on previous research [6,13,21] that indicated these variables may be associated with exposure and / or outcome variables, and these variables could be measured, which is recommended when causation is unknown [32].

We applied a Bonferroni correction to our results ($p \leq 0.001$) due to running many analyses. Only associations that met this level are discussed narratively in the results section.

Results

Most parents were: female (53%); between 36 and 45 years of age (43%); lived in London (17%); had a household income over £35,000 (55%); working (83%); highly educated (57%); married or co-habiting (84%); and of white ethnicity (87%) (Table 1).

Factors associated with children's non-household close contact

Of the 2010 parent responses, 15% (95% confidence interval (CI), 14% to 17%, $n = 309$) of children were perceived by the parents to have had close contact with a family member that they did not live with in the past 24 hours. This included 9% ($n = 189$) who had close contact with a family member aged under 70 years and 6% ($n = 120$) who had close contact with a family member aged 70 years or older, which includes $n = 45$ who had close contact with non-household family members under and over 70 years of age. The parent and child characteristics associated with children who had non-household close contact are shown in Table 2 (see Table 7, Appendix A for the descriptives in S1 Appendix). Parents with lower well-being had higher odds of reporting that their child had non-household close contact [adjusted odds ratio 1.94 (95% CI, 1.45 to 2.58)]. Parents who reported that their child had special educational needs, lower well-being, were vulnerable to COVID-19, and lived with someone who was over 70 years of age had higher odds of reporting that their child had had non-household close contact [adjusted odd ratios, 2.19 (95% CI, 1.47 to 3.27); 2.65 (95% CI, 2.03 to 3.46); 2.56 (95% CI, 1.55 to 4.24), respectively].

Table 3 shows the associations between children who had non-household close contact, as perceived by their parents, and the predictor variables relating to parent perceptions about

Table 1. Parent, child and household characteristics (n = 2,010).

Variable	Level	n, (%)*
Parent gender	Male	931 (46)
	Female	1065 (53)
Parent age	18–35 years	394 (20)
	36–45 years	868 (43)
	46 years \geq	748 (37)
Region	East Midlands	151 (8)
	East of England	219 (11)
	North East	118 (6)
	North West	273 (14)
	South East	335 (17)
	South West	163 (8)
	West Midlands	211 (10)
	Yorkshire & the Humber	195 (10)
	London	345 (17)
Household income	\leq £34,999	804 (40)
	£35,000 \geq	1114 (55)
Employment status ¹	Working	1677 (83)
	Not working	321 (16)
Parent Working from home ²	Yes	940 (59)
	No	628 (40)
Education level	\leq A-level	855 (43)
	Degree \geq	1139 (57)
Marital status	Living alone	327 (16)
	Married/cohabiting	1683 (84)
Ethnicity	White	1753 (87)
	BAME	241 (12)
Key worker status	Both parents	195 (10)
	One parent	847 (42)
	No	956 (48)
Child gender	Boy	1063 (53)
	Girl	947 (47)
Child school year	Early Years (ages 4 to 5)	101 (5)
	Key Stage 1 (ages 5 to 7)	356 (18)
	Key Stage 2 (ages 7 to 11)	675 (34)
	Key Stage 3 (ages 11 to 14)	395 (20)
	Key Stage 4 (ages 14 to 16)	328 (16)
	Years 12 & 13 (ages 16 to 18)	155 (8)
Child had special educational needs	Yes	161 (8)
	No	1832 (91)
Child lower well-being	Yes	519 (26)
	No	1491 (74)
Parent lower well-being	Yes	391 (19)
	No	1619 (81)
Child vulnerable COVID-19	Yes	157 (8)
	No	1826 (91)
Household vulnerable COVID-19	Yes	510 (25)
	No	1311 (65)

(Continued)

Table 1. (Continued)

Variable	Level	n, (%) [*]
Someone over 70 years	Yes	87 (4)
	No	1923 (96)
COVID-19 behaviours followed by child and parent	Continuous (0 = followed no behaviours, 11 = followed all behaviours)	N = 2,010, M = 5.60, SD = 3.10
Access to outside space ³	Garden	1784 (89)
	Other ³	157 (8)
	No	69 (3)

^{*}Percentages may not total 100 due to rounding errors and missing data.

¹ Working includes students and volunteers.

² Question only offered to participants who reported working in a paid job (full-time, part-time, and self-employed) and not to participants who reported being a student, on furlough and a volunteer.

³ Participants that reported no access to a garden but had access to other outdoor spaces such as patio, terrace, and balcony.

Abbreviations: N = number; % = percentage; M = mean; SD = standard deviation.

<https://doi.org/10.1371/journal.pone.0292344.t001>

lockdown (see Table 8, Appendix B for the descriptives in [S1 Appendix](#)). Parent's agreement that their child had extra support at school before the closures, were upset about not seeing other family members that they did not live with, and that the parent had found it hard to keep up with work or other important commitments was associated with their children's non-household close contact [adjusted odd ratios, 0.82 (95% CI, 0.74 to 0.90); 0.84 (95% CI, 0.75 to 0.93); 0.78 (95% CI, 0.70 to 0.87), respectively].

The behaviours that families followed, perceived by parents because of the risk of COVID-19 are presented in (see Table 9, Appendix C in [S1 Appendix](#)).

Factors associated with children's lower well-being

Of the 2010 parent responses, 26% (95% CI, 24% to 28%, n = 519) reported that their child was perceived to have had low well-being. The parent and child characteristics associated with child low well-being are shown in [Table 4](#) (see Table 10, Appendix D for the descriptives in [S1 Appendix](#)). Parents aged between 18 and 35 years old, who were a key worker and parents with lower well-being had higher odds of reporting that their child had lower well-being [adjusted odds ratio, 1.92 (95% CI, 1.40 to 2.64); 1.51 (95% CI, 1.20 to 1.90); 7.26 (95% CI, 5.62 to 9.38), respectively]. Parents who reported that their child had had special educational needs, were vulnerable to COVID-19, lived with someone else who was also vulnerable to COVID-19, and lived with someone that was over 70 years old also had higher odds of reporting that their child had lower well-being [adjusted odd ratios, 4.13 (95% CI, 2.90 to 5.87)]; 3.06 (95% CI, 2.15 to 4.36); 2.08 (95% CI, 1.64 to 2.64)]; 2.41 (95% CI, 1.51 to 3.83), respectively]. Parents who reported that their household followed multiple precautionary behaviours because of the risk of COVID-19 had higher odds of reporting that their child had lower well-being [adjusted odds ratio, 1.11 (95% CI, 1.07 to 1.15)]. All lockdown statements bar two were associated with lower well-being ([Table 5](#)), (see Table 11, Appendix E for descriptives in [S1 Appendix](#)).

Associations between well-being and leaving home

Parents who perceived that their child had left the home for shopping, to provide help to someone else, to meet family, for medical treatment or for another reason had higher odds of

Table 2. Binary logistic regression comparing parent and child characteristics and associations with children’s non-household close contact.

Variable	Level	Unadjusted odds Ratio (95% CI)	P-value	Adjusted odds ratio (95% CI) †	P-value
Parent gender	Male	0.88 (0.69 to 1.12)	0.30	0.97 (0.74 to 1.27)	0.80
	Female	Reference		Reference	
Parent age	18–35 years	2.13** (1.54 to 2.95)	<0.001	1.28* (1.25 to 2.65)	0.002
	36–45 years	1.29 (0.97 to 1.72)	0.09	1.17 (0.85 to 1.62)	0.34
	46 years ≥	Reference		Reference	
Region	East Midlands	0.73 (0.43 to 1.24)	0.25	0.69 (0.40 to 1.21)	0.19
	East of England	0.76 (0.48 to 1.21)	0.25	0.77 (0.47 to 1.26)	0.30
	North East	0.58 (0.31 to 1.08)	0.08	0.55 (0.28 to 1.06)	0.07
	North West	0.76 (0.50 to 1.17)	0.21	0.83 (0.52 to 1.32)	0.43
	South East	0.79 (0.53 to 1.18)	0.25	0.84 (0.55 to 1.28)	0.43
	South West	0.60 (0.35 to 1.03)	0.07	0.61 (0.35 to 1.08)	0.09
	West Midlands	0.66 (0.41 to 1.07)	0.09	0.63 (0.37 to 1.05)	0.08
	Yorkshire & the Humber	0.91 (0.58 to 1.44)	0.69	0.88 (0.54 to 1.44)	0.61
	London	Reference		Reference	
Household income	≤ £34,999	1.34* (1.05 to 1.72)	0.02	1.44* (1.08 to 1.92)	0.01
	£35,000 ≥	Reference		Reference	
Employment status ¹	Working	0.27 (1.21 to 0.86 to 1.72)	0.27	1.12 (0.77 to 1.63)	0.57
	Not working	Reference		Reference	
Parent Working from home ²	Yes	1.53* (1.15 to 2.05)	0.004	^^^	^^^
	No	Reference		Reference	
Education level	≤ A-level	0.77* (0.60 to 0.98)	0.04	0.70* (0.53 to 0.93)	0.01
	Degree ≥	Reference		Reference	
Marital status	Living alone	1.46* (1.08 to 1.98)	0.01	1.36 (0.98 to 1.90)	0.07
	Married/cohabiting	Reference		Reference	
Ethnicity	White	0.97 (0.67 to 1.41)	0.88	1.25 (0.83 to 1.87)	0.28
	BAME	Reference		Reference	
Key worker status	Both parents	1.18 (0.76 to 1.84)	0.47	1.18 (0.74 to 1.90)	0.49
	One parent	1.65** (1.28 to 2.14)	<0.001	1.53* (1.16 to 2.02)	0.002
	No	Reference		Reference	
Child gender	Boy	1.14 (0.89 to 1.46)	0.29	1.14 (0.88 to 1.48)	1.14
	Girl	Reference		Reference	
Child school year	Early Years	1.53 (0.73 to 3.18)	0.26	1.22 (0.55 to 2.71)	0.63
	Key Stage 1	2.24* (1.28 to 3.94)	0.01	2.11* (1.13 to 3.94)	0.02
	Key Stage 2	1.40 (0.81 to 2.41)	0.23	1.28 (0.70 to 2.33)	0.42
	Key Stage 3	1.48 (0.84 to 2.63)	0.18	1.53 (0.83 to 2.83)	0.17
	Key Stage 4	1.10 (0.60 to 2.01)	0.77	1.21 (0.64 to 2.30)	0.56
	Years 12 & 13	Reference		Reference	
Child had special educational needs	Yes	2.16** (1.49 to 3.14)	<0.001	2.19** (1.47 to 3.27)	<0.001
	No	Reference		Reference	
Child lower well-being	Yes	2.66** (2.07 to 3.42)	<0.001	2.65** (2.03 to 3.46)	<0.001
	No	Reference		Reference	
Parent lower well-being	Yes	2.15** (1.64 to 2.82)	<0.001	1.94** (1.45 to 2.58)	<0.001
	No	Reference		Reference	
Child vulnerable COVID-19	Yes	2.50** (1.73 to 3.61)	<0.001	2.17** (1.45 to 3.25)	<0.001
	No	Reference		Reference	

(Continued)

Table 2. (Continued)

Variable	Level	Unadjusted odds Ratio (95% CI)	P-value	Adjusted odds ratio (95% CI) †	P-value
Household vulnerable COVID-19	Yes	1.16 (0.87 to 1.54)	0.32	1.17 (0.87 to 1.59)	0.30
	No	Reference		Reference	
Someone over 70 years	Yes	2.77** (1.74 to 4.42)	<0.001	2.56** (1.55 to 4.24)	<0.001
	No	Reference		Reference	
COVID-19 behaviours followed by child and parent	Continuous (0 = followed no behaviours, 11 = followed all behaviours)	1.06* (1.02 to 1.11)	0.002	1.04 (0.99 to 1.08)	0.10
Access to outside space ³	Garden	0.73 (0.40 to 1.38)	0.33	0.88 (0.44 to 1.75)	0.71
	Other ³	1.28 (0.63 to 2.60)	0.49	1.25 (0.58 to 2.73)	0.71
	No	Reference		Reference	

* $p \leq .05$ and formatted bold.

** $p \leq .001$ and formatted bold.

Some results are rounded to 3 rather than 2 decimal places to distinguish between $p \leq .05$ and $p \leq .001$.

† When interpreting the predictor listed in the row, we controlled for the other variables listed here: participant gender, age, region, household income, employment status, education level, marital status, ethnicity, and the child's gender and school year.

^^^ Not included variable highly correlated with employment variable.

¹ Working includes students and volunteers.

² Question only offered to participants who reported working in a paid job (full-time, part-time, and self-employed) and not to participants who reported being a student, on furlough and a volunteer.

³ Participants that reported no access to a garden but had access to other outdoor spaces such as patio, terrace, and balcony.

Abbreviations: CI = confidence interval.

<https://doi.org/10.1371/journal.pone.0292344.t002>

reporting that their child had lower well-being (Table 6) [adjusted odds ratio, 1.24 (95% CI, 1.13 to 1.35); 1.37 (95% CI, 1.21 to 1.56); 1.19 (95% CI, 1.07 to 1.33); 3.70 (95% CI, 2.64 to 5.18); 1.22 (95% CI, 1.08 to 1.37), respectively]. Parents who perceived that their child was not leaving the home to exercise also had higher odds of reporting that their child had lower well-being [adjusted odds ratio, 0.93 (95% CI, 0.89 to 0.97)].

Discussion

During the COVID-19 pandemic, interventions were implemented to reduce physical contacts, including school closures and limits to physical contact between members of different households. We explored the impact of these measures to identify the factors associated with children having: 1) close contact with family members from outside their household and 2) a low well-being.

Physical close contact with non-household family members

Our finding that 15% of children had close contact with non-household family members when schools were closed is concerning, as this would have increased the risk of disease transmission. This is particularly problematic for the 6% who had close contact with a non-household family member aged 70 years or over, who would be particularly at risk from COVID-19.

We found several variables associated with non-household contact that seem to point towards increased odds for such interactions among families that require childcare. This included, for example, when one parent was a key worker and when parents reported they had been unable to keep up with work or other important commitments. At the time of the survey parents were able to go back to work and some children were eligible to attend school.

Table 3. Binary logistic regression comparing statements about lockdown and associations with children's non-household close contact. Close contact is defined by a child's close contact with a family member outside the household (n = 309).

Statement	Level	Unadjusted odds ratio (95%, CI)	P-value	Adjusted odds ratio (95%, CI) †	P-value
If child goes out, she/he is likely to catch coronavirus	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.85* (0.75 to 0.95)	0.004	0.89 (0.79 to 1.01)	0.07
If child goes out, she/he is likely to bring coronavirus back into our home	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.86* (0.77 to 0.96)	0.01	0.91 (0.81 to 1.03)	0.13
Child is keeping up with his/her schoolwork	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.16* (1.04 to 1.29)	0.01	1.14* (1.02 to 1.27)	0.03
I feel confident helping child with her/his schoolwork	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.06 (0.94 to 1.19)	0.32	1.08 (0.96 to 1.23)	0.20
I feel supported by child's school	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.00 (0.89 to 1.12)	0.96	0.99 (0.68 to 1.12)	0.87
I have access to all the resources that child needs to do her/his schoolwork	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.05 (0.94 to 1.18)	0.38	1.09 (0.96 to 1.23)	0.18
During lockdown, child has learned about important things she/he wouldn't normally learn at school	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.98 (0.87 to 1.11)	0.74	1.03 (0.30 to 1.17)	0.69
In the past 7 days, child has been bored	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.84** (0.75 to 0.93)	0.001	0.85* (0.76 to 0.95)	0.004
In the past 7 days, my household has had a regular structure to the day	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.12 (1.00 to 1.26)	0.05	1.09 (0.96 to 1.23)	0.18
In the past 7 days, child has kept in touch with her/his friends	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.00 (0.90 to 1.12)	0.96	0.95 (0.84 to 1.07)	0.36
Child is worried about coronavirus	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.98 (0.88 to 1.09)	0.72	0.99 (0.88 to 1.10)	0.82
In the past 7 days, child has felt upset about not seeing other family members who do not live with us	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.81** (0.73 to 0.89)	<0.001	0.84** (0.75 to 0.93)	0.001
In the past 7 days, I have found it hard to keep up with work or other important commitments	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.75** (0.67 to 0.83)	<0.001	0.78** (0.70 to 0.87)	<0.001
In the past 7 days, people in my household have been getting along well	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.13 (1.00 to 1.28)	0.05	1.07 (0.94 to 1.22)	0.28
I am worried about the financial impact of lockdown measures	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.92 (0.83 to 1.02)	0.13	0.93 (0.83 to 1.03)	0.18
Before the school closures, child had extra support at school	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.80** (0.73 to 0.88)	<0.001	0.82** (0.74 to 0.90)	<0.001

* $p \leq .05$ and formatted bold.

** $p \leq .001$ and formatted bold.

Some results are rounded to 3 rather than 2 decimal places to distinguish between $p \leq .05$ and $p \leq .001$.

† When interpreting the predictor listed in the row, we controlled for the other variables listed here: participant gender, age, region, household income, employment status, education level, marital status, ethnicity, and the child's gender and school year.

Abbreviations: CI = confidence interval.

<https://doi.org/10.1371/journal.pone.0292344.t003>

However, research suggests that most eligible children were still not attending school [21], and many will have needed alternative childcare.

We found that the odds for non-household family close contact was relatively equal across all children's ages, which contrasts with previous research [7]. We suspect that the restrictions in place at the time of our survey explains this result. A longitudinal German study found that during COVID-19, the activities that children engaged in differed between ages [33]. However, these age differences disappeared when the guidance was more restrictive. That study also found that children commonly met elderly relatives (and friends) throughout the one-year study period, which supports our findings.

Table 4. Binary logistic regression comparing parent and child characteristics and associations with children’s lower well-being (n = 519).

Variable	Level	Unadjusted odds Ratio (95% CI)	P-value	Adjusted odds ratio (95% CI) †	P-value
Parent gender	Male	0.91 (0.74 to 1.11)	0.36	0.92 (0.74 to 1.15)	0.46
	Female	Reference		Reference	
Parent age	18–35 years	1.67** (1.27 to 2.19)	<0.001	1.92** (1.40 to 2.64)	<0.001
	36–45 years	1.11 (0.88 to 1.40)	0.38	1.25 (0.96 to 1.62)	0.09
	46 years ≥	Reference		Reference	
Region	East Midlands	1.27 (0.84 to 1.91)	0.26	1.21 (0.78 to 1.88)	0.39
	East of England	0.88 (0.60 to 1.29)	0.51	0.93 (0.61 to 1.39)	0.71
	North East	0.72 (0.44 to 1.18)	0.20	0.77 (0.46 to 1.30)	0.33
	North West	0.80 (0.56 to 1.15)	0.23	0.90 (0.61 to 1.33)	0.61
	South East	0.90 (0.64 to 1.26)	0.53	0.90 (0.62 to 1.29)	0.56
	South West	0.98 (0.64 to 1.48)	0.91	1.04 (0.67 to 1.63)	0.85
	West Midlands	0.79 (0.54 to 1.18)	0.25	0.75 (0.49 to 1.15)	0.19
	Yorkshire & the Humber	0.72 (0.48 to 1.09)	0.12	0.71 (0.46 to 1.11)	0.13
	London	Reference		Reference	
	Household income	≤ £34,999	1.12 (0.91 to 1.37)	0.29	1.08 (0.85 to 1.37)
£35,000 ≥		Reference		Reference	
Employment status ¹	Working	1.12 (0.85 to 1.48)	0.44	1.12 (0.82 to 1.52)	0.48
	Not working	Reference		Reference	
Parent Working from home ²	Yes	1.16 (0.92 to 1.47)	0.20	^^^	^^^
	No	Reference		Reference	
Education level	≤ A-level	0.92 (0.75 to 1.12)	0.39	0.92 (0.74 to 1.16)	0.50
	Degree ≥	Reference		Reference	
Marital status	Living alone	1.17 (0.90 to 1.53)	0.24	1.15 (0.87 to 1.53)	0.33
	Married/cohabiting	Reference		Reference	
Ethnicity	White	0.93 (0.69 to 1.26)	0.65	1.06 (0.76 to 1.48)	0.73
	BAME	Reference		Reference	
Key worker status	Both parents	1.70* (1.21 to 2.39)	0.002	1.71* (1.18 to 2.46)	0.004
	One parent	1.60** (1.29 to 1.98)	<0.001	1.51** (1.20 to 1.90)	<0.001
	No	Reference		Reference	
Child gender	Boy	1.20 (0.98 to 1.47)	0.07	1.22 (0.98 to 1.50)	0.07
	Girl	Reference		Reference	
Child school year	Early Years	0.99 (0.55 to 1.79)	0.98	0.71 (0.38 to 1.32)	0.28
	Key Stage 1	1.13 (0.73 to 1.75)	0.59	0.80 (0.50 to 1.29)	0.37
	Key Stage 2	0.97 (0.65 to 1.47)	0.90	0.71 (0.46 to 1.10)	0.13
	Key Stage 3	1.22 (0.79 to 1.87)	0.37	1.03 (0.66 to 1.61)	1.61
	Key Stage 4	1.36 (0.88 to 2.11)	0.17	1.15 (0.73 to 1.80)	0.55
	Years 12 & 13	Reference		Reference	
Child has special educational needs	Yes	4.24** (3.05 to 5.89)	<0.001	4.13** (2.90 to 5.87)	<0.001
	No	Reference		Reference	
Parent low well-being	Yes	6.77** (5.33 to 8.60)	<0.001	7.26** (5.62 to 9.38)	<0.001
	No	Reference		Reference	
Child vulnerable COVID-19	Yes	3.34** (2.40 to 4.65)	<0.001	3.06** (2.15 to 4.36)	<0.001
	No	Reference		Reference	
Household vulnerable COVID-19	Yes	2.01** (1.60 to 2.51)	<0.001	2.08** (1.64 to 2.64)	<0.001
	No	Reference		Reference	

(Continued)

Table 4. (Continued)

Variable	Level	Unadjusted odds Ratio (95% CI)	P-value	Adjusted odds ratio (95% CI) †	P-value
Someone over 70 years	Yes	2.69** (1.75 to 4.16)	<0.001	2.41** (1.51 to 3.83)	<0.001
	No	Reference		Reference	
COVID-19 behaviours followed by child and parent	Continuous (0 = followed no behaviours, 11 = followed all behaviours)	1.11** (1.07 to 1.14)	<0.001	1.11** (1.07 to 1.15)	<0.001
Access to outside space ³	Garden	0.89 (0.52 to 1.53)	0.67	1.10 (0.60 to 2.03)	0.76
	Other ³	1.19 (0.64 to 2.23)	0.58	1.36 (0.68 to 2.73)	0.38
	No	Reference		Reference	

* $p \leq .05$ and formatted bold.

** $p \leq .001$ and formatted bold.

Some results are rounded to 3 rather than 2 decimal places to distinguish between $p \leq .05$ and $p \leq .001$.

† When interpreting the predictor listed in the row, we controlled for the other variables listed here: participant gender, age, region, household income, employment status, education level, marital status, ethnicity, and the child's gender and school year.

^^^ Not included variable highly correlated with employment variable.

¹ Working includes students and volunteers.

² Question only offered to participants who reported working in a paid job (full-time, part-time, and self-employed) and not to participants who reported being a student, on furlough and a volunteer.

³ Participants that reported no access to a garden but had access to other outdoor spaces such as patio, terrace, and balcony.

Abbreviations: CI = confidence interval.

<https://doi.org/10.1371/journal.pone.0292344.t004>

There appeared to be a cluster of predictive variables that indicated that children with worse psychological well-being had higher odds of meeting up with non-household family members. Variables in this group included children or their parent having low well-being and children being worried about non-household family members. We interpret these findings as the close contact may have been used to try to improve children's well-being [34], although as we are unable to determine causality; it could be that children's well-being reduced because of meeting their non-household family members.

Children who had extra support before the school closures and had special educational needs also had higher odds of non-household family close contact. This suggests that worries about education also increased the odds of non-household close contact, which aligns with previous research [7].

Our results were less clear in terms of the perceived risk of COVID-19 and the impact on children's non-household family close contact. We did not find any associations between children's non-household family close contact and the lockdown statements that related to COVID-19. This finding is at odds with previous research [7]. In addition, children who were vulnerable to COVID-19 and lived with someone over 70 years old had higher odds of non-household family close contact. These findings are concerning, suggesting increased odds for contagion in these more vulnerable groups.

Children with a low well-being

Over a quarter (26%) of children reported on in our study had low well-being. A study in Switzerland conducted while schools were closed due to the COVID-19 pandemic found children's well-being and family functioning had reduced compared to before the pandemic, and the psychological impacts were greater for children at risk for neurodevelopmental impairments [35]. Children with special educational needs had four times higher odds of having a lower well-

Table 5. Binary logistic regression comparing statements about lockdown and associations with children's lower well-being (n = 519).

Statement	Level	Unadjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI) †	P-value
If child goes out, she/he is likely to catch coronavirus	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.63** (0.57 to 0.70)	<0.001	0.63** (0.57 to 0.70)	<0.001
If child goes out, she/he is likely to bring coronavirus back into our home	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.63** (0.58 to 0.70)	<0.001	0.63** (0.57 to 0.70)	<0.001
Child is keeping up with his/her schoolwork	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.43** (1.31 to 1.57)	<0.001	1.46** (1.33 to 1.60)	<0.001
I feel confident helping child with her/his schoolwork	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.34** (1.22 to 1.48)	<0.001	1.34** (1.21 to 1.48)	<0.001
I feel supported by child's school	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.26** (1.15 to 1.38)	<0.001	1.24** (1.12 to 1.37)	<0.001
I have access to all the resources that child needs to do her/his schoolwork	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.30** (1.18 to 1.43)	<0.001	1.31** (1.18 to 1.44)	<0.001
During lockdown, child has learned about important things she/he wouldn't normally learn at school	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.12* (1.01 to 1.24)	0.02	1.13* (1.02 to 1.25)	0.02
In the past 7 days, child has been bored	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.68** (0.62 to 0.75)	<0.001	0.68** (0.61 to 0.75)	<0.001
In the past 7 days, my household has had a regular structure to the day	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.23** (1.12 to 1.36)	<0.001	1.23** (1.11 to 1.36)	<0.001
In the past 7 days, child has kept in touch with her/his friends	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.15* (1.05 to 1.25)	0.01	1.67 (0.89 to 3.15)	0.11
Child is worried about coronavirus	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.60** (0.54 to 0.66)	<0.001	0.59** (0.53 to 0.65)	<0.001
In the past 7 days, child has felt upset about not seeing other family members who do not live with us	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.64** (0.59 to 0.70)	<0.001	0.63** (0.57 to 0.69)	<0.001
In the past 7 days, I have found it hard to keep up with work or other important commitments	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.56** (0.51 to 0.61)	<0.001	0.55** (0.49 to 0.60)	<0.001
In the past 7 days, people in my household have been getting along well	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	1.47** (1.33 to 1.63)	<0.001	1.46** (1.31 to 1.63)	<0.001
I am worried about the financial impact of lockdown measures	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.78** (0.71 to 0.85)	<0.001	0.77** (0.70 to 0.85)	<0.001
Before the school closures, child had extra support at school	5-point Likert-scale (1 = strongly agree, 5 = strongly disagree)	0.68** (0.63 to 0.74)	<0.001	0.69** (0.63 to 0.75)	<0.001

* $p \leq .05$ and formatted bold.

** $p \leq .001$ and formatted bold.

Some results are rounded to 3 rather than 2 decimal places to distinguish between $p \leq .05$ and $p \leq .001$.

† When interpreting the predictor listed in the row, we controlled for the other variables listed here: participant gender, age, region, household income, employment status, education level, marital status, ethnicity, and the child's gender and school year.

Abbreviations: CI = confidence interval.

<https://doi.org/10.1371/journal.pone.0292344.t005>

being compared to children without special educational needs. Previous research supports this finding [36]. In addition, a study suggests that children with special education needs are at risk for emotional, conduct, attention and peer relationship problems [37]. Therefore, the odds of adverse mental health problems could be increased in children with special educational needs due to the increased odds for challenging behaviour during lockdown. Parents who struggle to manage their children's behaviour are prone to using adverse parenting styles, and are at increased risk of family conflict and parental distress [38–40]. That said, 'special educational needs' covers a wide range of health and educational needs and research is needed to unpack what makes these children have higher odds of having a poor well-being; this result could be from educational worries and a lack of academic support for these children [35].

Table 6. Binary logistic regression comparing reasons for children leaving the home by children with low well-being (n = 519).

Number of times that child had left the home for each reason on a continuous scale starting at 0	Child higher well-being, n, (%)	Child lower well-being, n, (%)	Unadjusted odds ratio (95%, CI)	P-value	Adjusted odds ratio (95%, CI) †	P-value
To go to the shops for groceries, toiletries, or medicines	N = 1491, M = 0.53, SD = 1.03	N = 519, M = 0.83, SD = 1.24	1.25** (1.15 to 1.36)	<0.001	1.24** (1.13 to 1.35)	<0.001
To go to the shops for other items	N = 1491, M = 0.38, SD = 0.91	N = 519, M = 0.68, SD = 1.13	1.32** (1.20 to 1.45)	<0.001	1.31** (1.19 to 1.45)	<0.001
To provide help to someone else	N = 1491, M = 0.15, SD = 0.71	N = 519, M = 0.42, SD = 0.99	1.44** (1.27 to 1.64)	<0.001	1.37** (1.21 to 1.56)	<0.001
To meet friends	N = 1491, M = 0.44, SD = 1.51	N = 519, M = 0.64, SD = 1.20	1.14** (1.06 to 1.24)	<0.001	1.14* (1.05 to 1.24)	0.002
To meet family members who don't live with you	N = 1491, M = 0.42, SD = 0.88	N = 519, M = 0.59, SD = 0.95	1.22** (1.10 to 1.35)	<0.001	1.19** (1.07 to 1.33)	0.001
For a medical need (e.g., an outpatient appointment)	N = 1497, M = 0.04, SD = 0.25	N = 519, M = 0.24, SD = 0.60	3.75** (2.75 to 5.11)	<0.001	3.70** (2.64 to 5.18)	<0.001
To go to school	N = 1491, M = 0.62, SD = 1.48	N = 519, M = 0.77, SD = 1.51	1.07 (1.00 to 1.14)	0.05	1.06 (0.99 to 1.13)	0.12
For exercise	N = 1491, M = 3.27, SD = 2.99	N = 519, M = 2.64, SD = 2.53	0.92** (0.89 to 0.96)	<0.001	0.93** (0.89 to 0.97)	<0.001
For another reason	N = 1491, M = 0.15, SD = 0.76	N = 519, M = 0.33, SD = 0.97	1.25** (1.12 to 1.40)	<0.001	1.22** (1.08 to 1.37)	0.001

* $p \leq .05$ and formatted bold.

** $p \leq .001$ and formatted bold.

Some results are rounded to 3 rather than 2 decimal places to distinguish between $p \leq .05$ and $p \leq .001$

† When interpreting the predictor listed in the row, we controlled for the other variables listed here: participant gender, age, region, household income, employment status, education level, marital status, ethnicity, and the child's gender and school year.

Abbreviations: N = number; M = mean; SD = standard deviation; % = percentage; CI = confidence interval.

<https://doi.org/10.1371/journal.pone.0292344.t006>

We also observed children had higher odds for low well-being with factors that related to the home environment: parents who reported that their child had lower well-being also tended to report that they were bored or upset about not seeing family members, and that people in the household had not been getting along, or there was no structure to the day. Parents also had higher odds of being worried about the financial impact of lockdown or unable to keep up with work and other commitments. Similar factors were identified in a study conducted during the COVID-19 pandemic that found individuals with poor sleep quality, increased distress due to financial circumstances, dependents, and or who were not adjusting to lockdown had higher odds of experiencing depression [41]. In addition, there is research showing the relationship between parent low well-being and child poor mental health outcomes [5,38,42]. We found that children were at seven times higher odds of lower well-being when the parent had low well-being. Our findings indicate that not only is parental well-being associated with child well-being but there also appears to be a link between parental distress due to home circumstances, such as financial worries.

Factors related to vulnerability to COVID-19 were also associated with children having lower well-being. These findings mirror research showing that factors associated with poor

well-being in children include being worried about a grandparent's vulnerability to COVID-19, infecting their grandparents [15,16] and being vulnerable to COVID-19 themselves [43,44]. Children also had higher odds of a lower well-being if one of their parents was a key worker. Keyworkers commonly interacted with many people daily, which increased their risk of COVID-19 [45]. Families that adopted more protective behaviours because of the risk of COVID-19 also had higher odds of having a child with lower well-being; it is possible that increased levels of protective behaviours reflected a higher general sense of worry about the pandemic within the household.

More positively, children who had a higher well-being had higher odds of having parents who had confidence in home-schooling and who perceived that children were keeping up with their schooling. Research has shown that parental self-efficacy can improve children's well-being [46]. It is possible that this explains our results perhaps by reducing tension within the home about schoolwork. We did not find any associations with parental education, income, or employment status in contrast to previous research [6,13,21,47] although we did note that younger parents had higher odds of reporting low well-being for their children than older parents. Younger adults in general experienced higher levels of stress and anxiety during the pandemic [41] because of more challenging working and living conditions, something which might account for our findings.

Exercise was also a protective factor; children had higher odds of having higher well-being the more times they had left the home to exercise. This finding aligns with previous research that shows the benefits of exercise on physical and mental health [41,48–51]. We were surprised that access to outside space had no associations with either of our outcomes, although having access to outside space does not necessarily mean children use the space. To counter-balance the increased stress on families as a result of the pandemic, exercise should be promoted as a way to maintain well-being and parents should be taught how to increase their self-efficacy in managing difficult situations.

Limitations

We used a cross-sectional study design and the findings are based on a single point in time. Cross-sectional designs are common in health research as data can be gathered quickly so that the data can be used to respond rapidly to the health threat [52]. We used purposive sampling to meet pre-determined quotas for parent and children characteristics to broadly represent parents and children in England. The use of quota rather than random sampling means that it is not possible to quantify the nature of any bias in the prevalence estimates that we have made. However, we have no reason to believe that the associations between the different variables that we measured would be affected by any theoretical bias [53]. Data were collected from self-reports, which can lead to self-report bias [54]. However, self-report data is a valid study design method [55,56]. The RCADS is designed for children aged between 8 and 18 although parents reported on children from four years old [57]. However, we suggest this has minimal impact on our findings, RCADS has been found to be a reliable and valid measure in children as young as three years old [58].

Conclusions

During the COVID-19 pandemic we found that although children reduced their close contact, 15% had non-adherent physical contact with non-household family members. The reasons for close contact were largely related to a need for childcare, although factors relating to COVID-19, children's well-being and education were also important. Children who had special educational needs or had a parent with low well-being had higher odds of having a lower well-being

themselves. Exercise and parent self-efficacy with home-schooling may help maintain children's mental and physical health.

Supporting information

S1 Text. Full survey material. The information can be downloaded at: DOI [10.18742/21757232](https://doi.org/10.18742/21757232).
(DOCX)

S1 Appendix.
(DOCX)

Author Contributions

Conceptualization: Lisa Woodland, Louise E. Smith, Rebecca K. Webster, Richard Amlôt, G. James Rubin.

Data curation: Lisa Woodland.

Funding acquisition: Rebecca K. Webster, Richard Amlôt.

Investigation: Lisa Woodland.

Methodology: Lisa Woodland, Louise E. Smith, Samantha K. Brooks, Rebecca K. Webster, Richard Amlôt, Antonia Rubin, G. James Rubin.

Project administration: Lisa Woodland.

Resources: G. James Rubin.

Supervision: Rebecca K. Webster, Richard Amlôt, G. James Rubin.

Visualization: Lisa Woodland.

Writing – original draft: Lisa Woodland.

Writing – review & editing: Louise E. Smith, Samantha K. Brooks, Rebecca K. Webster, Richard Amlôt, Antonia Rubin, G. James Rubin.

References

1. HM Government Prime Minister's statement on coronavirus (COVID-19): 23 March 2020. <https://www.gov.uk/government/speeches/pm-address-to-the-nation-on-coronavirus-23-march-2020> (accessed 11 June 2020).
2. HM Government Children of critical workers and vulnerable children who can access schools or educational settings. <https://www.gov.uk/government/publications/coronavirus-covid-19-maintaining-educational-provision/guidance-for-schools-colleges-and-local-authorities-on-maintaining-educational-provision> (accessed 16 March 2021).
3. HM Government Prime Minister's statement on coronavirus (COVID-19): 11 May 2020. <https://www.gov.uk/government/speeches/pm-statement-on-coronavirus-11-may-2020> (accessed 22 March 2022).
4. HM Government, PM: Six people can meet outside under new measures to ease lockdown. 2020.
5. Viner R.; Russell S.; Saullé R.; Croker H.; Stansfield C.; Packer J.; Nicholls D.; Goddings A.-L.; Bonell C.; Hudson L.; Hope S.; Ward J.; Schwalbe N.; Morgan A.; Minozzi S., School Closures During Social Lockdown and Mental Health, Health Behaviors, and Well-being Among Children and Adolescents During the First COVID-19 Wave. *JAMA Pediatrics* 2022.
6. Woodland L.; Hodson A.; Webster R. K.; Amlôt R.; Smith L. E.; Rubin G. J., A qualitative study about how families coped with managing their well-being, children's physical activity and education during the COVID-19 school closures in England. *PLOS ONE* 2022, 17 (12), e0279355. <https://doi.org/10.1371/journal.pone.0279355> PMID: 36548349

7. Brooks S. K.; Smith L. E.; Webster R. K.; Weston D.; Woodland L.; Hall I.; Rubin G. J., The impact of unplanned school closure on children's social contact: rapid evidence review. *Euro Surveill* 2020, 25 (13). <https://doi.org/10.2807/1560-7917.ES.2020.25.13.2000188> PMID: [32265006](https://pubmed.ncbi.nlm.nih.gov/32265006/)
8. Mizumoto K.; Yamamoto T.; Nishiura H., Contact behaviour of children and parental employment behaviour during school closures against the pandemic influenza A (H1N1-2009) in Japan. *Journal of International Medical Research* 2013, 41 (3), 716–724. <https://doi.org/10.1177/0300060513478061> PMID: [23613502](https://pubmed.ncbi.nlm.nih.gov/23613502/)
9. DiMatteo M. R., The role of effective communication with children and their families in fostering adherence to pediatric regimens. *Patient Education and Counseling* 2004, 55 (3), 339–344. <https://doi.org/10.1016/j.pec.2003.04.003> PMID: [15582339](https://pubmed.ncbi.nlm.nih.gov/15582339/)
10. Kunin-Batson A. S.; Seburg E. M.; Crain A. L.; Jaka M. M.; Langer S. L.; Levy R. L.; Sherwood N. E., Household factors, family behavior patterns, and adherence to dietary and physical activity guidelines among children at risk for obesity. *Journal of nutrition education and behavior* 2015, 47 (3), 206–215. e1. <https://doi.org/10.1016/j.jneb.2015.01.002> PMID: [25748634](https://pubmed.ncbi.nlm.nih.gov/25748634/)
11. Smith L. E.; D'Antoni D.; Jain V.; Pearce J. M.; Weinman J.; Rubin G. J., A systematic review of factors affecting intended and actual adherence with antiviral medication as treatment or prophylaxis in seasonal and pandemic flu. *Influenza and other respiratory viruses* 2016, 10 (6), 462–478. <https://doi.org/10.1111/irv.12406> PMID: [27397480](https://pubmed.ncbi.nlm.nih.gov/27397480/)
12. Gentili D.; Bardin A.; Ros E.; Piovesan C.; Ramigni M.; Dalmanzio M.; Dettori M.; Filia A.; Cinquetti S., Impact of Communication Measures Implemented During a School Tuberculosis Outbreak on Risk Perception among Parents and School Staff, Italy, 2019. *International Journal of Environmental Research and Public Health* 2020, 17 (3), 911. <https://doi.org/10.3390/ijerph17030911> PMID: [32024183](https://pubmed.ncbi.nlm.nih.gov/32024183/)
13. Woodland L.; Hodson A.; Webster R. K.; Amlôt R.; Smith L. E.; Rubin G. J., A Qualitative Study Evaluating the Factors Affecting Families' Adherence to the First COVID-19 Lockdown in England Using the COM-B Model and TDF. *International Journal of Environmental Research and Public Health* 2022, 19 (12), 7305. <https://doi.org/10.3390/ijerph19127305> PMID: [35742548](https://pubmed.ncbi.nlm.nih.gov/35742548/)
14. HM Government Sixteenth SAGE meeting on Wuhan Coronavirus (Covid-19), 16th March 2020; 2020.
15. Sarkadi A.; Sahlin Torp L.; Pérez-Aronsson A.; Warner G., Children's expressions of worry during the COVID-19 pandemic in Sweden. *Journal of Pediatric Psychology* 2021, 46 (8), 939–949. <https://doi.org/10.1093/jpepsy/jsab060> PMID: [34383921](https://pubmed.ncbi.nlm.nih.gov/34383921/)
16. Idoiaga N.; Berasategi N.; Eiguren A.; Picaza M., Exploring children's social and emotional representations of the Covid-19 pandemic. *Frontiers in Psychology* 2020, 11, 1952. <https://doi.org/10.3389/fpsyg.2020.01952> PMID: [32922334](https://pubmed.ncbi.nlm.nih.gov/32922334/)
17. Denford S.; Morton K. S.; Lambert H.; Zhang J.; Smith L. E.; Rubin G. J.; Cai S.; Zhang T.; Robin C.; Lasseter G.; Hickman M.; Oliver I.; Yardley L., Understanding patterns of adherence to COVID-19 mitigation measures: a qualitative interview study. *Journal of Public Health* 2021, 43 (3), 508–516. <https://doi.org/10.1093/pubmed/fdab005> PMID: [33559682](https://pubmed.ncbi.nlm.nih.gov/33559682/)
18. Lasseter G.; Compston P.; Robin C.; Lambert H.; Hickman M.; Denford S.; Reynolds R.; Zhang J.; Cai S.; Zhang T.; Smith L. E.; Rubin J.; Yardley L.; Amlôt R.; Oliver I., Exploring the impact of shielding advice on the health and wellbeing of individuals identified as extremely vulnerable and advised to shield in Southwest England amid the COVID-19 pandemic: A mixed-methods evaluation. Cold Spring Harbor Laboratory: 2022.
19. BMG Research BMG About Us. <https://www.bmgresearch.co.uk/bmg/about-us/> (accessed 1 September 2022).
20. Smith L. E.; Woodland L.; Amlôt R.; Rubin A.; Rubin G. J., A cross-sectional survey of parental perceptions of COVID-19 related hygiene measures within schools and adherence to social distancing in journeys to and from school. *BMJ Paediatrics Open* 2020, 4 (1).
21. Woodland L.; Smith L. E.; Webster R. K.; Amlôt R.; Rubin A.; Wessely S.; Rubin G. J., Why did some parents not send their children back to school following school closures during the COVID-19 pandemic: a cross-sectional survey. *BMJ Paediatrics Open* 2021, 5 (1), e001014. <https://doi.org/10.1136/bmjpo-2020-001014> PMID: [34611551](https://pubmed.ncbi.nlm.nih.gov/34611551/)
22. Zhang C.; Conrad F. In *Speeding in web surveys: The tendency to answer very fast and its association with straightlining*, Survey research methods, 2014; pp 127–135.
23. Callegaro M.; DiSogra C., Computing Response Metrics for Online Panels. *Public Opinion Quarterly* 2008, 72 (5), 1008–1032.
24. HM Government Schools, pupils and their characteristics: Academic Year 2019/20. <https://explore-education-statistics.service.gov.uk/find-statistics/school-pupils-and-their-characteristics> (accessed 25 June 2020).
25. HM Government [Withdrawn] Guidance for contacts of people with confirmed coronavirus (COVID-19) infection who do not live with the person. <https://www.gov.uk/government/publications/guidance-for->

- [contacts-of-people-with-possible-or-confirmed-coronavirus-covid-19-infection-who-do-not-live-with-the-person/guidance-for-contacts-of-people-with-possible-or-confirmed-coronavirus-covid-19-infection-who-do-not-live-with-the-person](#) (accessed 16 August 2023).
26. Chorpita B. F.; Yim L.; Moffitt C.; Umemoto L. A.; Francis S. E., Assessment of symptoms of DSM-IV anxiety and depression in children: a revised child anxiety and depression scale. *Behaviour Research and Therapy* 2000, 38 (8), 835–855. [https://doi.org/10.1016/s0005-7967\(99\)00130-8](https://doi.org/10.1016/s0005-7967(99)00130-8) PMID: 10937431
 27. Kroenke K.; Spitzer R. L.; Williams J. B. W.; Lowe B., An Ultra-Brief Screening Scale for Anxiety and Depression: The PHQ-4. *Psychosomatics* 2009, 50 (6), 613–621. <https://doi.org/10.1176/appi.psy.50.6.613> PMID: 19996233
 28. Piqueras J. A.; Martín-Vivar M.; Sandin B.; San Luis C.; Pineda D., The Revised Child Anxiety and Depression Scale: A systematic review and reliability generalization meta-analysis. *Journal of affective disorders* 2017, 218, 153–169. <https://doi.org/10.1016/j.jad.2017.04.022> PMID: 28475961
 29. Wicke F. S.; Krakau L.; Löwe B.; Beutel M. E.; Brähler E., Update of the standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *Journal of Affective Disorders* 2022, 312, 310–314. <https://doi.org/10.1016/j.jad.2022.06.054> PMID: 35760191
 30. IBM Corp IBM SPSS Statistics for Windows, 26.0 Armonk, NY.
 31. IBM Corp IBM SPSS Statistics for Windows, 28.0 Armonk, NY.
 32. VanderWeele T. J., Principles of confounder selection. *European journal of epidemiology* 2019, 34, 211–219. <https://doi.org/10.1007/s10654-019-00494-6> PMID: 30840181
 33. Paulsen M.; Zychlinsky Scharff A.; De Cassan K.; Sugianto R. I.; Blume C.; Blume H.; Christmann M.; Hauß C.; Illig T.; Jonczyk R.; Klopp N.; Kopfnagel V.; Lichtinghagen R.; Lucas H.; Luhr A.; Mutschler F.; Pietschmann T.; Pott P.-C.; Prokein J.; Schaefer P.; Stahl F.; Stanislawski N.; Von Der Born J.; Schmidt B. M. W.; Heiden S.; Stiesch M.; Memaran N.; Melk A., Children and Adolescents' Behavioral Patterns in Response to Escalating COVID-19 Restriction Reveal Sex and Age Differences. *Journal of Adolescent Health* 2022, 70 (3), 378–386. <https://doi.org/10.1016/j.jadohealth.2021.11.021> PMID: 34972613
 34. Morina N.; Kip A.; Hoppen T. H.; Priebe S.; Meyer T., Potential impact of physical distancing on physical and mental health: a rapid narrative umbrella review of meta-analyses on the link between social connection and health. *BMJ Open* 2021, 11 (3), e042335. <https://doi.org/10.1136/bmjopen-2020-042335> PMID: 33737424
 35. Ehrler M.; Werninger I.; Schnider B.; Eichelberger D. A.; Naef N.; Disselhoff V.; Kretschmar O.; Haggmann C. F.; Latal B.; Wehrle F. M., Impact of the COVID-19 pandemic on children with and without risk for neurodevelopmental impairments. *Acta Paediatrica* 2021, 110 (4), 1281–1288. <https://doi.org/10.1111/apa.15775> PMID: 33486835
 36. Essex M. J.; Kraemer H. C.; Armstrong J. M.; Boyce W. T.; Goldsmith H. H.; Klein M. H.; Woodward H.; Kupfer D. J., Exploring Risk Factors for the Emergence of Children's Mental Health Problems. *Archives of General Psychiatry* 2006, 63 (11), 1246. <https://doi.org/10.1001/archpsyc.63.11.1246> PMID: 17088505
 37. Deighton J.; Lereya S. T.; Casey P.; Patalay P.; Humphrey N.; Wolpert M., Prevalence of mental health problems in schools: poverty and other risk factors among 28 000 adolescents in England. *British Journal of Psychiatry* 2019, 215 (3), 565–567. <https://doi.org/10.1192/bjp.2019.19> PMID: 30698513
 38. Wille N.; Bettge S.; Ravens-Sieberer U., Risk and protective factors for children's and adolescents' mental health: results of the BELLA study. *European Child & Adolescent Psychiatry* 2008, 17 (S1), 133–147. <https://doi.org/10.1007/s00787-008-1015-y> PMID: 19132313
 39. Prime H.; Wade M.; Browne D. T., Risk and resilience in family well-being during the COVID-19 pandemic. *American Psychologist* 2020, 75 (5), 631. <https://doi.org/10.1037/amp0000660> PMID: 32437181
 40. Spinelli M.; Lionetti F.; Pastore M.; Fasolo M., Parents' stress and children's psychological problems in families facing the COVID-19 outbreak in Italy. *Frontiers in psychology* 2020, 11, 1713. <https://doi.org/10.3389/fpsyg.2020.01713> PMID: 32719646
 41. Varma P.; Junge M.; Meaklim H.; Jackson M. L., Younger people are more vulnerable to stress, anxiety and depression during COVID-19 pandemic: A global cross-sectional survey. *Progress in Neuro-Psychopharmacology and Biological Psychiatry* 2021, 109, 110236. <https://doi.org/10.1016/j.pnpbpb.2020.110236> PMID: 33373680
 42. Davis E.; Sawyer M. G.; Lo S. K.; Priest N.; Wake M., Socioeconomic risk factors for mental health problems in 4–5-year-old children: Australian population study. *Academic Pediatrics* 2010, 10 (1), 41–47. <https://doi.org/10.1016/j.acap.2009.08.007> PMID: 20129480
 43. Tunçgenç B.; Newson M.; Sulik J.; Zhao Y.; Dezechache G.; Deroy O.; Zein M. E., Social alignment matters: Following pandemic guidelines is associated with better wellbeing. *BMC Public Health* 2022, 22 (1).

44. Saurabh K.; Ranjan S., Compliance and Psychological Impact of Quarantine in Children and Adolescents due to Covid-19 Pandemic. *The Indian Journal of Pediatrics* 2020, 87 (7), 532–536. <https://doi.org/10.1007/s12098-020-03347-3> PMID: 32472347
45. Environmental Modelling Group (EMG) Transmission Group *COVID-19 Risk by Occupation and Workplace*; HM Government: 11 February, 2021.
46. Albanese A. M.; Russo G. R.; Geller P. A., The role of parental self-efficacy in parent and child well-being: A systematic review of associated outcomes. *Child: care, health and development* 2019, 45 (3), 333–363. <https://doi.org/10.1111/cch.12661> PMID: 30870584
47. Reiss F., Socioeconomic inequalities and mental health problems in children and adolescents: A systematic review. *Social Science & Medicine* 2013, 90, 24–31.
48. Biddle S. J. H.; Ciaccioni S.; Thomas G.; Vergeer I., Physical activity and mental health in children and adolescents: An updated review of reviews and an analysis of causality. *Psychology of Sport and Exercise* 2019, 42, 146–155.
49. Ahn S.; Fedewa A. L., A Meta-analysis of the Relationship Between Children's Physical Activity and Mental Health. *Journal of Pediatric Psychology* 2011, 36 (4), 385–397. <https://doi.org/10.1093/jpepsy/jsq107> PMID: 21227908
50. Eddolls W. T. B.; McNarry M. A.; Lester L.; Winn C. O. N.; Stratton G.; Mackintosh K. A., The association between physical activity, fitness and body mass index on mental well-being and quality of life in adolescents. *Quality of Life Research* 2018, 27 (9), 2313–2320. <https://doi.org/10.1007/s11136-018-1915-3> PMID: 29948603
51. Benzing V.; Gaillard P.; Scheidegger D.; Dössegger A.; Nigg C. R.; Schmidt M., COVID-19: Physical Activity and Quality of Life in a Sample of Swiss School Children during and after the First Stay-at-Home. *International Journal of Environmental Research and Public Health* 2022, 19 (4), 2231. <https://doi.org/10.3390/ijerph19042231> PMID: 35206418
52. Wang X.; Cheng Z., Cross-sectional studies: strengths, weaknesses, and recommendations. *Chest* 2020, 158 (1), S65–S71. <https://doi.org/10.1016/j.chest.2020.03.012> PMID: 32658654
53. Kohler U Possible Uses of Nonprobability Sampling for the Social Sciences. *Survey Methods: Insights from the Field*. <https://surveyinsights.org/?p=10981> (accessed 29 July 2020).
54. Epstein W. M., Response bias in opinion polls and American social welfare. *The Social Science Journal* 2006, 43 (1), 99–110.
55. Kormos C.; Gifford R., The validity of self-report measures of proenvironmental behavior: A meta-analytic review. *Journal of Environmental Psychology* 2014, 40, 359–371.
56. Craig K.; Hale D.; Grainger C.; Stewart M. E., Evaluating metacognitive self-reports: systematic reviews of the value of self-report in metacognitive research. *Metacognition and Learning* 2020, 15, 155–213.
57. Ebesutani C.; Chorpita B. F.; Higa-Mcmillan C. K.; Nakamura B. J.; Regan J.; Lynch R. E., A Psychometric Analysis of the Revised Child Anxiety and Depression Scales—Parent Version in a School Sample. *Journal of Abnormal Child Psychology* 2011, 39 (2), 173–185. <https://doi.org/10.1007/s10802-010-9460-8> PMID: 20878460
58. Ebesutani C.; Tottenham N.; Chorpita B., The Revised Child Anxiety and Depression Scale—Parent Version: Extended Applicability and Validity for Use with Younger Youth and Children with Histories of Early-Life Caregiver Neglect. *Journal of Psychopathology and Behavioral Assessment* 2015, 37 (4), 705–718. <https://doi.org/10.1007/s10862-015-9494-x> PMID: 30364688