BMJ Open

How is the COVID-19 lockdown impacting the mental health of parents and their school children? A cross-sectional online survey

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-043397
Article Type:	Original research
Date Submitted by the Author:	01-Aug-2020
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Keywords:	PUBLIC HEALTH, MENTAL HEALTH, PREVENTIVE MEDICINE

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How is the COVID-19 lockdown impacting the mental health of parents and their school children?

A cross-sectional online survey

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Word count: 3866

ABSTRACT

Objective
Investigate the impact of the COVID-19 lockdown on feelings of loneliness and social isolation in parents of school-age children

Design
Cross sectional online survey of parents of primary and secondary school-age children

Setting
1214 Community-dwelling adults in the United Kingdom

Participants
1214 parents of school-age children in the United Kingdom

Methods
An online survey explored the impact of lockdown on the mental health of parents with school-age children, and in particular about feelings of social isolation and loneliness. Associations between the UCLA three-item Loneliness Scale (UCLATILS), the Direct Measure of Loneliness (DMOL) and the characteristics of the study participants were assessed using ordinal logistic regression models

Main outcome measures
Self-reported measures of social isolation and loneliness using UCLATILS and DMOL.

Results
Half of respondents felt they lacked companionship, 45% had feelings of being left out, 58% felt isolated and 46% felt lonely. The factors that were associated with higher levels of loneliness on UCLATILS were female gender, parenting a child with special needs, lack of a dedicated space for distance learning, disruption of sleep patterns and low levels of physical activity during the lockdown. Factors associated with a higher DMOL were female gender, single-parenting, parenting a child with special needs, unemployment, low physical activity, lack of a dedicated study-space and disruption of sleep patterns during the lockdown.

Conclusions
The COVID-19 lockdown has increased feelings of social isolation and loneliness among parents with school-age children. Two modifiable health seeking lifestyle behaviours such as increased levels of physical activity and the maintenance of good sleep hygiene practices during the lockdown were identified as key factors in reducing feelings of social isolation and loneliness.

Article summary

- We surveyed 1214 parents of school-age children to assess the impact of the lockdown measures on feelings of social isolation and loneliness
- We collected data on mental health, physical activity levels and other lifestyle factors in the first 100 days of the lockdown
- School closures have a significant impact on the mental health of parents of school-age children, and this should be taken into account when considering future COVID-19 risk mitigation strategies
- The adoption of health-seeking self-care behaviours such as increased levels of physical activity and good sleep hygiene practices can help reduce the risk of social isolation and loneliness

INTRODUCTION

The COVID-19 pandemic has affected educational systems, leading to the near-total closures of educational institutions in the United Kingdom. As of 6 May 2020, schools were suspended in 177 countries affecting over 1.3 billion learners worldwide (1), and in many cases closures have resulted in the universal cancellation of examinations (2, 3). UNICEF estimated that almost four months of education will be lost as a result of the lockdown (4). School closures have far-reaching economic and societal consequences, including the disruption of routine everyday behaviours and routines. In the UK, over two million workers have already lost their jobs (5, 6), and although the long-term impact of the pandemic on education is not yet clear, the pre-existing attainment gap between the poorest and richest children (7) may widen significantly as a result of COVID-19 (4, 8, 9). Children and young people make up 21% of the population of England (10), and by the time they return to school after the summer break, some would have been out of education for nearly six months.

Lockdown measures significantly limit social interactions, opportunities for social intercourse or in being able to receive the social support needed to promote mental wellbeing (11). The temporary closure of schools also means that children miss out on vital social skills and physical activity which may cause further detriment to their mental health and the quality of their social interaction with their parents and other members of the household (12). Loss of routine social contact could also lead to different patterns of social response (13, 14) whilst increasing feelings of social isolation and loneliness (15-17). There is growing concern over the impact of school closures on the mental health and wellbeing of parents and school-aged children (18-20), and in particular about feelings of social isolation and loneliness.

The impact of loneliness on public mental health is well characterised (21), and include depression (22, 23), anxiety (24) and suicide (25, 26), and is linked with cardiovascular conditions (27, 28) and cancer (29). Prolonged periods of loneliness and social isolation are also associated with future mental health problems up to 9 years later (30), and the strongest association was with depression (31) and stress (32). Although acknowledged to be different concepts, social isolation and loneliness may affect

people of all ages (33), and the terms are used interchangeably such that they are often considered together (34). There have been numerous attempts in the literature to identify predictors of loneliness (30, 35, 36), but this subjective phenomenon remains difficult to measure, and its prevalence is thought to be significantly under-represented. Known predictors of loneliness include lining alone, living in rented accommodation, household size, education level, self-reported health measures and, paradoxically, living in population-dense areas.

The measurement of social isolation and loneliness is challenging as it is largely subjective and qualitative in nature (37). The UK Office for National Statistics (ONS) recommends the use of the UCLA three-item loneliness scale (UCLATILS) as an indirect measure for loneliness, and a fourth Direct Measure of Loneliness (DMOL) question (38). ONS also recommends attempting to harmonise these indicators across the UK Government Statistical Service. The recency of the recommendations may be a reason behind the lack of standardised and retrospective data on loneliness in the UK. Successful interventions aimed at tackling social isolation and loneliness include leveraging existing community assets such as parks and green spaces, befriending schemes, skill development strategies, psychological therapies (39-42). The UK government published its first Loneliness Strategy in October 2018, signalling the first important step in tackling this rising problem of society. Reports have already documented loneliness in the elderly as a result of the COVID-19 lockdown (43), but research regarding this aspect of mental health on parents with school-age children during the pandemic is scarce in the first 100 days after the lockdown was initiated resulting in school closures in the UK.

Study objectives

The aim of this study was to explore how the lockdown is affecting the mental health of parents of school-age children, and in particular to assess the impact of an extended period of school closures on feelings of social isolation & loneliness.

METHODS

Study design

We conducted a cross-sectional online survey of adult parents and legal guardians of children who were attending primary or secondary education in the UK.

The link to the electronic survey was published and available on the Imperial College Qualtrics platform for a period of 9 weeks (May to July 2020). The survey was open and could be accessed by anyone with a link. Using snowball sampling, potentially eligible participants received an invitation email from the head teacher of schools where study information was disseminated including the Participant Information Sheet (PIS) and link to the survey. The researchers' personal and professional networks were also mobilized to respond and further disseminate the eSurvey among eligible participants. The PIS included information regarding the study's aims, the protection of participants' personal data, their right to withdraw from the study at any time, which data were stored, where and for how long, who the investigator was, the purpose of

the study and survey length. Participants were informed that this was a voluntary survey without any monetary incentives but offering the possibility to access the results and underlying the potential collective benefits of taking parts in terms of knowledge and policies. The data collected were stored on the Imperial secure database and only the team researchers could access the eSurvey results.

The survey comprised a total of 51 questions displayed on one page and was accessible using a personal computer or smartphone. Questions regarding demographic characteristics of the users included information on gender, age, educational level, number of people living in the household, first part of postal code and employment status. Participants could review their answers before submitting them. All data collected through the survey were anonymised and not personally identifiable. The online survey technical functionality was tested before being published. The first question asked participants to confirm their consent to participate in the eSurvey.

Experiences and perceptions related to the impact of the lockdown on the mental health of parents and other members of their household were evaluated through a number of questions concerning self-reported or perceived levels of depression, stress, feeling of loneliness, social isolation and boredom. Loneliness was measured using the validated UCLATILS with responses never/hardly ever, some of the time, and often (44). The questions were scored 1 to 3, then totalled to a score ranging from 3 to 9. Loneliness was subsequently categorized as follows: no loneliness (score =1), moderate loneliness (score = 2 to 3), and severe loneliness (score = 4 to 5). An additional one item DMOL (45) was also used as recommended by the Office of National Statistics. Questions concerning users' experiences were scored on a 1-5 Likert scale. Respondents were able to refrain from providing an answer by selecting 'no opinion'.

The survey included eleven additional questions to explore perceptions of feelings of social isolation pre- and post-school closures. Perceptions on distance learning were explored through questions related to whether or not their child received regular homework, live or online lessons, had access to technology (personal computer, tablet or phone), time spent studying, and whether the child had access to a dedicated space to study. Perceptions on the impact of school closures on the lifestyle behaviours of respondents and their school children were recorded by asking questions relating to pre- and post-lockdown self-reported measures of physical activity levels of both parents and children, the children's sleeping patterns and how children spent their leisure time. The quality of the survey was assessed by completing the Checklist for Reporting Results of Internet E-Surveys (CHERRIES).

Statistical analysis

Analyses were conducted separately for the UCLATILS and DMOL. Parent and child characteristics were described using frequencies and percentages. Pearson's chi-square test was used to identify differences of statistical significance. Associations between the UCLATILS, DMOL and the characteristics of the study participants were assessed using ordinal logistic regression models. The factors that were significant in the univariable models (p-value <0.05) were considered in the multivariable analyses. All analyses were performed using Stata 15 statistical software (StataCorp).

Ethics
The study was given ethical approval by Imperial College Research Ethics Committee (ICREC # 20IC5978). Participants consented to take part in the survey.

Public involvement
The study protocol and online survey were developed in collaboration with the Governing Board of Brackenbury Primary School in the London Borough of Hammersmith & Fulham.

RESULTS

Demographic profile of respondents
The electronic survey captured responses from 1214 respondents from across England **(Table 1).** More than half (53.1%) were aged 40-49 years, whereas 2.5%, 29.2%, 14.4% and 0.9% were in the second, third, fifth or sixth decade of age respectively. Eighty seven percent of respondents were female, and 80.5% identified as white ethnic background. Sixty six percent were educated to university degree, 70.9% were in full or part-time employment and 87.1% had a partner that was employed. A fifth (20.8%) had one child, 53.5% had two children, and 25.8% had three or more children. Only 3.8% were a single parent family, whereas 75.3% of respondents were living in households consisting of 4 or more people.

School and children characteristics
Nine out of ten (89.5%) children attended a public school. More than half (54.1%) of respondents had a child receiving primary education, 22.3% in secondary school and 23.6% had more than one child, one attending either primary or secondary schools. Eleven percent of respondents had a child with special needs. Sixty eight percent indicated that their child had access to a dedicated space where they can learn or study at home. The vast majority (97.9%) of children had access to a personal computer, laptop, tablet or smartphone, of whom 54.0% had their own devices and 43.9% did not have their own but could access devices belonging to other members of their household and two percent did not have access to any technology. Distance learning was accessed by 90.7% of children, but only 47.7% of respondents reported their child was receiving live or online lessons. Only 9.5% of children received private tuition. The time spent on distance learning ranged between 0-8 hours per day, with 36.8% studying for less than 2 hours, 30.7% studying between 2-4 hours and 32.5% studding more than 4 hours.

Mental health and physical wellbeing
The vast majority of respondents felt their children were experiencing medium to high levels of boredom (93.8%) and medium or high levels of stress (82.3%) during the lockdown compared to before school closures. Almost half of the participants (48.1%) have reported a shift in the sleeping pattern of children by staying up until much later in the evening during the lockdown. Only 37.2% of respondents reported that the sleeping patterns of their children did not change during the lockdown. Forty-five percent reported that their levels of physical activity were low during the lockdown. Seventy percent of respondents felt that school closures also reduced the physical activity of their child.

Table 1: Respondent characteristics

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
PARENT CHARACTERISTICS																
Age group									0.05							0.004
20-29	30	(100.0)	6	(20.0)	10	(33.3)	14	(46.7)		9	(30.0)	13	(43.3)	8	(26.7)	
30-39	354	(100.0)	122	(34.5)	85	(24.0)	147	(41.5)		166	(47.6)	127	(36.4)	56	(16.0)	
40-49	643	(100.0)	202	(31.4)	184	(28.6)	257	(40.0)		346	(54.3)	219	(34.4)	72	(11.3)	
50-59	174	(100.0)	73	(42.0)	52	(29.9)	49	(28.2)		109	(63.0)	46	(26.6)	18	(10.4)	
60+	11	(100.0)	4	(36.4)	3	(27.3)	4	(36.4)		7	(63.6)	3	(27.3)	1	(9.1)	
Gender									<0.001							0.002
Male	149	(100.0)	75	(50.3)	31	(20.8)	43	(28.9)		99	(66.4)	39	(26.2)	11	(7.4)	
Female	1062	(100.0)	331	(31.2)	303	(28.5)	428	(40.3)		537	(51.1)	369	(35.1)	144	(13.7)	
Ethnicity									0.23							0.42
White	962	(100.0)	322	(33.5)	269	(28.0)	371	(38.6)		512	(53.7)	322	(33.8)	120	(12.6)	
Black	25	(100.0)	7	(28.0)	5	(20.0)	13	(52.0)		11	(45.8)	8	(33.3)	5	(20.8)	
Asian	101	(100.0)	27	(26.7)	25	(24.8)	49	(48.5)		43	(43.4)	39	(39.4)	17	(17.2)	
Mixed/other	107	(100.0)	42	(39.3)	30	(28.0)	35	(32.7)		60	(56.6)	34	(32.1)	12	(11.3)	
Level of education									0.15							0.004
Secondary school	274	(100.0)	92	(33.6)	67	(24.5)	115	(42.0)		125	(46.3)	95	(35.2)	50	(18.5)	
Diploma	127	(100.0)	40	(31.5)	34	(26.8)	53	(41.7)		64	(51.2)	42	(33.6)	19	(15.2)	
Bachelor's Degree	446	(100.0)	151	(33.9)	126	(28.3)	169	(37.9)		234	(53.1)	155	(35.1)	52	(11.8)	
Master's Degree	264	(100.0)	81	(30.7)	77	(29.2)	106	(40.2)		152	(57.8)	90	(34.2)	21	(8.0)	
Doctorate	88	(100.0)	39	(44.3)	28	(31.8)	21	(23.9)		58	(65.9)	21	(23.9)	9	(10.2)	
Employment									0.15							0.001
Employed full-time	479	(100.0)	168	(35.1)	143	(29.9)	168	(35.1)		264	(55.5)	158	(33.2)	54	(11.3)	
Employed part-time	372	(100.0)	121	(32.5)	98	(26.3)	153	(41.1)		189	(51.2)	133	(36.0)	47	(12.7)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
Self-employed	182	(100.0)	63	(34.6)	52	(28.6)	67	(36.8)		107	(59.4)	59	(32.8)	14	(7.8)	
Not working**	170	(100.0)	53	(31.2)	37	(21.8)	80	(47.1)		74	(44.3)	55	(32.9)	38	(22.8)	
Number of people in the household									0.37							0.024
2	45	100.0)	11	(24.4)	11	(24.4)	23	(51.1)		13	(28.9)	21	(46.7)	11	(24.4)	
3	249	100.0)	85	(34.1)	66	(26.5)	98	(39.4)		136	(54.6)	76	(30.5)	37	(14.9)	
4	597	100.0)	201	(33.7)	173	(29.0)	223	(37.4)		323	(54.9)	202	(34.4)	63	(10.7)	
5	208	(100.0)	76	(36.5)	58	(27.9)	74	(35.6)		114	(55.3)	63	(30.6)	29	(14.1)	
6+	94	(100.0)	29	(30.9)	20	(21.3)	45	(47.9)		46	(49.5)	35	(37.6)	12	(12.9)	
Physical activity levels during the lockdown									0.001							<0.001
Low	176	(100.0)	48	(27.3)	50	(28.4)	78	(44.3)		85	(48.9)	51	(29.3)	38	(21.8)	
Medium	575	(100.0)	178	(31.0)	153	(26.6)	244	(42.4)		279	(48.9)	220	(38.5)	72	(12.6)	
High	436	(100.0)	175	(40.1)	123	(28.2)	138	(31.7)		262	(60.9)	126	(29.3)	42	(9.8)	
CHILD CHARACTERISTICS																
Level of schooling									0.04							0.001
Primary	656	(100.0)	209	(31.9)	171	(26.1)	276	(42.1)		319	(49.1)	226	(34.8)	105	(16.2)	
Secondary	270	(100.0)	106	(39.3)	78	(28.9)	86	(31.9)		165	(61.1)	81	(30.0)	24	(8.9)	
Both (I have ≥1 child)	285	(100.0)	91	(31.9)	85	(29.8)	109	(38.3)		152	(54.5)	101	(36.2)	26	(9.3)	
Special needs									0.009							0.008
Yes	133	(100.0)	35	(26.3)	30	(22.6)	68	(51.1)		53	(40.8)	53	(40.8)	24	(18.5)	
No	1077	(100.0)	371	(34.4)	304	(28.2)	402	(37.3)		583	(54.6)	354	(33.1)	131	(12.3)	
Dedicated space to study									0.001							<0.001
Yes	831	(100.0)	304	(36.6)	230	(27.7)	297	(35.7)		476	(57.8)	256	(31.1)	91	(11.1)	
No	379	(100.0)	102	(26.9)	104	(27.4)	173	(45.6)		160	(42.7)	151	(40.3)	64	(17.1)	
Access to technology									0.02							<0.001
Yes	653	(100.0)	240	(36.8)	173	(26.5)	240	(36.8)		380	(58.8)	195	(30.2)	71	(11.0)	
Yes, but not their own	532	(100.0)	162	(30.5)	157	(29.5)	213	(40.0)		253	(47.8)	202	(38.2)	74	(14.0)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
No	25	(100.0)	5	(20.0)	4	(16.0)	16	(64.0)		4	(17.4)	10	(43.5)	9	(39.1)	
In receipt of distance learning									0.46							0.03
Yes	1101	(100.0)	375	(34.1)	301	(27.3)	425	(38.6)		589	(54.0)	368	(33.8)	133	(12.2)	
No	110	(100.0)	31	(28.2)	33	(30.0)	46	(41.8)		47	(43.1)	40	(36.7)	22	(20.2)	
In receipt of live/online lessons									0.24							0.001
Yes	409	(100.0)	142	(34.7)	116	(28.4)	151	(36.9)		234	(57.6)	133	(32.8)	39	(9.6)	
No	449	(100.0)	139	(31.0)	119	(26.5)	191	(42.5)		210	(47.1)	160	(35.9)	76	(17.0)	
Sleeping pattern									<0.001							<0.001
No major change in sleeping pattern	449	(100.0)	187	(41.6)	128	(28.5)	134	(29.8)		285	(63.9)	123	(27.6)	38	(8.5)	
Slight change	168	(100.0)	61	(36.3)	44	(26.2)	63	(37.5)		90	(54.9)	53	(32.3)	21	(12.8)	
child now sleeps much later in the evening	580	(100.0)	153	(26.4)	158	(27.2)	269	(46.4)		253	(44.0)	229	(39.8)	93	(16.2)	
child now sleeping much earlier in the evening	9	(100.0)	4	(44.4)	3	(33.3)	2	(22.2)		7	(77.8)	1	(11.1)	1	(11.1)	

Table 2: Univariable and multivariable association of three-item UCLATILS with characteristics of study participants

	Univariable		Multivariable	
	OR (95) CI)	p-value	Adjusted OR (95) CI)	p-value
Age				
50+	*Ref.*		*Ref.*	
20-39	1.56 (1.12, 2.16)	0.008	1.26 (0.85, 1.86)	0.24
40-49	1.59 (1.18, 2.16)	0.003	1.38 (0.98, 1.94)	0.07
Gender of the parent				
Male	*Ref.*		*Ref.*	
Female	2.03 (1.46, 2.82)	<0.001	1.82 (1.29, 2.57)	0.001
Level of schooling				
Secondary	*Ref.*		*Ref.*	
Primary	1.41 (1.08, 1.83)	0.011	1.28 (0.94, 1.75)	0.12
Both (more than 1 child)	1.32 (0.97, 1.79)	0.079	1.13 (0.81, 1.59)	0.47
Access to technology				
Yes	*Ref.*		*Ref.*	
No	2.51 (1.11, 5.71)	0.03	1.62 (0.70, 3.74)	0.26
Special needs				
No	*Ref.*		*Ref.*	
Yes	1.66 (1.18, 2.35)	0.004	1.44 (1.01, 2.06)	0.04
Dedicated space				
Yes	*Ref.*		*Ref.*	
No	1.52 (1.21, 1.91)	<0.001	1.33 (1.04, 1.69)	0.02
Change in the sleeping patterns				
No	*Ref.*		*Ref.*	
Slight disruption	1.31 (0.94, 1.82)	0.110	1.27 (0.91, 1.78)	0.16
Marked disruption*	1.95 (1.55, 2.46)	<0.001	1.90 (1.50, 2.41)	<0.001
Physical activity level of the parent during the lockdown				
High	*Ref.*		*Ref.*	
Low	1.77 (1.28, 2.45)	0.001	1.53 (1.09, 2.14)	0.01
Medium	1.56 (1.24, 1.97)	<0.001	1.45 (1.14, 1.84)	0.002

*Applies to children who's sleeping pattern changed and slept much earlier or later than prior to lockdown

Table 3: Univariable and multivariable association of ONS Direct Measure of Loneliness (DMOL) score with characteristics of study participants

	Univariable		Multivariable	
	OR (95) CI)	p-value	Adjusted OR (95) CI)	p-value
Age				
50+	*Ref.*		*Ref.*	
20-39	1.98 (1.38, 2.85)	<0.001	1.47 (0.95, 2.27)	0.09
40-49	1.37 (0.97, 1.92)	0.07	1.22 (0.83, 1.79)	0.32
Gender of the parent				
Male	*Ref.*		*Ref.*	
Female	1.88 (1.31, 2.71)	0.001	1.52 (1.03, 2.24)	0.03
Education				
University degree or higher	*Ref.*		*Ref.*	
Secondary school or high school diploma	1.50 (1.18, 1.90)	0.001	1.27 (0.98, 1.64)	0.07
Employment status				
Employed	*Ref.*		*Ref.*	
Unemployed*	1.83 (1.32, 2.53)	<0.001	1.70 (1.21, 2.38)	0.002
Physical activity level of the parent during the lockdown				
High	*Ref.*		*Ref.*	
Medium	1.62 (1.26, 2.08)	<0.001	1.53 (1.18, 1.99)	0.002
Low	1.86 (1.30, 2.64)	0.001	1.53 (1.06, 2.21)	
Number of people at home				
3 or above	*Ref.*		*Ref.*	
Single parent family	2.49 (1.42, 4.39)	0.002	2.12 (1.17, 3.82)	0.01
Level of schooling				
Secondary	*Ref.*		*Ref.*	
Primary	1.65 (1.23, 2.20)	0.001	1.35 (0.96, 1.92)	0.09
Both (more than 1 child)	1.31 (0.94, 1.84)	0.11	1.05 (0.72, 1.53)	0.79
Access to technology				
Yes	*Ref.*		*Ref.*	
No	4.09 (1.86, 8.99)	<0.001	1.60 (0.69, 3.71)	0.28
Special needs				
No	*Ref.*		*Ref.*	
Yes	1.82 (1.28, 2.58)	0.001	1.45 (1.01, 2.08)	0.05
Dedicated space				

	Univariable		Multivariable	
	OR (95) CI)	**p-value**	**Adjusted OR (95) CI)**	**p-value**
Yes	*Ref.*		*Ref.*	
No	1.83 (1.44, 2.33)	<0.001	1.59 (1.23, 2.06)	<0.001
Distance learning				
Yes	*Ref.*		*Ref.*	
No	1.56 (1.06, 2.29)	0.03	1.34 (0.88, 2.03)	0.17
Change in the sleeping patterns				
No	*Ref.*		*Ref.*	
Slightly	1.45 (1.01, 2.09)	0.04	1.41 (0.97, 2.05)	0.07
A lot	2.18 (1.70, 2.81)	<0.001	2.15 (1.65, 2.79)	<0.001

* Unemployed/ Unable to work/Student/Retired

Loneliness and social isolation

Forty six percent (46.3%) of respondents felt they lacked companionship, whereas 52.4% reported having feelings of being left out, 58% reported feeling isolated from others on UCLATILS (**Table 1; Supplementary table)**. . More than half (58.9%) reported they felt lonely often or most of the time on DMOL. Parents reported that 58.5%, 71.0% and 72.2% of children felt they lacked companionship, had feelings of being left out, or feeling isolated from others in that same order, whereas 46.9% showed signs of feeling lonely often or most of the time on DMOL. Overall, 43.3% of respondents confirmed that their children were experiencing feelings of social isolation. More than two thirds (68.8%) felt that video calls where their child could see their teacher could help reduce feelings of social isolation, whereas 60.6% felt this could reduce feelings of loneliness. Overall, 43.9% and 33.0% felt that the lockdown and school closures respectively had caused them and their child to feel significantly more depressed **(Supplementary table).**

UCLA three-item Loneliness Score (UCLATILS)

The multivariable ordinal logistic model suggested that the main factors associated with significantly higher odds of having a higher level of UCLATILS were female gender of the respondent, having a child with special needs, lack of a dedicated space, a change in the child's sleeping patterns, and having low or medium physical activity during the lockdown **(table 2).** The univariably significant association of age, level of schooling (primary or secondary education) and access to technology with UCLATI Loneliness Score were attenuated and became non-significant in the multivariable model. Compared to male respondents, females were 82% more likely to have a higher UCLATILS. Parents of children who had special needs, and those who lacked a dedicated space to study had 44.0% and 33% higher odds of scoring higher UCLATILS respectively. Parents with low or medium level of physical activity had 53% and 45% higher odds of reporting a higher UCLATILS respectively compared to high during lockdown **(table 2).** Households who reported a disruption in the sleeping pattern of their children were 90% more likely to report a higher UCLATILS.

Direct Measure of Loneliness (DMOL)

The factors associated with higher DMOL were gender, employment status, physical activity level, household size, having children with special needs, having dedicated space to study and changes in sleeping patters during the lockdown (**table 3).** In particular, female respondents and those who were unemployed were 52.0% and 70.0% more likely to report a higher DMOL in that same order. Respondents with low or medium levels of physical activity during the lockdown had a 53% increase in the odds of scoring a higher DMOL. Having a child with special needs increased the odds of scoring higher on DMOL by 45%, whereas single parent families and those whose children changed their sleeping patterns had 2.1-fold higher odds of scoring a higher DMOL.

Households who reported a lack of a dedicated space to study scored 59.0% higher on DMOL (**table 3).** The associations of other parent and child characteristics that were significantly associated in the univariate analysis with a DMOL (age, education, level of schooling, access to technology and distance learning) were attenuated and became nonsignificant in the multivariable model.

General perceptions about lockdown, school closures, cancellation of exams and student preparedness for next academic year

Two thirds of respondents (66.2%) said they were indifferent that end of year exams being cancelled, compared to 10.8% who were happy, and 23.0% who said they were unhappy with this decision. Parents felt that only 30% of children preferred exams to be online as opposed to face-to-face. Fifty six percent of parents of secondary education children felt that their child would not be adequately prepared to sit exams if they were to be taken online. Twenty one percent reported they would be unhappy or very unhappy to send their child back to school should the lockdown be lifted and schools re-open again for this academic year.

DISCUSSION

We collected data in the first 100 days of lockdown and found that female gender, lower levels of physical activity, parenting a child with special needs, lower levels of education, unemployment, reduced access to technology, not having a dedicated space where the child can study and the disruption of the child's sleep patterns during the lockdown are the main factors associated with a significantly higher odds of reporting feelings of loneliness.

Our findings are consistent with the results of other studies that tracked the mental health of adults, children and young people aged 4-16 years throughout the COVID-19 crisis and showed that parents reported an increase in their child's emotional, behavioural, and restless/attentional difficulties (46). Access to personal computers, smartphones and tablets vary widely in relation to income levels. Private schools are significantly more likely to provide children with adequate equipment including laptops and tablets (7), and this has direct implications on the efficiency of online schooling since distance learning relies on digital access and electronic devices that the child can use at home.

Another major issue with online provision and distance learning is access to a dedicated space for the child at home that will facilitate such learning. Our data highlighted a significant association between the lack of a dedicated space and increased measures of loneliness in adult respondents. Lack of a dedicated space may be proxy-measure of lower income in families who are more likely to live in an overcrowded environment (47). The pre-existing attainment gap which loomed between the poorest and richest children showed that children from disadvantaged backgrounds were twice as likely to leave formal education without GCSEs in English and Maths compared to their peers who live in less deprived areas or whose parents have a higher total household income (48). The Education Endowment Foundation has suggested school closures could reverse the progress made in the last decade to narrow this gap (49) as children from better-off families will have received as much as 35% more home learning than children from the poorest households (50). This raises particular concern for parents of low-income who are less likely to be in a position to assist their children's studies with financial resources and this can play a significant role in a child's learning (51). School closures have thus shed a light on the subsequent social and economic consequences of the pandemic including a rise in inequalities and those factors that could be considered as a proxy-measure of income deprivation

such as digital exclusion, reduced access to tablets and smartphones or a dedicated study where the child can study.

A recent study established that disruption of good sleep hygiene practices could lead to a behavioural profile of social withdrawal and loneliness (52), whereas loneliness is a known independent risk factor for physical inactivity (53). This was reflected in the findings of our study which showed that both factors (lower physical activity level and disruption of sleep patterns) were independently associated with higher loneliness. Pertinently, both of these personal risk factors are modifiable and could be addressed through self-care practices. For example, exercise has long been associated with better sleep, and evidence is accumulating on the efficacy of exercise as a nonpharmacologic treatment option for disturbed sleep (54). Physical activity interventions in particular have also been shown to reduce loneliness and improve psychological well-being (55, 56).

Social interaction and physical activity are known key factors in promoting a healthy state of physical and mental wellbeing (57-59), but the unprecedented social distancing and lockdown measures have forced the vast majority of the UK population to stay at home for long periods of time. This significantly limited routine opportunities for social interactions with peers, while the closure of schools, gyms and some parks and play areas significantly reduced physical activity levels. Many households were also faced with various issues including concern over job security coupled to the increased need to supervise their children's learning and homework when one or both parents are required to work from home. Our study showed that these factors are likely to adversely affect the mental health of individuals, and in particular by increasing the prevalence of social isolation and loneliness in households.

Preventative measures that can be implemented to reduce the risk of social isolation and loneliness and bridge social distancing during lockdown include the use of digital technologies. China and Singapore established various initiatives to minimise outbreak-related stress and poor mental wellbeing including the deployment of enhanced social support networks and psychological services that could be delivered online (60-62). Teachers can also play an important role in alleviating a child's sense of isolation at school (63), but the extent to which this could be accomplished with live or online lessons whilst distance learning remains unclear.

Our UK study illustrated an increasing trend in the prevalence of social isolation and loneliness in parents of school-age children during the lockdown as was evidenced among emergency workers and other the quarantined populations (64, 65). The prevailing assumption that a resurgence of COVID-19 cases is expected in the winter months shortly after schools re-open in September is leading to the development of a range of preparedness and risk mitigation strategies (66). Recent modelling studies predict that school closures alone would only prevent 2–4% of deaths, which is significantly less than other social distancing interventions (67). Thus, whereas school closures present an apparently logical method of reducing virus transmission as evidenced from previous influenza outbreaks, it poses a dilemma for policy makers seeking measures to protect populations (67). Recent modelling studies predict that school closures alone would only prevent 2–4% of deaths, which is significantly less than other social distancing interventions (67). Thus, whereas school closures present an apparently logical method of reducing virus transmission as evidenced from

previous influenza outbreaks, they pose a dilemma for policy makers seeking measures to protect populations (67). This is reflected in the findings of our study which showed that one in five respondents may be unwilling to send their child back to school should schools re-open again for this academic year. Because school closures have a significant impact on public mental health and wellbeing (20) and may exacerbate inequalities (49, 50), this should be taken into account when considering future risk mitigation strategies to minimise virus transmission in the community and educational settings.

The principle limitation of our study was the lack of follow-up, and not recording information about household income and demographic and lifestyle factors such as nutrition, smoking, use of alcohol and recreational drugs which may have enabled a fuller exploration of the factors that could influence the primary outcome measures examined. Further, the demographic profile of study participants largely consisted of white and employed female parents implying that this cross-section may not be representative of the wider UK parent population. We also acknowledged that since this was an online survey, we may have excluded parents with little or no digital access. These limitations restrict the generalisability of our findings to the wider population of parents across the UK. In spite of these limitations, our findings echo the results of other studies which show that lockdown measures are negatively impacting the public mental health of individuals across all age groups and may be significantly increasing the prevalence of social isolation and loneliness (18-20).

The extraordinary measures introduced to control the COVID-19 pandemic has exacerbated pre-existing inequalities within society (68). When coupled to social distancing measures, the school closures have negatively impacted the mental health of school children and their parents and increased the prevalence of social isolation and loneliness in the community setting.

Conclusions

School closures and social distancing measures implemented during the first 100 days of the COVID-19 lockdown have had an impact on the daily routines of many people and have influenced various aspects of government policy. Policy prescriptions and public health messaging should promote the adoption of good health-seeking self-care behaviours such as increased levels of physical activity and the maintenance of good sleep hygiene practices to help prevent or reduce the risk social isolation and loneliness, and this applies in particular where there is a single parent. Policy makers need to balance the impact of school closures on children and their families, and any future risk mitigation strategies should ideally not further disadvantage to the most vulnerable groups in society.

Acknowledgements: The authors thank Mr David Collins (Head Teacher) and the Governing Board of Brackenbury Primary School for disseminating the survey.

Author Contributors: All authors provided substantial contributions to the conception (AEO, CVH, HM), design (AEO, EB, CVH), acquisition (IW, AA, ER), and interpretation (EB, IW, HM, AM) of study data and approved the final version of the paper. AEO took the lead in planning the study with support from co-authors. EB carried out the data analysis with support from AA. AEO is the guarantor.

Funding: The research was supported by the National Institute for Health Research (NIHR) Applied Research Collaboration (ARC) North West London. The views expressed are those of the authors and not necessarily those of the NHS or the NIHR or the Department of Health and Social Care

Competing interests: None.

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Supplementary table 1: Prevalence of low, moderate and high levels of loneliness (UCLATILS and DMOL) in relation to respondent characteristics

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
PARENT CHARACTERISTICS																
How many children do you have									0.35							0.24
1	251	(100.0)	80	(31.9)	67	(26.7)	104	(41.4)		126	(50.2)	89	(35.5)	36	(14.3)	
2	649	(100.0)	222	(34.2)	184	(28.4)	243	(37.4)		351	(54.7)	222	(34.6)	69	(10.7)	
3	244	(100.0)	(86	(35.2)	70	(28.7)	88	(36.1)		130	(54.2)	73	(30.4)	37	(15.4)	
4	50	(100.0)	14	(28.0)	11	(22.0)	25	(50.0)		23	(46.9)	18	(36.7)	8	(16.3)	
5+	18	(100.0)	5	(27.8)	2	(11.1)	11	(61.1)		7	(38.9)	6	(33.3)	5	(27.8)	
Does partner work?									0.09							<0.001
Yes	995	(100.0)	348	(35.0)	284	(28.5)	363	(36.5)		560	(56.9)	318	(32.3)	107	(10.9)	
No	146	(100.0)	43	(29.5)	36	(24.7)	67	(45.9)		56	(38.9)	56	(38.9)	32	(22.2)	
Key worker									0.07							0.03
Yes	213	(100.0)	77	(36.2)	65	(30.5)	71	(33.3)		121	(57.6)	69	(32.9)	20	(9.5)	
No	394	(100.0)	125	(31.7)	100	(25.4)	169	(42.9)		201	(51.1)	124	(31.6)	68	(17.3)	
Physical activity levels before the lockdown									0.08							0.02
Low	63	(100.0)	27	(42.9)	13	(20.6)	23	(36.5)		41	(66.1)	14	(22.6)	7	(11.3)	
Medium	626	(100.0)	215	(34.4)	186	(29.7)	225	(35.9)		347	(56.2)	196	(31.7)	75	(12.1)	
High	505	(100.0)	161	(31.9)	129	25.5)	215	(42.6)		241	(48.0)	192	(38.3)	69	(13.8)	
Videocall reduces SI									<0.001							0.02
Yes	825	(100.0)	245	(29.7)	238	(28.9)	342	(41.5)		411	(50.2)	296	(36.2)	111	(13.6)	
No	375	(100.0)	159	(42.4)	91	(24.3)	125	(33.3)		219	(59.0)	110	(29.7)	42	(11.3)	
Videocall reduces loneliness									<0.001							<0.001
Yes	712	(100.0)	194	(27.3)	204	(28.7)	314	(44.1)		339	(48.0)	266	(37.6)	102	(14.4)	
No	464	(100.0)	201	(43.3)	121	(26.1)	142	30.6)		285	(62.0)	128	(27.8)	47	(10.2)	
Depression due to lockdown									<0.001							<0.001
Yes	523	(100.0)	82	(15.7)	124	(23.7)	317	(60.6)		151	(29.0)	236	(45.3)	134	(25.7)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
No	672	(100.0)	316	(47.0)	207	(30.8)	149	(22.2)		477	(72.1)	166	(25.1)	19	(2.9)	
Cancelation of the exams									0.77							0.04
Unhappy	276	(100.0)	89	(32.3)	77	(27.9)	110	(39.9)		126	(45.8)	104	(37.8)	45	(16.4)	
Neutral	793	(100.0)	267	(33.7)	215	(27.1)	311	(39.2)		429	(54.8)	260	(33.2)	94	(12.0)	
Happy	130	(100.0)	49	(37.7)	37	(28.5)	44	(33.9)		76	(58.9)	41	(31.8)	12	(9.3)	
Preference of online exams									0.38							0.86
Yes	494	(100.0)	158	(32.0)	140	(28.3)	196	(39.7)		261	(53.3)	164	(33.5)	65	(13.3)	
No	644	(100.0)	231	(35.9)	176	(27.3)	237	(36.8)		347	(54.6)	211	(33.2)	78	(12.3)	
Sending child to school after lockdown									0.20							0.09
Very unhappy	100	(100.0)	39	(39.0)	23	(23.0)	38	(38.0)		54	(55.7)	28	(28.9)	15	(15.5)	
Unhappy	158	(100.0)	59	(37.3)	48	(30.4)	51	(32.3)		89	(58.2)	48	(31.4)	16	(10.5)	
Neither unhappy nor happy	230	(100.0)	86	(37.4)	64	(27.8)	80	(34.8)		130	(57.0)	69	(30.3)	29	(12.7)	
Happy	363	(100.0)	108	(29.8)	95	(26.2)	160	(44.1)		170	(46.8)	149	(41.0)	44	(12.1)	
Very happy	353	(100.0)	115	(32.6)	101	(28.6)	137	(38.8)		193	(54.8)	111	(31.5)	48	(13.6)	
CHILD CHARACTERISTICS																
Type of school									0.38							0.07
State school	1082	(100.0)	356	(32.9)	302	(27.9)	424	(39.2)		559	(52.2)	366	(34.2)	146	(13.6)	
Private school	128	(100.0)	50	(39.1)	32	(25.0)	46	(35.9)		77	(60.6)	41	(32.3)	9	(7.1)	
Private tuition									0.94							0.08
Yes	115	(100.0)	40	(34.8)	32	(27.8)	43	(37.4)		70	(60.9)	37	(32.2)	8	(7.0)	
No	1095	(100.0)	366	(33.4)	302	(27.6)	427	(39.0)		566	(52.3)	371	(34.3)	146	(13.5)	
Time spent studying									0.04							<0.001
≤2 hours	439	(100.0)	130	(29.6)	112	(25.5)	197	(44.9)		195	(44.8)	157	(36.1)	83	(19.1)	
2-4 hours	365	(100.0)	124	(34.0)	109	(29.9)	132	(36.2)		202	(55.8)	119	(32.9)	41	(11.3)	
≥4 hours	386	(100.0)	146	(37.8)	108	(28.0)	132	(34.2)		231	(60.5)	124	(32.5)	27	(7.1)	
Boredom									<0.001							<0.001

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
Low	74	(100.0)	40	(54.1)	16	21.6)	18	(24.3)		50	(68.5)	18	(24.7)	5	(6.8)	
Medium	396	(100.0)	165	(41.7)	117	(29.5)	114	(28.8)		250	(63.5)	116	(29.4)	28	(7.1)	
High	734	(100.0)	200	(27.2)	199	(27.1)	335	(45.6)		334	(45.9)	273	(37.6)	120	(16.5)	
Stress									<0.001							<0.001
Low	213	(100.0)	115	(54.0)	54	(25.4)	44	(20.7)		159	(75.7)	41	(19.5)	10	(4.8)	
Medium	531	(100.0)	190	(35.8)	158	(29.8)	183	(34.5)		308	(58.6)	177	(33.7)	41	(7.8)	
High	457	(100.0)	98	(21.4)	120	(26.3)	239	(52.3)		166	(36.4)	188	(41.2)	102	(22.4)	
Signs of depression									<0.001							<0.001
Yes	146	(100.0)	30	(20.5)	35	(24.0)	81	(55.5)		54	(37.0)	59	(40.4)	33	(22.6)	
No	297	(100.0)	128	(43.1)	85	(28.6)	84	(28.3)		194	(65.8)	87	(29.5)	14	(4.7)	
Children complaining of feeling social isolated or lonely									<0.001							<0.001
Yes	521	(100.0)	85	(16.3)	137	(26.3)	299	(57.4)		170	(32.8)	231	(44.6)	117	(22.6)	
No	685	(100.0)	321	(46.9)	196	(28.6)	168	(24.5)		466	(68.9)	175	(25.9)	35	(5.2)	
Physical activity levels before the lockdown									0.27							0.30
Low	17	(100.0)	3	(17.6)	6	(35.3)	8	(47.1)		10	(62.5)	3	(18.8)	3	(18.8)	
Medium	281	(100.0)	108	(38.4)	77	(27.4)	96	(34.2)		159	(57.0)	86	(30.8)	34	(12.2)	
High	901	(100.0)	290	(32.2)	247	(27.4)	364	(40.4)		462	(51.7)	317	(35.5)	115	(12.9)	
Physical activity levels during the lockdown									0.44							0.62
Low	174	(100.0)	56	(32.2)	41	(23.6)	77	(44.3)		83	(48.3)	66	(38.4)	23	(13.4)	
Medium	715	(100.0)	231	(32.3)	203	(28.4)	281	(39.3)		376	(53.0)	246	(34.6)	88	(12.4)	
High	304	(100.0)	111	(36.5)	85	(28.0)	108	(35.5)		168	(55.8)	92	(30.6)	41	(13.6)	
Readiness to undertake exams									<0.001							<0.001
Ready	217	(100.0)	83	(38.2)	51	(23.5)	83	(38.2)		285	(46.2)	233	(37.8)	99	(16.0)	
Neutral	279	(100.0)	123	(44.1)	71	(25.4)	85	(30.5)		184	(66.2)	77	(27.7)	17	(6.1)	
Unready	627	(100.0)	178	(28.4)	186	(29.7)	263	(41.9)		126	(58.3)	65	(30.1)	25	(11.6)	

Appendix 1: Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

Item Category	*Checklist Item*	*Page Number*	*Description*
Design	Study design	4	The target population were adult (aged 18 years and over) parents and legal guardians of children who were attending primary or secondary education in the UK.
IRB (Institutional Review Board) approval and informed consent process	IRB approval	6	The study was given ethical approval by the Head of Imperial College London PCPH Department, Professor Azeem Majeed, and by the Joint Research Compliance Office under the Imperial College Research Ethics Committee process (approval 20IC5978 ICREC HOD JRCO)
	Informed consent	4 and 5	The link to the Participant Information Sheet was accessible on the eSurvey page and sent to heads of schools who were contacted. The PIS included information regarding the study such as the protection of the participants' personal data, their right to withdraw from the study at any time, the length of time of the survey, which data were stored, where and for how long, who the investigator was, and the purpose of the study. They were informed this was a voluntary survey without any monetary incentives but with offering the possibility to access the results and underlying the potential collective benefits of taking parts in terms of knowledge and policies. The first question of the survey asked participants to confirm their consent to participate in the eSurvey.
	Data protection	5	The data collected were stored on the Imperial secure database and only the team researchers could access the eSurvey results.
Development and pre-testing	Development and testing	4 and 5	The study protocol and online survey were developed in collaboration with the Governing Board of Brackenbury Primary School in the London Borough of Hammersmith & Fulham. The online survey technical functionality was tested before being published.
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	4	This was an open survey using a snowball sampling.
	Contact mode	4	Part of the potentially eligible participants received an invitation email from the head teacher of schools where study information was disseminated including the Participant Information Sheet and link to the survey. The researchers' personal and professional networks were also mobilized through email and other messaging applications such as WhatsApp to respond and further disseminate the eSurvey among eligible participants.
	Advertising the survey	4	The study was advertised through head teachers of schools and researchers' networks
Survey	Web/E-mail	4	The survey was hosted by the Imperial College Qualtrics platform.

Administration	Context	p 10	The Head Teacher of Brackenbury Primary School disseminated the survey to parents of that school to give parents the opportunity to reflect on an issue that is important to them given the nature of the study. This was a 'right-in-time' study earmarked for recruitment *during* the lockdown
	Mandatory/voluntary	5	This was a voluntary survey
	Incentives	4 and 5	Participants were informed in the PIC that no monetary incentives were offered but non-monetary incentives such as the possibility to access the results and the potential collective benefits of taking parts in terms of knowledge and policies were mentioned.
	Time/Date	4	The survey was accessible for a period of 9 weeks from 14 May 2020 to 4 July 2020.
	Randomization of items or questionnaires	-	No randomization of items was used.
	Adaptive questioning	-	No adaptive questioning of items was used.
	Number of Items	5	The survey comprised a total of 51 questions.
	Number of screens (pages)	5	All questions were displayed on one page and was accessible using a personal computer or smartphone.
	Completeness check	4	Most items provided a non-response option such as "not applicable" or "rather not say", though not all. Selection of a response option to questions was not forced but were all fully completed. Analysis was conducted on fully completed questionnaires.
	Review step	5	Participants could review their answers before submitting them.
Response rates	Unique site visitor	-	Not applicable as response rates were not calculated.
	View rate	-	Not applicable as response rates were not calculated.
	Participation rate	-	Not applicable as response rates were not calculated.
	Completion rate	-	Not applicable as response rates were not calculated.
Preventing multiple entries from the same individual	Cookies used	-	No cookies were used.
	IP check	-	Qualtrics registered the IP address of respondents and did not allow a respondent for completing another survey from the same IP address for a period of one week.
	Log file analysis	-	No log files analysis.
	Registration	-	No registration.

Analysis	Handling of incomplete questionnaires	-	Only completed questionnaires were included in the final dataset.
	Questionnaires submitted with an atypical timestamp	-	Not applicable
	Statistical correction	-	None

BMJ Open

How is the COVID-19 lockdown impacting the mental health of parents of school-age children? A cross-sectional online survey

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-043397.R1
Article Type:	Original research
Date Submitted by the Author:	14-Dec-2020
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Primary Subject Heading:	Public health
Secondary Subject Heading:	Health policy, Epidemiology, Qualitative research
Keywords:	PUBLIC HEALTH, MENTAL HEALTH, EPIDEMIOLOGY

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How is the COVID-19 lockdown impacting the mental health of parents of school-age children?
A cross-sectional online survey

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Word count: 3866

ABSTRACT

Objective
Investigate the impact of the COVID-19 lockdown on feelings of loneliness and social isolation in parents of school-age children

Design
Cross sectional online survey of parents of primary and secondary school-age children

Setting
Community setting

Participants
1214 parents of school-age children in the United Kingdom

Methods
An online survey explored the impact of lockdown on the mental health of parents with school-age children, and in particular about feelings of social isolation and loneliness. Associations between the UCLA three-item Loneliness Scale (UCLATILS), the Direct Measure of Loneliness (DMOL) and the characteristics of the study participants were assessed using ordinal logistic regression models

Main outcome measures
Self-reported measures of social isolation and loneliness using UCLATILS and DMOL.

Results
Half of respondents felt they lacked companionship, 45% had feelings of being left out, 58% felt isolated and 46% felt lonely. The factors that were associated with higher levels of loneliness on UCLATILS were female gender, parenting a child with special needs, lack of a dedicated space for distance learning, disruption of sleep patterns and low levels of physical activity during the lockdown. Factors associated with a higher DMOL were female gender, single-parenting, parenting a child with special needs, unemployment, low physical activity, lack of a dedicated study-space and disruption of sleep patterns during the lockdown.

Conclusions
The COVID-19 lockdown has increased feelings of social isolation and loneliness among parents with school-age children. Two modifiable health seeking lifestyle behaviours such as increased levels of physical activity and the maintenance of good sleep hygiene practices during the lockdown were identified as key factors in reducing feelings of social isolation and loneliness.

Article summary

Strengths and limitations of this study

- We surveyed 1214 parents of school-age children to assess the impact of the lockdown measures on feelings of social isolation and loneliness
- We assessed direct and indirect measures of loneliness using the Direct Measure of Loneliness recommended by the Office of National Statistics and the validated UCLA 3-item Loneliness Scale
- We used Cohen's kappa to determine whether both direct (DMOL) and indirect (UCLATILS) measures of loneliness are correlated
- We also collected data on mental health, physical activity levels and other lifestyle factors during the first 100 days of the lockdown
- We used univariable and multivariable statistical models to determine the modifiable and non-modifiable risk factors associated with loneliness as assessed by two validated measures

INTRODUCTION

The COVID-19 pandemic has affected educational systems worldwide, leading to the near-total closures of educational institutions in the United Kingdom. As of 6 May 2020, schools were suspended in 177 countries affecting over 1.3 billion learners worldwide (1), and in many cases closures have resulted in the universal cancellation of examinations (2, 3). UNICEF estimated that almost four months of education will be lost as a result of the lockdown (4). School closures have far-reaching economic and societal consequences, including the disruption of everyday behaviours and routines. In the UK, over two million workers have already lost their jobs (5, 6), and although the long-term impact of the pandemic on education is not yet clear, the pre-existing attainment gap between the poorest and richest children (7) may widen significantly as a result of COVID-19 (4, 8, 9). Children and young people make up 21% of the population of England (10), and by the time they returned to school after the summer break, some would have been out of education for nearly six months.

Lockdown measures significantly limit social interactions, opportunities for social intercourse or the ability to receive the social support needed to promote mental well-being (11). The temporary closure of schools also means that children miss out on vital social skills and physical activity which may cause further detriment to their mental health and the quality of their social interaction with their parents and other members of the household (12). Loss of routine social contact could also lead to different patterns of social response (13, 14) whilst increasing feelings of social isolation and loneliness (15-17). There is growing concern over the impact of school closures on the mental health and well-being of parents and school-age children (18-20), and in particular about increasing feelings of social isolation and loneliness (21).

The impact of loneliness on public mental health is well characterised (22), and includes depression (23, 24), anxiety (25) and suicide (26, 27), and is also linked with

cardiovascular conditions (28, 29) and cancer (30). Prolonged periods of loneliness and social isolation are also associated with future mental health problems up to 9 years later (31), including a strong association with depression (32) and stress (33). Although acknowledged to be different concepts, social isolation and loneliness may affect people of all ages (34), and the terms are used interchangeably such that they are often considered together (35). There have been numerous attempts in the literature to identify predictors of loneliness (31, 36, 37), but this subjective phenomenon remains difficult to measure, and its prevalence is thought to be significantly under-represented. Known predictors of loneliness include living alone, living in rented accommodation, household size, education level, self-reported health measures and, paradoxically, living in population-dense areas.

The measurement of social isolation and loneliness is challenging as it is largely subjective and qualitative in nature (38). The UK Office for National Statistics (ONS) recommends the use of the validated UCLA three-item loneliness scale (UCLATILS) as an indirect measure for loneliness, and an additional Direct Measure of Loneliness (DMOL) question (39). ONS recommends attempting to harmonise these indicators across the UK Government Statistical Service, but the recency of the recommendations may be a reason behind the lack of standardised and retrospective data on loneliness in the UK. Although both scores measure loneliness, they are fundamentally different. The composite score of UCLATIS measures general and indirect loneliness and feelings of social isolation, whereas the DMOL is a separate (single item) measure that assesses the current/temporal feeling of loneliness by the respondent and is recommended for use by ONS

Successful interventions aimed at tackling social isolation and loneliness include leveraging existing community assets such as parks and green spaces, befriending schemes, skill development strategies, psychological therapies (40-43). The UK government published its first Loneliness Strategy in October 2018, signalling the first important step in tackling this rising problem of society. Preventative measures that can be implemented to reduce the risk of social isolation and loneliness and bridge social distancing during lockdown include the use of digital technologies. China and Singapore established various initiatives to minimise outbreak-related stress and poor mental wellbeing including the deployment of enhanced social support networks and psychological services that could be delivered online (44-46). Teachers can also play an important role in alleviating a child's sense of isolation at school (47, 48), but the extent to which this can be accomplished with live or online lessons through remote learning remains unclear. Reports have already documented loneliness in the elderly as a result of the COVID-19 lockdown (49), but research regarding this aspect of mental health on parents with school-age children during the pandemic is scarce in the first 100 days after the lockdown and this population remains largely understudied.

Study objectives

The aim of this study was to explore how the lockdown is affecting the mental health of parents of school-age children, and in particular to assess the impact of an extended period of school closures on feelings of social isolation & loneliness.

METHODS

Study design

We conducted a cross-sectional online survey of adult parents and legal guardians of children who were attending primary or secondary education in the UK.

The link to the electronic survey was published and available on the Imperial College Qualtrics platform between 29 May and 11 July 2020 (6 weeks). The survey was open and could be accessed by anyone with a link. Potentially eligible participants received an invitation email from the study team, and the head teacher of Brackenbury Primary School also disseminated the email and link to his counterparts in other schools. Study information was disseminated including the Participant Information Sheet (PIS) and link to the survey. The researchers' personal and professional networks were also mobilized to respond and further disseminate the eSurvey among eligible participants. The PIS included information regarding the study's aims, the protection of participants' personal data, their right to withdraw from the study at any time, which data were stored, where and for how long, who the investigator was, the purpose of the study and survey length. Participants were informed that this was a voluntary survey without any monetary incentives but offering the possibility to access the findings at a later stage whilst underlying the potential collective benefits of taking part in terms of helping advance knowledge in this area and the formulation of future policies to tackle the COVID-19 pandemic. The data collected were stored on the Imperial College London secure database and only the team researchers could access the eSurvey results.

The survey comprised a total of 51 questions displayed on one page and was accessible using a personal computer or smartphone. Questions regarding demographic characteristics of the users included information on gender, age, ethnicity, educational level, number of people living in the household, first part of postal code and employment status. Participants could review their answers before submitting them. All data collected through the survey were anonymised and not personally identifiable. The online survey technical functionality was tested before being published. The first question asked participants to confirm their consent to participate in the eSurvey.

Experiences and perceptions related to the impact of the lockdown on the mental health of parents and other members of their household were evaluated through a number of questions concerning self-reported or perceived levels of depression, stress, feeling of loneliness, social isolation and boredom. Indirect measures of loneliness were measured using the validated UCLA 3-item Loneliness Scale (UCLATILS) with responses never/hardly ever (score of 1), some of the time (score of 2), and often (score of 3) (50). The questions were each scored 1 to 3, then totalled to a score ranging from 3 to 9. Indirect measure of loneliness using UCLATILS was subsequently categorized as follows: no loneliness (score =3), moderate loneliness (score = 4-6), and severe loneliness (score = 7-9). An additional one item Direct Measure of Loneliness (DMOL) was also used as recommended by the Office of National Statistics (51). Questions concerning users' experiences were scored on a 1-5 Likert scale. Respondents were able to refrain from providing an answer by selecting 'no opinion'. Such answers were treated as missing data in all the analyses (listwise exclusion) but due to the small number of missingness (<1.5%) the data were not

imputed (52, 53). The association of the two scores was tested using the Cohen's kappa test of agreement.

The survey included eleven additional questions to explore perceptions of feelings of social isolation pre- and post-school closures. Perceptions on remote learning were explored through questions related to whether or not their child received regular homework, live or online lessons, had access to technology (personal computer, tablet or phone), time spent studying, and whether the child had access to a dedicated space to study. Perceptions on the impact of school closures on the lifestyle behaviours of respondents and their school children were recorded by asking questions relating to pre- and post-lockdown self-reported measures of physical activity levels of both parents and children, the children's sleeping patterns and how children spent their leisure time. The quality of the survey was assessed by completing the Checklist for Reporting Results of Internet E-Surveys (CHERRIES).

Statistical analysis

Analyses were conducted separately for the UCLATILS and DMOL as recommended by the ONS (51). Parent and child characteristics were described using frequencies and percentages. Pearson's chi-square test was used to identify differences of statistical significance. Associations between the UCLATILS, DMOL and the characteristics of the study participants were assessed using ordinal logistic regression models. The factors that were significant in the univariable models (p-value <0.05) were considered in the multivariable analyses. All analyses were performed using Stata 15 statistical software (StataCorp).

Ethics

The study was given ethical approval by Imperial College Research Ethics Committee (ICREC # 20IC5978). Participants consented to take part in the survey.

Patient and Public Involvement

No patient was involved. The study protocol and online survey were developed in collaboration with the Governing Board of Brackenbury Primary School in the London Borough of Hammersmith & Fulham where the lead author is also a co-opted School governor

RESULTS

Demographic profile of respondents

The electronic survey captured responses from 1214 respondents from across England **(Table 1).** More than half (53.1%) were aged 40-49 years, whereas 2.5%, 29.2%, 14.4% and 0.9% were in the second, third, fifth or sixth decade of age respectively. Eighty seven percent of respondents were female, and 80.5% identified as white ethnic background. Sixty six percent were educated to university degree, 70.9% were in full or part-time employment and 87.1% had a partner that was employed. A fifth (20.8%) had one child, 53.5% had two children, and 25.8% had three or more children. Only 3.8% were a single parent family, whereas 75.3% of respondents were living in households consisting of 4 or more people.

School and children characteristics

Nine out of ten (89.5%) children attended a state funded school. More than half (54.1%) of respondents had a child receiving primary education, 22.3% in secondary school and 23.6% had more than one child, one attending either primary or secondary schools. Eleven percent of respondents had a child a special educational need or disability (SEND) . Sixty eight percent indicated that their child had access to a dedicated space where they can learn or study at home. The vast majority (97.9%) of children had access to a personal computer, laptop, tablet or smartphone, of whom 54.0% had their own devices and 43.9% did not have their own but could access devices belonging to other members of their household and two percent did not have access to any technology. Remote learning was accessed by 90.7% of children, but only 47.7% of respondents reported their child was receiving live or online lessons. Only 9.5% of children received private tuition. The time spent on remote learning ranged between 0-8 hours per day, with 36.8% studying for less than 2 hours, 30.7% studying between 2-4 hours and 32.5% studding more than 4 hours.

Mental health and physical wellbeing

The vast majority of respondents felt their children were experiencing medium to high levels of boredom (93.8%) and medium or high levels of stress (82.3%) during the lockdown compared to before school closures. Almost half of the participants (48.1%) have reported a shift in the sleeping pattern of children by staying up until much later in the evening during the lockdown. Only 37.2% of respondents reported that the sleeping patterns of their children did not change during the lockdown. Forty-five percent reported that their levels of physical activity were low during the lockdown. Seventy percent of respondents felt that school closures also reduced the physical activity of their child.

Table 1: Respondent characteristics

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
PARENT CHARACTERISTICS																
Age group									0.05							0.004
20-29	30	(100.0)	6	(20.0)	10	(33.3)	14	(46.7)		9	(30.0)	13	(43.3)	8	(26.7)	
30-39	354	(100.0)	122	(34.5)	85	(24.0)	147	(41.5)		166	(47.6)	127	(36.4)	56	(16.0)	
40-49	643	(100.0)	202	(31.4)	184	(28.6)	257	(40.0)		346	(54.3)	219	(34.4)	72	(11.3)	
50-59	174	(100.0)	73	(42.0)	52	(29.9)	49	(28.2)		109	(63.0)	46	(26.6)	18	(10.4)	
60+	11	(100.0)	4	(36.4)	3	(27.3)	4	(36.4)		7	(63.6)	3	(27.3)	1	(9.1)	
Gender									<0.001							0.002
Male	149	(100.0)	75	(50.3)	31	(20.8)	43	(28.9)		99	(66.4)	39	(26.2)	11	(7.4)	
Female	1062	(100.0)	331	(31.2)	303	(28.5)	428	(40.3)		537	(51.1)	369	(35.1)	144	(13.7)	
Ethnicity									0.23							0.42
White	962	(100.0)	322	(33.5)	269	(28.0)	371	(38.6)		512	(53.7)	322	(33.8)	120	(12.6)	
Black	25	(100.0)	7	(28.0)	5	(20.0)	13	(52.0)		11	(45.8)	8	(33.3)	5	(20.8)	
Asian	101	(100.0)	27	(26.7)	25	(24.8)	49	(48.5)		43	(43.4)	39	(39.4)	17	(17.2)	
Mixed/other	107	(100.0)	42	(39.3)	30	(28.0)	35	(32.7)		60	(56.6)	34	(32.1)	12	(11.3)	
Level of education									0.15							0.004
Secondary school	274	(100.0)	92	(33.6)	67	(24.5)	115	(42.0)		125	(46.3)	95	(35.2)	50	(18.5)	
Diploma	127	(100.0)	40	(31.5)	34	(26.8)	53	(41.7)		64	(51.2)	42	(33.6)	19	(15.2)	
Bachelor's Degree	446	(100.0)	151	(33.9)	126	(28.3)	169	(37.9)		234	(53.1)	155	(35.1)	52	(11.8)	
Master's Degree	264	(100.0)	81	(30.7)	77	(29.2)	106	(40.2)		152	(57.8)	90	(34.2)	21	(8.0)	
Doctorate	88	(100.0)	39	(44.3)	28	(31.8)	21	(23.9)		58	(65.9)	21	(23.9)	9	(10.2)	
Employment									0.15							0.001
Employed full-time	479	(100.0)	168	(35.1)	143	(29.9)	168	(35.1)		264	(55.5)	158	(33.2)	54	(11.3)	
Employed part-time	372	(100.0)	121	(32.5)	98	(26.3)	153	(41.1)		189	(51.2)	133	(36.0)	47	(12.7)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
Self-employed	182	(100.0)	63	(34.6)	52	(28.6)	67	(36.8)		107	(59.4)	59	(32.8)	14	(7.8)	
Not working**	170	(100.0)	53	(31.2)	37	(21.8)	80	(47.1)		74	(44.3)	55	(32.9)	38	(22.8)	
Number of people in the household									0.37							0.024
2	45	100.0)	11	(24.4)	11	(24.4)	23	(51.1)		13	(28.9)	21	(46.7)	11	(24.4)	
3	249	100.0)	85	(34.1)	66	(26.5)	98	(39.4)		136	(54.6)	76	(30.5)	37	(14.9)	
4	597	100.0)	201	(33.7)	173	(29.0)	223	(37.4)		323	(54.9)	202	(34.4)	63	(10.7)	
5	208	(100.0)	76	(36.5)	58	(27.9)	74	(35.6)		114	(55.3)	63	(30.6)	29	(14.1)	
6+	94	(100.0)	29	(30.9)	20	(21.3)	45	(47.9)		46	(49.5)	35	(37.6)	12	(12.9)	
Physical activity levels during the lockdown									0.001							<0.001
Low	176	(100.0)	48	(27.3)	50	(28.4)	78	(44.3)		85	(48.9)	51	(29.3)	38	(21.8)	
Medium	575	(100.0)	178	(31.0)	153	(26.6)	244	(42.4)		279	(48.9)	220	(38.5)	72	(12.6)	
High	436	(100.0)	175	(40.1)	123	(28.2)	138	(31.7)		262	(60.9)	126	(29.3)	42	(9.8)	
CHILD CHARACTERISTICS																
Level of schooling									0.04							0.001
Primary	656	(100.0)	209	(31.9)	171	(26.1)	276	(42.1)		319	(49.1)	226	(34.8)	105	(16.2)	
Secondary	270	(100.0)	106	(39.3)	78	(28.9)	86	(31.9)		165	(61.1)	81	(30.0)	24	(8.9)	
Both (I have ≥1 child)	285	(100.0)	91	(31.9)	85	(29.8)	109	(38.3)		152	(54.5)	101	(36.2)	26	(9.3)	
Special needs									0.009							0.008
Yes	133	(100.0)	35	(26.3)	30	(22.6)	68	(51.1)		53	(40.8)	53	(40.8)	24	(18.5)	
No	1077	(100.0)	371	(34.4)	304	(28.2)	402	(37.3)		583	(54.6)	354	(33.1)	131	(12.3)	
Dedicated space to study									0.001							<0.001
Yes	831	(100.0)	304	(36.6)	230	(27.7)	297	(35.7)		476	(57.8)	256	(31.1)	91	(11.1)	
No	379	(100.0)	102	(26.9)	104	(27.4)	173	(45.6)		160	(42.7)	151	(40.3)	64	(17.1)	
Access to technology									0.02							<0.001
Yes	653	(100.0)	240	(36.8)	173	(26.5)	240	(36.8)		380	(58.8)	195	(30.2)	71	(11.0)	
Yes, but not their own	532	(100.0)	162	(30.5)	157	(29.5)	213	(40.0)		253	(47.8)	202	(38.2)	74	(14.0)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
No	25	(100.0)	5	(20.0)	4	(16.0)	16	(64.0)		4	(17.4)	10	(43.5)	9	(39.1)	
In receipt of distance learning									0.46							0.03
Yes	1101	(100.0)	375	(34.1)	301	(27.3)	425	(38.6)		589	(54.0)	368	(33.8)	133	(12.2)	
No	110	(100.0)	31	(28.2)	33	(30.0)	46	(41.8)		47	(43.1)	40	(36.7)	22	(20.2)	
In receipt of live/online lessons									0.24							0.001
Yes	409	(100.0)	142	(34.7)	116	(28.4)	151	(36.9)		234	(57.6)	133	(32.8)	39	(9.6)	
No	449	(100.0)	139	(31.0)	119	(26.5)	191	(42.5)		210	(47.1)	160	(35.9)	76	(17.0)	
Sleeping pattern									<0.001							<0.001
No major change in sleeping pattern	449	(100.0)	187	(41.6)	128	(28.5)	134	(29.8)		285	(63.9)	123	(27.6)	38	(8.5)	
Slight change	168	(100.0)	61	(36.3)	44	(26.2)	63	(37.5)		90	(54.9)	53	(32.3)	21	(12.8)	
child now sleeps much later in the evening	580	(100.0)	153	(26.4)	158	(27.2)	269	(46.4)		253	(44.0)	229	(39.8)	93	(16.2)	
child now sleeping much earlier in the evening	9	(100.0)	4	(44.4)	3	(33.3)	2	(22.2)		7	(77.8)	1	(11.1)	1	(11.1)	

Table 2: Univariable and multivariable association of three-item UCLATILS with characteristics of study participants

	Univariable		Multivariable	
	OR (95) CI)	**p-value**	**Adjusted OR (95) CI)**	**p-value**
Age				
50+	*Ref.*		*Ref.*	
20-39	1.56 (1.12, 2.16)	0.008	1.26 (0.85, 1.86)	0.24
40-49	1.59 (1.18, 2.16)	0.003	1.38 (0.98, 1.94)	0.07
Gender of the parent				
Male	*Ref.*		*Ref.*	
Female	2.03 (1.46, 2.82)	<0.001	1.82 (1.29, 2.57)	0.001
Level of schooling				
Secondary	*Ref.*		*Ref.*	
Primary	1.41 (1.08, 1.83)	0.011	1.28 (0.94, 1.75)	0.12
Both (more than 1 child)	1.32 (0.97, 1.79)	0.079	1.13 (0.81, 1.59)	0.47
Access to technology				
Yes	*Ref.*		*Ref.*	
No	2.51 (1.11, 5.71)	0.03	1.62 (0.70, 3.74)	0.26
Special needs				
No	*Ref.*		*Ref.*	
Yes	1.66 (1.18, 2.35)	0.004	1.44 (1.01, 2.06)	0.04
Dedicated space				
Yes	*Ref.*		*Ref.*	
No	1.52 (1.21, 1.91)	<0.001	1.33 (1.04, 1.69)	0.02
Change in the sleeping patterns				
No	*Ref.*		*Ref.*	
Slight disruption	1.31 (0.94, 1.82)	0.110	1.27 (0.91, 1.78)	0.16
Marked disruption*	1.95 (1.55, 2.46)	<0.001	1.90 (1.50, 2.41)	<0.001
Physical activity level of the parent during the lockdown				
High	*Ref.*		*Ref.*	
Low	1.77 (1.28, 2.45)	0.001	1.53 (1.09, 2.14)	0.01
Medium	1.56 (1.24, 1.97)	<0.001	1.45 (1.14, 1.84)	0.002

*Applies to children who's sleeping pattern changed and slept much earlier or later than prior to lockdown

Table 3: Univariable and multivariable association of ONS Direct Measure of Loneliness (DMOL) score with characteristics of study participants

	Univariable		Multivariable	
	OR (95) CI)	p-value	Adjusted OR (95) CI)	p-value
Age				
50+	*Ref.*		*Ref.*	
20-39	1.98 (1.38, 2.85)	<0.001	1.47 (0.95, 2.27)	0.09
40-49	1.37 (0.97, 1.92)	0.07	1.22 (0.83, 1.79)	0.32
Gender of the parent				
Male	*Ref.*		*Ref.*	
Female	1.88 (1.31, 2.71)	0.001	1.52 (1.03, 2.24)	0.03
Education				
University degree or higher	*Ref.*		*Ref.*	
Secondary school or high school diploma	1.50 (1.18, 1.90)	0.001	1.27 (0.98, 1.64)	0.07
Employment status				
Employed	*Ref.*		*Ref.*	
Unemployed*	1.83 (1.32, 2.53)	<0.001	1.70 (1.21, 2.38)	0.002
Physical activity level of the parent during the lockdown				
High	*Ref.*		*Ref.*	
Medium	1.62 (1.26, 2.08)	<0.001	1.53 (1.18, 1.99)	0.002
Low	1.86 (1.30, 2.64)	0.001	1.53 (1.06, 2.21)	
Number of people at home				
3 or above	*Ref.*		*Ref.*	
Single parent family	2.49 (1.42, 4.39)	0.002	2.12 (1.17, 3.82)	0.01
Level of schooling				
Secondary	*Ref.*		*Ref.*	
Primary	1.65 (1.23, 2.20)	0.001	1.35 (0.96, 1.92)	0.09
Both (more than 1 child)	1.31 (0.94, 1.84)	0.11	1.05 (0.72, 1.53)	0.79
Access to technology				
Yes	*Ref.*		*Ref.*	
No	4.09 (1.86, 8.99)	<0.001	1.60 (0.69, 3.71)	0.28
Special needs				
No	*Ref.*		*Ref.*	
Yes	1.82 (1.28, 2.58)	0.001	1.45 (1.01, 2.08)	0.05
Dedicated space				

	Univariable		Multivariable	
	OR (95) CI)	**p-value**	**Adjusted OR (95) CI)**	**p-value**
Yes	*Ref.*		*Ref.*	
No	1.83 (1.44, 2.33)	<0.001	1.59 (1.23, 2.06)	<0.001
Distance learning				
Yes	*Ref.*		*Ref.*	
No	1.56 (1.06, 2.29)	0.03	1.34 (0.88, 2.03)	0.17
Change in the sleeping patterns				
No	*Ref.*		*Ref.*	
Slightly	1.45 (1.01, 2.09)	0.04	1.41 (0.97, 2.05)	0.07
A lot	2.18 (1.70, 2.81)	<0.001	2.15 (1.65, 2.79)	<0.001

* Unemployed/ Unable to work/Student/Retired

Loneliness and social isolation

The Cohen's kappa test between the direct and indirect measures of loneliness (UCLATIS and DMOL) suggested lack of agreement (kappa= -0.34) and therefore it was deemed important to explore the two scores separately. On the UCLATILS which collected was an indirect measure of loneliness, forty six percent (46.3%) of respondents felt they lacked companionship, whereas 52.4% reported having feelings of being left out, and 58% reported feeling isolated from others (**Table 1; Supplementary table)**. More than half (58.9%) reported they felt lonely often or most of the time on the direct measure (DMOL). Parents reported that 58.5%, 71.0% and 72.2% of children felt they lacked companionship, had feelings of being left out, or feeling isolated from others in that same order, whereas 46.9% showed signs of feeling lonely often or most of the time on DMOL. Overall, 43.3% of respondents confirmed that their children were experiencing feelings of social isolation. More than two thirds (68.8%) felt that video calls where their child could see their teacher could help reduce feelings of social isolation, whereas 60.6% felt this could reduce feelings of loneliness. Overall, 43.9% and 33.0% felt that the lockdown and school closures respectively had caused them and their child to feel significantly more depressed **(Supplementary table).**

UCLA three-item Loneliness Score (UCLATILS)

The multivariable ordinal logistic model suggested that the main factors associated with significantly higher odds of having a higher level of UCLATILS (the indirect measure of loneliness) were female gender of the respondent, having a child with special needs, lack of a dedicated space, a change in the child's sleeping patterns, and having low or medium physical activity during the lockdown **(table 2).** The univariably significant association of age, level of schooling (primary or secondary education) and access to technology with UCLATILS were attenuated and became non-significant in the multivariable model. Compared to male respondents, females were 82% more likely to have a higher score on UCLATILS. Parents of children who had special needs, and those who lacked a dedicated space to study had 44.0% and 33% higher odds of scoring higher on UCLATILS respectively. Parents with a low or medium level of physical activity had 53% and 45% higher odds of reporting a higher UCLATILS respectively compared to respondents who had high levels of physical activity during lockdown **(table 2).** Households who reported a disruption in the sleeping pattern of their children were 90% more likely to report a higher UCLATILS.

Direct Measure of Loneliness (DMOL)

The factors associated with higher DMOL (the direct measure) were gender, employment status, physical activity level, household size, having children with special needs, having dedicated space to study and changes in sleeping patters during the lockdown (**table 3).** In particular, female respondents and those who were unemployed were 52.0% and 70.0% more likely to report a higher DMOL in that same order. Respondents with low or medium levels of physical activity during the lockdown had a 53% increase in the odds of scoring a higher DMOL. Having a child with special needs increased the odds of scoring higher on DMOL by 45%, whereas single parent families and those whose children changed their sleeping patterns had 2.1-fold higher odds of scoring a higher DMOL.

Households who reported a lack of a dedicated space to study scored 59.0% higher on DMOL (**table 3).** The associations of other parent and child characteristics that

were significantly associated in the univariate analysis with a DMOL (age, education, level of schooling, access to technology and distance learning) were attenuated and became nonsignificant in the multivariable model.

General perceptions about lockdown, school closures, cancellation of exams and student preparedness for next academic year

Two thirds of respondents (66.2%) said they were indifferent that end-of-year exams were being cancelled, compared to 10.8% who were happy, and 23.0% who said they were unhappy with this decision. Parents felt that only 30% of children preferred exams to be online as opposed to face-to-face. Fifty six percent of parents of secondary education children felt that their child would not be adequately prepared to sit exams if they were to be taken online. Twenty one percent reported they would be unhappy or very unhappy to send their child back to school should the lockdown be lifted and schools re-open again before the end of the academic year 2019/2020.

DISCUSSION

We collected data for 6 weeks during the first 100 days of lockdown in the UK and found that female gender, lower levels of physical activity, parenting a child with special needs, lower levels of education, unemployment, reduced access to technology, not having a dedicated space where the child can study and the disruption of the child's sleep patterns during the lockdown are the main factors associated with a significantly higher odds of parents reporting feelings of loneliness.

Our findings are consistent with the results of other studies (54, 55) and reviews (56, 57) including those that tracked the mental health of adults, children and young people aged 4-16 years throughout the COVID-19 crisis and showed that parents reported an increase in their child's emotional, behavioural, and restless/attentional difficulties (21, 58). It is also corroborates existing data which shows that access to personal computers, smartphones and tablets varies widely in relation to income levels, with private schools being significantly more likely to provide children with adequate equipment including laptops and tablets (7). It is unsurprising that appropriate access to technology has direct implications on the efficiency of online schooling since remote learning relies on digital access and electronic devices that the child can use at home (59).

Another major issue with online provision and remote learning is access to a dedicated space for the child at home that will facilitate such learning. Our study highlighted a significant association between the lack of a dedicated space and increased measures of loneliness in adult respondents using both the direct and indirect measures of loneliness. The lack of a dedicated space may be a proxy-measure for lower income in families who are more likely to live in an overcrowded environment (60). The pre-existing attainment gap which loomed between the poorest and richest children showed that children from disadvantaged backgrounds were twice as likely to leave formal education without GCSEs in English and Maths compared to their peers who live in less deprived areas or whose parents have a higher total household income (61). The Education Endowment Foundation has also suggested that school closures could reverse the progress made in the last decade to narrow this gap (62) as children

from better-off families will have received as much as 35% more home learning than children from the poorest households (63). This raises particular concerns for parents of low-income who are less likely to be in a position to assist their children's studies with financial resources and this can play a significant role in a child's learning (64). School closures have thus shed a light on the subsequent social and economic consequences of the pandemic including a rise in inequalities and those factors that could be considered as a proxy-measure of income deprivation such as digital exclusion, reduced access to tablets and smartphones or a dedicated space where the child can study (33).

A recent study established that disruption of good sleep hygiene practices could lead to a behavioural profile of social withdrawal and loneliness (65), whereas loneliness is a known independent risk factor for physical inactivity (66). This was reflected in the findings of our study which showed that both modifiable risk factors (lower physical activity levels and disruption of sleep patterns) were independently associated with higher loneliness. Pertinently, both of these personal risk factors are modifiable and could be addressed through self-care practices. For example, exercise has long been associated with better sleep, and evidence is accumulating on the efficacy of exercise as a nonpharmacologic treatment option for disturbed sleep (67). Physical activity interventions in particular have also been shown to reduce loneliness and improve psychological wellbeing (68, 69).

Social interaction and physical activity are also known key factors in promoting a healthy state of physical and mental wellbeing (70-72), but the unprecedented social distancing and lockdown measures have forced the vast majority of the UK population to stay at home for long periods of time. This significantly limited routine opportunities for social interactions with peers, while the closure of schools, gyms and some parks and play areas significantly reduced physical activity levels, including those of parents of school-age children since this group remains largely understudied. Many households were also faced with various issues including concern over job security coupled to the increased need to supervise their children's learning and homework when one or both parents are required to work from home. Our study showed that these factors are likely to adversely affect the mental health of individuals, and in particular by increasing the prevalence of social isolation and loneliness in households.

Our UK study illustrated an increasing trend in the prevalence of social isolation and loneliness in parents of school-age children during the lockdown as was evidenced among emergency workers and other the quarantined populations (73, 74). However, this is the first study that investigated the level of loneliness in a population of parents with school-age children in the UK using both a direct and an indirect measure of loneliness.

The findings of this study may be used to direct interventions aimed at reducing feelings of social isolation and loneliness and to promote good mental health of parents with school-age children. COVID-19 lockdown can be deemed as a period of crisis that has dramatically affected the dynamics of households with school-age children. It is very important to look into the needs of this population during the lockdown as studies have shown that crises, quarantining and restrictions among school-age children have both short and long-term effect on their mental health which

may affect the mental health of their parents(75)(76). Future studies should investigate the effect of remote education on the mental health of children taking into account the findings of Martin et. al who found that more than two hours of daily screen exposure can negatively affect the mental health of young children (77).

The prevailing assumption that a resurgence of COVID-19 cases is expected in the winter months shortly after schools re-open in September has led to the development of a range of preparedness and risk mitigation strategies (78). Recent modelling studies predict that school closures alone would only prevent 2–4% of deaths, which is significantly less than other social distancing interventions (79). Thus, whereas school closures present an apparently logical method of reducing virus transmission as evidenced from previous influenza outbreaks, they pose a dilemma for policy makers seeking measures to protect populations (79). This is reflected in the findings of our study which showed that one in five respondents may be unwilling to send their child back to school should schools re-open again for this academic year. Because school closures have a significant impact on public mental health and wellbeing (20) and may exacerbate inequalities (62, 63), this should be taken into account when considering future risk mitigation strategies to minimise virus transmission in the community and educational settings.

The principal limitation of our study was the lack of follow-up, and not recording information about household income and demographic and lifestyle factors such as nutrition, smoking, use of alcohol and recreational drugs which may have enabled a fuller exploration of the factors that could influence the primary outcome measures examined. Further, the demographic profile of study participants largely consisted of white and employed female parents implying that this cross-section may not be representative of the wider UK parent population. We also acknowledged that since this was an online survey, we may have excluded parents with little or no digital access. These limitations restrict the generalisability of our findings to the wider population of parents across the UK. In spite of these limitations, our findings echo the results of other studies which show that lockdown measures are negatively impacting the public mental health of individuals across all age groups and may be significantly increasing the prevalence of social isolation and loneliness (18-20).

Parents of school-age children remain an understudied population, especially in that they are raising the “next generation” of yound adults. The mental health of parents during the lockdown is of major importance because it can significantly impact the psycho-social development and mental health of their children. The extraordinary measures introduced to control the COVID-19 pandemic have exacerbated pre-existing inequalities within society (80). When coupled with social distancing measures, the school closures have negatively impacted the mental health of school children and their parents and increased the prevalence of social isolation and loneliness in the community setting.

Conclusions

School closures and social distancing measures implemented during the first 100 days of the COVID-19 lockdown significantly impacted the daily routines of many people and influenced various aspects of government policy. Policy prescriptions and public health messaging should promote the adoption of good health-seeking self-care behaviours such as increased levels of physical activity and the maintenance of good

sleep hygiene practices to help prevent or reduce the risk of social isolation and loneliness, and this applies in particular where there is a single parent. Policy makers need to balance the impact of school closures on children and their families, and any future risk mitigation strategies should ideally not be a further disadvantage to the most vulnerable groups in society.

Acknowledgements: The authors thank Mr David Collins (Head Teacher) and the Governing Board of Brackenbury Primary School for disseminating the survey

Author Contributors: All authors provided substantial contributions to the conception (AEO, CVH, HM), design (AEO, EB, CVH), acquisition (IW, AA, ER), and interpretation (EB, IW, HM, AM) of study data and approved the final version of the paper. AEO took the lead in planning the study with support from co-authors. EB carried out the data analysis with support from AA. AEO is the guarantor.

Data sharing statement
No additional data are available

Funding: No funding was received. Austen El-Osta & Azeem Majeed are supported by the National Institute for Health Research (NIHR) Applied Research Collaboration (ARC) North West London. The views expressed are those of the authors and not necessarily those of the NHS or the NIHR or the Department of Health and Social Care

Competing interests: None

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Supplementary table 1: Prevalence of low, moderate and high levels of loneliness (UCLATILS and DMOL) in relation to respondent characteristics

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
PARENT CHARACTERISTICS																
How many children do you have									0.35							0.24
1	251	(100.0)	80	(31.9)	67	(26.7)	104	(41.4)		126	(50.2)	89	(35.5)	36	(14.3)	
2	649	(100.0)	222	(34.2)	184	(28.4)	243	(37.4)		351	(54.7)	222	(34.6)	69	(10.7)	
3	244	(100.0)	(86	(35.2)	70	(28.7)	88	(36.1)		130	(54.2)	73	(30.4)	37	(15.4)	
4	50	(100.0)	14	(28.0)	11	(22.0)	25	(50.0)		23	(46.9)	18	(36.7)	8	(16.3)	
5+	18	(100.0)	5	(27.8)	2	(11.1)	11	(61.1)		7	(38.9)	6	(33.3)	5	(27.8)	
Does partner work?									0.09							<0.001
Yes	995	(100.0)	348	(35.0)	284	(28.5)	363	(36.5)		560	(56.9)	318	(32.3)	107	(10.9)	
No	146	(100.0)	43	(29.5)	36	(24.7)	67	(45.9)		56	(38.9)	56	(38.9)	32	(22.2)	
Key worker									0.07							0.03
Yes	213	(100.0)	77	(36.2)	65	(30.5)	71	(33.3)		121	(57.6)	69	(32.9)	20	(9.5)	
No	394	(100.0)	125	(31.7)	100	(25.4)	169	(42.9)		201	(51.1)	124	(31.6)	68	(17.3)	
Physical activity levels before the lockdown									0.08							0.02
Low	63	(100.0)	27	(42.9)	13	(20.6)	23	(36.5)		41	(66.1)	14	(22.6)	7	(11.3)	
Medium	626	(100.0)	215	(34.4)	186	(29.7)	225	(35.9)		347	(56.2)	196	(31.7)	75	(12.1)	
High	505	(100.0)	161	(31.9)	129	25.5)	215	(42.6)		241	(48.0)	192	(38.3)	69	(13.8)	
Videocall reduces SI									<0.001							0.02
Yes	825	(100.0)	245	(29.7)	238	(28.9)	342	(41.5)		411	(50.2)	296	(36.2)	111	(13.6)	
No	375	(100.0)	159	(42.4)	91	(24.3)	125	(33.3)		219	(59.0)	110	(29.7)	42	(11.3)	
Videocall reduces loneliness									<0.001							<0.001
Yes	712	(100.0)	194	(27.3)	204	(28.7)	314	(44.1)		339	(48.0)	266	(37.6)	102	(14.4)	
No	464	(100.0)	201	(43.3)	121	(26.1)	142	30.6)		285	(62.0)	128	(27.8)	47	(10.2)	
Depression due to lockdown									<0.001							<0.001
Yes	523	(100.0)	82	(15.7)	124	(23.7)	317	(60.6)		151	(29.0)	236	(45.3)	134	(25.7)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
No	672	(100.0)	316	(47.0)	207	(30.8)	149	(22.2)		477	(72.1)	166	(25.1)	19	(2.9)	
Cancelation of the exams									0.77							0.04
Unhappy	276	(100.0)	89	(32.3)	77	(27.9)	110	(39.9)		126	(45.8)	104	(37.8)	45	(16.4)	
Neutral	793	(100.0)	267	(33.7)	215	(27.1)	311	(39.2)		429	(54.8)	260	(33.2)	94	(12.0)	
Happy	130	(100.0)	49	(37.7)	37	(28.5)	44	(33.9)		76	(58.9)	41	(31.8)	12	(9.3)	
Preference of online exams									0.38							0.86
Yes	494	(100.0)	158	(32.0)	140	(28.3)	196	(39.7)		261	(53.3)	164	(33.5)	65	(13.3)	
No	644	(100.0)	231	(35.9)	176	(27.3)	237	(36.8)		347	(54.6)	211	(33.2)	78	(12.3)	
Sending child to school after lockdown									0.20							0.09
Very unhappy	100	(100.0)	39	(39.0)	23	(23.0)	38	(38.0)		54	(55.7)	28	(28.9)	15	(15.5)	
Unhappy	158	(100.0)	59	(37.3)	48	(30.4)	51	(32.3)		89	(58.2)	48	(31.4)	16	(10.5)	
Neither unhappy nor happy	230	(100.0)	86	(37.4)	64	(27.8)	80	(34.8)		130	(57.0)	69	(30.3)	29	(12.7)	
Happy	363	(100.0)	108	(29.8)	95	(26.2)	160	(44.1)		170	(46.8)	149	(41.0)	44	(12.1)	
Very happy	353	(100.0)	115	(32.6)	101	(28.6)	137	(38.8)		193	(54.8)	111	(31.5)	48	(13.6)	
CHILD CHARACTERISTICS																
Type of school									0.38							0.07
State school	1082	(100.0)	356	(32.9)	302	(27.9)	424	(39.2)		559	(52.2)	366	(34.2)	146	(13.6)	
Private school	128	(100.0)	50	(39.1)	32	(25.0)	46	(35.9)		77	(60.6)	41	(32.3)	9	(7.1)	
Private tuition									0.94							0.08
Yes	115	(100.0)	40	(34.8)	32	(27.8)	43	(37.4)		70	(60.9)	37	(32.2)	8	(7.0)	
No	1095	(100.0)	366	(33.4)	302	(27.6)	427	(39.0)		566	(52.3)	371	(34.3)	146	(13.5)	
Time spent studying									0.04							<0.001
≤2 hours	439	(100.0)	130	(29.6)	112	(25.5)	197	(44.9)		195	(44.8)	157	(36.1)	83	(19.1)	
2-4 hours	365	(100.0)	124	(34.0)	109	(29.9)	132	(36.2)		202	(55.8)	119	(32.9)	41	(11.3)	
≥4 hours	386	(100.0)	146	(37.8)	108	(28.0)	132	(34.2)		231	(60.5)	124	(32.5)	27	(7.1)	
Boredom									<0.001							<0.001

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
Low	74	(100.0)	40	(54.1)	16	21.6)	18	(24.3)		50	(68.5)	18	(24.7)	5	(6.8)	
Medium	396	(100.0)	165	(41.7)	117	(29.5)	114	(28.8)		250	(63.5)	116	(29.4)	28	(7.1)	
High	734	(100.0)	200	(27.2)	199	(27.1)	335	(45.6)		334	(45.9)	273	(37.6)	120	(16.5)	
Stress									<0.001							<0.001
Low	213	(100.0)	115	(54.0)	54	(25.4)	44	(20.7)		159	(75.7)	41	(19.5)	10	(4.8)	
Medium	531	(100.0)	190	(35.8)	158	(29.8)	183	(34.5)		308	(58.6)	177	(33.7)	41	(7.8)	
High	457	(100.0)	98	(21.4)	120	(26.3)	239	(52.3)		166	(36.4)	188	(41.2)	102	(22.4)	
Signs of depression									<0.001							<0.001
Yes	146	(100.0)	30	(20.5)	35	(24.0)	81	(55.5)		54	(37.0)	59	(40.4)	33	(22.6)	
No	297	(100.0)	128	(43.1)	85	(28.6)	84	(28.3)		194	(65.8)	87	(29.5)	14	(4.7)	
Children complaining of feeling social isolated or lonely									<0.001							<0.001
Yes	521	(100.0)	85	(16.3)	137	(26.3)	299	(57.4)		170	(32.8)	231	(44.6)	117	(22.6)	
No	685	(100.0)	321	(46.9)	196	(28.6)	168	(24.5)		466	(68.9)	175	(25.9)	35	(5.2)	
Physical activity levels before the lockdown									0.27							0.30
Low	17	(100.0)	3	(17.6)	6	(35.3)	8	(47.1)		10	(62.5)	3	(18.8)	3	(18.8)	
Medium	281	(100.0)	108	(38.4)	77	(27.4)	96	(34.2)		159	(57.0)	86	(30.8)	34	(12.2)	
High	901	(100.0)	290	(32.2)	247	(27.4)	364	(40.4)		462	(51.7)	317	(35.5)	115	(12.9)	
Physical activity levels during the lockdown									0.44							0.62
Low	174	(100.0)	56	(32.2)	41	(23.6)	77	(44.3)		83	(48.3)	66	(38.4)	23	(13.4)	
Medium	715	(100.0)	231	(32.3)	203	(28.4)	281	(39.3)		376	(53.0)	246	(34.6)	88	(12.4)	
High	304	(100.0)	111	(36.5)	85	(28.0)	108	(35.5)		168	(55.8)	92	(30.6)	41	(13.6)	
Readiness to undertake exams									<0.001							<0.001
Ready	217	(100.0)	83	(38.2)	51	(23.5)	83	(38.2)		285	(46.2)	233	(37.8)	99	(16.0)	
Neutral	279	(100.0)	123	(44.1)	71	(25.4)	85	(30.5)		184	(66.2)	77	(27.7)	17	(6.1)	
Unready	627	(100.0)	178	(28.4)	186	(29.7)	263	(41.9)		126	(58.3)	65	(30.1)	25	(11.6)	

Appendix 1: Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

Item Category	*Checklist Item*	*Page Number*	*Description*
Design	Study design	4	The target population were adult (aged 18 years and over) parents and legal guardians of children who were attending primary or secondary education in the UK.
IRB (Institutional Review Board) approval and informed consent process	IRB approval	6	The study was given ethical approval by the Head of Imperial College London PCPH Department, Professor Azeem Majeed, and by the Joint Research Compliance Office under the Imperial College Research Ethics Committee process (approval 20IC5978 ICREC HOD JRCO)
	Informed consent	4 and 5	The link to the Participant Information Sheet was accessible on the eSurvey page and sent to heads of schools who were contacted. The PIS included information regarding the study such as the protection of the participants' personal data, their right to withdraw from the study at any time, the length of time of the survey, which data were stored, where and for how long, who the investigator was, and the purpose of the study. They were informed this was a voluntary survey without any monetary incentives but with offering the possibility to access the results and underlying the potential collective benefits of taking parts in terms of knowledge and policies. The first question of the survey asked participants to confirm their consent to participate in the eSurvey.
	Data protection	5	The data collected were stored on the Imperial secure database and only the team researchers could access the eSurvey results.
Development and pre-testing	Development and testing	4 and 5	The study protocol and online survey were developed in collaboration with the Governing Board of Brackenbury Primary School in the London Borough of Hammersmith & Fulham. The online survey technical functionality was tested before being published.
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	4	This was an open survey using a snowball sampling.
	Contact mode	4	Part of the potentially eligible participants received an invitation email from the head teacher of schools where study information was disseminated including the Participant Information Sheet and link to the survey. The researchers' personal and professional networks were also mobilized through email and other messaging applications such as WhatsApp to respond and further disseminate the eSurvey among eligible participants.
	Advertising the survey	4	The study was advertised through head teachers of schools and researchers' networks
Survey	Web/E-mail	4	The survey was hosted by the Imperial College Qualtrics platform.

Administration	Context	p 10	The Head Teacher of Brackenbury Primary School disseminated the survey to parents of that school to give parents the opportunity to reflect on an issue that is important to them given the nature of the study. This was a 'right-in-time' study earmarked for recruitment *during* the lockdown
	Mandatory/voluntary	5	This was a voluntary survey
	Incentives	4 and 5	Participants were informed in the PIC that no monetary incentives were offered but non-monetary incentives such as the possibility to access the results and the potential collective benefits of taking parts in terms of knowledge and policies were mentioned.
	Time/Date	4	The survey was accessible for a period of 9 weeks from 14 May 2020 to 4 July 2020.
	Randomization of items or questionnaires	-	No randomization of items was used.
	Adaptive questioning	-	No adaptive questioning of items was used.
	Number of Items	5	The survey comprised a total of 51 questions.
	Number of screens (pages)	5	All questions were displayed on one page and was accessible using a personal computer or smartphone.
	Completeness check	4	Most items provided a non-response option such as "not applicable" or "rather not say", though not all. Selection of a response option to questions was not forced but were all fully completed. Analysis was conducted on fully completed questionnaires.
	Review step	5	Participants could review their answers before submitting them.
Response rates	Unique site visitor	-	Not applicable as response rates were not calculated.
	View rate	-	Not applicable as response rates were not calculated.
	Participation rate	-	Not applicable as response rates were not calculated.
	Completion rate	-	Not applicable as response rates were not calculated.
Preventing multiple entries from the same individual	Cookies used	-	No cookies were used.
	IP check	-	Qualtrics registered the IP address of respondents and did not allow a respondent for completing another survey from the same IP address for a period of one week.
	Log file analysis	-	No log files analysis.
	Registration	-	No registration.
Analysis	Handling of incomplete questionnaires	-	Only completed questionnaires were included in the final dataset.

	Questionnaires submitted with an atypical timestamp	-	Not applicable
	Statistical correction	-	None

BMJ Open

How is the COVID-19 lockdown impacting the mental health of parents of school-age children in the United Kingdom? A cross-sectional online survey

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2020-043397.R2
Article Type:	Original research
Date Submitted by the Author:	26-Apr-2021
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Primary Subject Heading:	Public health
Secondary Subject Heading:	Health policy, Epidemiology, Qualitative research
Keywords:	PUBLIC HEALTH, MENTAL HEALTH, EPIDEMIOLOGY

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How is the COVID-19 lockdown impacting the mental health of parents of school-age children in the United Kingdom?
A cross-sectional online survey

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Word count: 3866

ABSTRACT

Objective
Investigate the impact of the COVID-19 lockdown on feelings of loneliness and social isolation in parents of school-age children

Design
Cross sectional online survey of parents of primary and secondary school-age children

Setting
Community setting

Participants
1214 parents of school-age children in the United Kingdom

Methods
An online survey explored the impact of lockdown on the mental health of parents with school-age children, and in particular about feelings of social isolation and loneliness. Associations between the UCLA three-item Loneliness Scale (UCLATILS), the Direct Measure of Loneliness (DMOL) and the characteristics of the study participants were assessed using ordinal logistic regression models

Main outcome measures
Self-reported measures of social isolation and loneliness using UCLATILS and DMOL.

Results
Half of respondents felt they lacked companionship, 45% had feelings of being left out, 58% felt isolated and 46% felt lonely. The factors that were associated with higher levels of loneliness on UCLATILS were female gender, parenting a child with special needs, lack of a dedicated space for distance learning, disruption of sleep patterns and low levels of physical activity during the lockdown. Factors associated with a higher DMOL were female gender, single-parenting, parenting a child with special needs, unemployment, low physical activity, lack of a dedicated study-space and disruption of sleep patterns during the lockdown.

Conclusions
The COVID-19 lockdown has increased feelings of social isolation and loneliness among parents of school-age children. Two modifiable health seeking lifestyle behaviours (increased levels of physical activity and the maintenance of good sleep hygiene practices) were identified as key factors in reducing feelings of social isolation and loneliness during lockdown.

Article summary

Strengths and limitations of this study

- We surveyed 1214 parents of school-age children to assess the impact of lockdown measures on feelings of social isolation and loneliness
- We assessed direct and indirect measures of loneliness using the Direct Measure of Loneliness recommended by the Office of National Statistics and the validated UCLA 3-item Loneliness Scale, and used Cohen's kappa to determine whether both measures of loneliness are correlated
- We collected data on mental health, physical activity levels and other lifestyle factors in the first 100 days of the lockdown
- A key limitation of the study was lack of follow-up which restricted the assessment of the trajectory of feelings of social isolation and loneliness over time
- School closures have a significant impact on the mental health of parents of school-age children, and this should be taken into account when considering future COVID-19 risk mitigation strategies

INTRODUCTION

The COVID-19 pandemic has affected educational systems worldwide, leading to the near-total closures of educational institutions in the United Kingdom. As of 6 May 2020, schools were suspended in 177 countries affecting over 1.3 billion learners worldwide (1), and in many cases closures have resulted in the universal cancellation of examinations (2, 3). UNICEF estimated that almost four months of education will be lost as a result of the lockdown (4). School closures have far-reaching economic and societal consequences, including the disruption of everyday behaviours and routines. In the UK, over two million workers have already lost their jobs (5, 6), and although the long-term impact of the pandemic on education is not yet clear, the pre-existing attainment gap between the poorest and richest children (7) may widen significantly as a result of COVID-19 (4, 8, 9). Children and young people make up 21% of the population of England (10), and by the time they returned to school after the summer break, some would have been out of education for nearly six months.

Lockdown measures significantly limit social interactions, opportunities for social intercourse or the ability to receive the social support needed to promote mental well-being (11). The temporary closure of schools also means that children miss out on vital social skills and physical activity which may cause further detriment to their mental health and the quality of their social interaction with their parents and other members of the household (12). Loss of routine social contact could also lead to different patterns of social response (13, 14) whilst increasing feelings of social isolation and loneliness (15-17). There is growing concern over the impact of school closures on the mental health and well-being of parents and school-age children (18-20), and in particular about increasing feelings of social isolation and loneliness (21).

The impact of loneliness on public mental health is well characterised (22), and includes depression (23, 24), anxiety (25) and suicide (26, 27), and is also linked with

cardiovascular conditions (28, 29) and cancer (30). Prolonged periods of loneliness and social isolation are also associated with future mental health problems up to 9 years later (31), including a strong association with depression (32) and stress (33). Although acknowledged to be different concepts, social isolation and loneliness may affect people of all ages (34), and the terms are used interchangeably such that they are often considered together (35). There have been numerous attempts in the literature to identify predictors of loneliness (31, 36, 37), but this subjective phenomenon remains difficult to measure, and its prevalence is thought to be significantly under-represented. Known predictors of loneliness include living alone, living in rented accommodation, household size, education level, self-reported health measures and, paradoxically, living in population-dense areas.

The measurement of social isolation and loneliness is challenging as it is largely subjective and qualitative in nature (38). The UK Office for National Statistics (ONS) recommends the use of the validated UCLA three-item loneliness scale (UCLATILS) as an indirect measure for loneliness, and an additional Direct Measure of Loneliness (DMOL) question (39). ONS recommends attempting to harmonise these indicators across the UK Government Statistical Service, but the recency of the recommendations may be a reason behind the lack of standardised and retrospective data on loneliness in the UK. Although both scores measure loneliness, they are fundamentally different. The composite score of UCLATIS measures general and indirect loneliness and feelings of social isolation, whereas the DMOL is a separate (single item) measure that assesses the current/temporal feeling of loneliness by the respondent and is recommended for use by ONS

Successful interventions aimed at tackling social isolation and loneliness include leveraging existing community assets such as parks and green spaces, befriending schemes, skill development strategies, psychological therapies (40-43). The UK government published its first Loneliness Strategy in October 2018, signalling the first important step in tackling this rising problem of society. Preventative measures that can be implemented to reduce the risk of social isolation and loneliness and bridge social distancing during lockdown include the use of digital technologies. China and Singapore established various initiatives to minimise outbreak-related stress and poor mental wellbeing including the deployment of enhanced social support networks and psychological services that could be delivered online (44-46). Teachers can also play an important role in alleviating a child's sense of isolation at school (47, 48), but the extent to which this can be accomplished with live or online lessons through remote learning remains unclear. Reports have already documented loneliness in the elderly as a result of the COVID-19 lockdown (49), but research regarding this aspect of mental health on parents with school-age children during the pandemic is scarce in the first 100 days after the lockdown and this population remains largely understudied.

Study objectives

The aim of this study was to explore how the lockdown is affecting the mental health of parents of school-age children, and in particular to assess the impact of an extended period of school closures on feelings of social isolation & loneliness.

METHODS

Study design

We conducted a cross-sectional online survey of adult parents and legal guardians of children who were attending primary or secondary education in the UK.

The link to the electronic survey was published and available on the Imperial College Qualtrics platform between 29 May and 11 July 2020 (6 weeks). The survey was open and could be accessed by anyone with a link. Potentially eligible participants received an invitation email from the study team, and the head teacher of Brackenbury Primary School also disseminated the email and link to his counterparts in other schools. Study information was disseminated including the Participant Information Sheet (PIS) and link to the survey. The researchers' personal and professional networks were also mobilized to respond and further disseminate the eSurvey among eligible participants. The PIS included information regarding the study's aims, the protection of participants' personal data, their right to withdraw from the study at any time, which data were stored, where and for how long, who the investigator was, the purpose of the study and survey length. Participants were informed that this was a voluntary survey without any monetary incentives but offering the possibility to access the findings at a later stage whilst underlying the potential collective benefits of taking part in terms of helping advance knowledge in this area and the formulation of future policies to tackle the COVID-19 pandemic. The data collected were stored on the Imperial College London secure database and only the team researchers could access the eSurvey results.

The survey comprised a total of 51 questions displayed on one page and was accessible using a personal computer or smartphone. Questions regarding demographic characteristics of the users included information on gender, age, ethnicity, educational level, number of people living in the household, first part of postal code and employment status. Participants could review their answers before submitting them. All data collected through the survey were anonymised and not personally identifiable. The online survey technical functionality was tested before being published. The first question asked participants to confirm their consent to participate in the eSurvey.

Experiences and perceptions related to the impact of the lockdown on the mental health of parents and other members of their household were evaluated through a number of questions concerning self-reported or perceived levels of depression, stress, feeling of loneliness, social isolation and boredom. Indirect measures of loneliness were measured using the validated UCLA 3-item Loneliness Scale (UCLATILS) with responses never/hardly ever (score of 1), some of the time (score of 2), and often (score of 3) (50). The questions were each scored 1 to 3, then totalled to a score ranging from 3 to 9. Indirect measure of loneliness using UCLATILS was subsequently categorized as follows: no loneliness (score =3), moderate loneliness (score = 4-6), and severe loneliness (score = 7-9). An additional one item Direct Measure of Loneliness (DMOL) was also used as recommended by the Office of National Statistics (51). Questions concerning users' experiences were scored on a 1-5 Likert scale. Respondents were able to refrain from providing an answer by selecting 'no opinion'. Such answers were treated as missing data in all the analyses (listwise exclusion) but due to the small number of missingness (<1.5%) the data were not

imputed (52, 53). The association of the two scores was tested using the Cohen's kappa test of agreement.

The survey included eleven additional questions to explore perceptions of feelings of social isolation pre- and post-school closures. Perceptions on remote learning were explored through questions related to whether or not their child received regular homework, live or online lessons, had access to technology (personal computer, tablet or phone), time spent studying, and whether the child had access to a dedicated space to study. Perceptions on the impact of school closures on the lifestyle behaviours of respondents and their school children were recorded by asking questions relating to pre- and post-lockdown self-reported measures of physical activity levels of both parents and children, the children's sleeping patterns and how children spent their leisure time. The quality of the survey was assessed by completing the Checklist for Reporting Results of Internet E-Surveys (CHERRIES).

Statistical analysis

Analyses were conducted separately for the UCLATILS and DMOL as recommended by the ONS (51). Parent and child characteristics were described using frequencies and percentages. Pearson's chi-square test was used to identify differences of statistical significance. Associations between the UCLATILS, DMOL and the characteristics of the study participants were assessed using ordinal logistic regression models. The factors that were significant in the univariable models (p-value <0.05) were considered in the multivariable analyses. All analyses were performed using Stata 15 statistical software (StataCorp).

Ethics

The study was given ethical approval by Imperial College Research Ethics Committee (ICREC # 20IC5978). Participants consented to take part in the survey.

Patient and Public Involvement

No patient was involved. The study protocol and online survey were developed in collaboration with the Governing Board of Brackenbury Primary School in the London Borough of Hammersmith & Fulham where the lead author is also a co-opted School governor

RESULTS

Demographic profile of respondents

The electronic survey captured responses from 1214 respondents from across England **(Table 1).** More than half (53.1%) were aged 40-49 years, whereas 2.5%, 29.2%, 14.4% and 0.9% were in the second, third, fifth or sixth decade of age respectively. Eighty seven percent of respondents were female, and 80.5% identified as white ethnic background. Sixty six percent were educated to university degree, 70.9% were in full or part-time employment and 87.1% had a partner that was employed. A fifth (20.8%) had one child, 53.5% had two children, and 25.8% had three or more children. Only 3.8% were a single parent family, whereas 75.3% of respondents were living in households consisting of 4 or more people.

School and children characteristics

Nine out of ten (89.5%) children attended a state funded school. More than half (54.1%) of respondents had a child receiving primary education, 22.3% in secondary school and 23.6% had more than one child, one attending either primary or secondary schools. Eleven percent of respondents had a child a special educational need or disability (SEND) . Sixty eight percent indicated that their child had access to a dedicated space where they can learn or study at home. The vast majority (97.9%) of children had access to a personal computer, laptop, tablet or smartphone, of whom 54.0% had their own devices and 43.9% did not have their own but could access devices belonging to other members of their household and two percent did not have access to any technology. Remote learning was accessed by 90.7% of children, but only 47.7% of respondents reported their child was receiving live or online lessons. Only 9.5% of children received private tuition. The time spent on remote learning ranged between 0-8 hours per day, with 36.8% studying for less than 2 hours, 30.7% studying between 2-4 hours and 32.5% studding more than 4 hours.

Mental health and physical wellbeing

The vast majority of respondents felt their children were experiencing medium to high levels of boredom (93.8%) and medium or high levels of stress (82.3%) during the lockdown compared to before school closures. Almost half of the participants (48.1%) have reported a shift in the sleeping pattern of children by staying up until much later in the evening during the lockdown. Only 37.2% of respondents reported that the sleeping patterns of their children did not change during the lockdown. Forty-five percent reported that their levels of physical activity were low during the lockdown. Seventy percent of respondents felt that school closures also reduced the physical activity of their child.

Table 1: Respondent characteristics

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
PARENT CHARACTERISTICS																
Age group									0.05							0.004
20-29	30	(100.0)	6	(20.0)	10	(33.3)	14	(46.7)		9	(30.0)	13	(43.3)	8	(26.7)	
30-39	354	(100.0)	122	(34.5)	85	(24.0)	147	(41.5)		166	(47.6)	127	(36.4)	56	(16.0)	
40-49	643	(100.0)	202	(31.4)	184	(28.6)	257	(40.0)		346	(54.3)	219	(34.4)	72	(11.3)	
50-59	174	(100.0)	73	(42.0)	52	(29.9)	49	(28.2)		109	(63.0)	46	(26.6)	18	(10.4)	
60+	11	(100.0)	4	(36.4)	3	(27.3)	4	(36.4)		7	(63.6)	3	(27.3)	1	(9.1)	
Gender									<0.001							0.002
Male	149	(100.0)	75	(50.3)	31	(20.8)	43	(28.9)		99	(66.4)	39	(26.2)	11	(7.4)	
Female	1062	(100.0)	331	(31.2)	303	(28.5)	428	(40.3)		537	(51.1)	369	(35.1)	144	(13.7)	
Ethnicity									0.23							0.42
White	962	(100.0)	322	(33.5)	269	(28.0)	371	(38.6)		512	(53.7)	322	(33.8)	120	(12.6)	
Black	25	(100.0)	7	(28.0)	5	(20.0)	13	(52.0)		11	(45.8)	8	(33.3)	5	(20.8)	
Asian	101	(100.0)	27	(26.7)	25	(24.8)	49	(48.5)		43	(43.4)	39	(39.4)	17	(17.2)	
Mixed/other	107	(100.0)	42	(39.3)	30	(28.0)	35	(32.7)		60	(56.6)	34	(32.1)	12	(11.3)	
Level of education									0.15							0.004
Secondary school	274	(100.0)	92	(33.6)	67	(24.5)	115	(42.0)		125	(46.3)	95	(35.2)	50	(18.5)	
Diploma	127	(100.0)	40	(31.5)	34	(26.8)	53	(41.7)		64	(51.2)	42	(33.6)	19	(15.2)	
Bachelor's Degree	446	(100.0)	151	(33.9)	126	(28.3)	169	(37.9)		234	(53.1)	155	(35.1)	52	(11.8)	
Master's Degree	264	(100.0)	81	(30.7)	77	(29.2)	106	(40.2)		152	(57.8)	90	(34.2)	21	(8.0)	
Doctorate	88	(100.0)	39	(44.3)	28	(31.8)	21	(23.9)		58	(65.9)	21	(23.9)	9	(10.2)	
Employment									0.15							0.001
Employed full-time	479	(100.0)	168	(35.1)	143	(29.9)	168	(35.1)		264	(55.5)	158	(33.2)	54	(11.3)	
Employed part-time	372	(100.0)	121	(32.5)	98	(26.3)	153	(41.1)		189	(51.2)	133	(36.0)	47	(12.7)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
Self-employed	182	(100.0)	63	(34.6)	52	(28.6)	67	(36.8)		107	(59.4)	59	(32.8)	14	(7.8)	
Not working**	170	(100.0)	53	(31.2)	37	(21.8)	80	(47.1)		74	(44.3)	55	(32.9)	38	(22.8)	
Number of people in the household									0.37							0.024
2	45	100.0)	11	(24.4)	11	(24.4)	23	(51.1)		13	(28.9)	21	(46.7)	11	(24.4)	
3	249	100.0)	85	(34.1)	66	(26.5)	98	(39.4)		136	(54.6)	76	(30.5)	37	(14.9)	
4	597	100.0)	201	(33.7)	173	(29.0)	223	(37.4)		323	(54.9)	202	(34.4)	63	(10.7)	
5	208	(100.0)	76	(36.5)	58	(27.9)	74	(35.6)		114	(55.3)	63	(30.6)	29	(14.1)	
6+	94	(100.0)	29	(30.9)	20	(21.3)	45	(47.9)		46	(49.5)	35	(37.6)	12	(12.9)	
Physical activity levels during the lockdown									0.001							<0.001
Low	176	(100.0)	48	(27.3)	50	(28.4)	78	(44.3)		85	(48.9)	51	(29.3)	38	(21.8)	
Medium	575	(100.0)	178	(31.0)	153	(26.6)	244	(42.4)		279	(48.9)	220	(38.5)	72	(12.6)	
High	436	(100.0)	175	(40.1)	123	(28.2)	138	(31.7)		262	(60.9)	126	(29.3)	42	(9.8)	
CHILD CHARACTERISTICS																
Level of schooling									0.04							0.001
Primary	656	(100.0)	209	(31.9)	171	(26.1)	276	(42.1)		319	(49.1)	226	(34.8)	105	(16.2)	
Secondary	270	(100.0)	106	(39.3)	78	(28.9)	86	(31.9)		165	(61.1)	81	(30.0)	24	(8.9)	
Both (I have ≥1 child)	285	(100.0)	91	(31.9)	85	(29.8)	109	(38.3)		152	(54.5)	101	(36.2)	26	(9.3)	
Special needs									0.009							0.008
Yes	133	(100.0)	35	(26.3)	30	(22.6)	68	(51.1)		53	(40.8)	53	(40.8)	24	(18.5)	
No	1077	(100.0)	371	(34.4)	304	(28.2)	402	(37.3)		583	(54.6)	354	(33.1)	131	(12.3)	
Dedicated space to study									0.001							<0.001
Yes	831	(100.0)	304	(36.6)	230	(27.7)	297	(35.7)		476	(57.8)	256	(31.1)	91	(11.1)	
No	379	(100.0)	102	(26.9)	104	(27.4)	173	(45.6)		160	(42.7)	151	(40.3)	64	(17.1)	
Access to technology									0.02							<0.001
Yes	653	(100.0)	240	(36.8)	173	(26.5)	240	(36.8)		380	(58.8)	195	(30.2)	71	(11.0)	
Yes, but not their own	532	(100.0)	162	(30.5)	157	(29.5)	213	(40.0)		253	(47.8)	202	(38.2)	74	(14.0)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
No	25	(100.0)	5	(20.0)	4	(16.0)	16	(64.0)		4	(17.4)	10	(43.5)	9	(39.1)	
In receipt of distance learning									0.46							0.03
Yes	1101	(100.0)	375	(34.1)	301	(27.3)	425	(38.6)		589	(54.0)	368	(33.8)	133	(12.2)	
No	110	(100.0)	31	(28.2)	33	(30.0)	46	(41.8)		47	(43.1)	40	(36.7)	22	(20.2)	
In receipt of live/online lessons									0.24							0.001
Yes	409	(100.0)	142	(34.7)	116	(28.4)	151	(36.9)		234	(57.6)	133	(32.8)	39	(9.6)	
No	449	(100.0)	139	(31.0)	119	(26.5)	191	(42.5)		210	(47.1)	160	(35.9)	76	(17.0)	
Sleeping pattern									<0.001							<0.001
No major change in sleeping pattern	449	(100.0)	187	(41.6)	128	(28.5)	134	(29.8)		285	(63.9)	123	(27.6)	38	(8.5)	
Slight change	168	(100.0)	61	(36.3)	44	(26.2)	63	(37.5)		90	(54.9)	53	(32.3)	21	(12.8)	
child now sleeps much later in the evening	580	(100.0)	153	(26.4)	158	(27.2)	269	(46.4)		253	(44.0)	229	(39.8)	93	(16.2)	
child now sleeping much earlier in the evening	9	(100.0)	4	(44.4)	3	(33.3)	2	(22.2)		7	(77.8)	1	(11.1)	1	(11.1)	

Table 2: Univariable and multivariable association of three-item UCLATILS with characteristics of study participants

	Univariable		Multivariable	
	OR (95) CI)	**p-value**	**Adjusted OR (95) CI)**	**p-value**
Age				
50+	*Ref.*		*Ref.*	
20-39	1.56 (1.12, 2.16)	0.008	1.26 (0.85, 1.86)	0.24
40-49	1.59 (1.18, 2.16)	0.003	1.38 (0.98, 1.94)	0.07
Gender of the parent				
Male	*Ref.*		*Ref.*	
Female	2.03 (1.46, 2.82)	<0.001	1.82 (1.29, 2.57)	0.001
Level of schooling				
Secondary	*Ref.*		*Ref.*	
Primary	1.41 (1.08, 1.83)	0.011	1.28 (0.94, 1.75)	0.12
Both (more than 1 child)	1.32 (0.97, 1.79)	0.079	1.13 (0.81, 1.59)	0.47
Access to technology				
Yes	*Ref.*		*Ref.*	
No	2.51 (1.11, 5.71)	0.03	1.62 (0.70, 3.74)	0.26
Special needs				
No	*Ref.*		*Ref.*	
Yes	1.66 (1.18, 2.35)	0.004	1.44 (1.01, 2.06)	0.04
Dedicated space				
Yes	*Ref.*		*Ref.*	
No	1.52 (1.21, 1.91)	<0.001	1.33 (1.04, 1.69)	0.02
Change in the sleeping patterns				
No	*Ref.*		*Ref.*	
Slight disruption	1.31 (0.94, 1.82)	0.110	1.27 (0.91, 1.78)	0.16
Marked disruption*	1.95 (1.55, 2.46)	<0.001	1.90 (1.50, 2.41)	<0.001
Physical activity level of the parent during the lockdown				
High	*Ref.*		*Ref.*	
Low	1.77 (1.28, 2.45)	0.001	1.53 (1.09, 2.14)	0.01
Medium	1.56 (1.24, 1.97)	<0.001	1.45 (1.14, 1.84)	0.002

*Applies to children who's sleeping pattern changed and slept much earlier or later than prior to lockdown

Table 3: Univariable and multivariable association of ONS Direct Measure of Loneliness (DMOL) score with characteristics of study participants

	Univariable		Multivariable	
	OR (95) CI)	p-value	Adjusted OR (95) CI)	p-value
Age				
50+	*Ref.*		*Ref.*	
20-39	1.98 (1.38, 2.85)	<0.001	1.47 (0.95, 2.27)	0.09
40-49	1.37 (0.97, 1.92)	0.07	1.22 (0.83, 1.79)	0.32
Gender of the parent				
Male	*Ref.*		*Ref.*	
Female	1.88 (1.31, 2.71)	0.001	1.52 (1.03, 2.24)	0.03
Education				
University degree or higher	*Ref.*		*Ref.*	
Secondary school or high school diploma	1.50 (1.18, 1.90)	0.001	1.27 (0.98, 1.64)	0.07
Employment status				
Employed	*Ref.*		*Ref.*	
Unemployed*	1.83 (1.32, 2.53)	<0.001	1.70 (1.21, 2.38)	0.002
Physical activity level of the parent during the lockdown				
High	*Ref.*		*Ref.*	
Medium	1.62 (1.26, 2.08)	<0.001	1.53 (1.18, 1.99)	0.002
Low	1.86 (1.30, 2.64)	0.001	1.53 (1.06, 2.21)	
Number of people at home				
3 or above	*Ref.*		*Ref.*	
Single parent family	2.49 (1.42, 4.39)	0.002	2.12 (1.17, 3.82)	0.01
Level of schooling				
Secondary	*Ref.*		*Ref.*	
Primary	1.65 (1.23, 2.20)	0.001	1.35 (0.96, 1.92)	0.09
Both (more than 1 child)	1.31 (0.94, 1.84)	0.11	1.05 (0.72, 1.53)	0.79
Access to technology				
Yes	*Ref.*		*Ref.*	
No	4.09 (1.86, 8.99)	<0.001	1.60 (0.69, 3.71)	0.28
Special needs				
No	*Ref.*		*Ref.*	
Yes	1.82 (1.28, 2.58)	0.001	1.45 (1.01, 2.08)	0.05
Dedicated space				

	Univariable		Multivariable	
	OR (95) CI)	**p-value**	**Adjusted OR (95) CI)**	**p-value**
Yes	*Ref.*		*Ref.*	
No	1.83 (1.44, 2.33)	<0.001	1.59 (1.23, 2.06)	<0.001
Distance learning				
Yes	*Ref.*		*Ref.*	
No	1.56 (1.06, 2.29)	0.03	1.34 (0.88, 2.03)	0.17
Change in the sleeping patterns				
No	*Ref.*		*Ref.*	
Slightly	1.45 (1.01, 2.09)	0.04	1.41 (0.97, 2.05)	0.07
A lot	2.18 (1.70, 2.81)	<0.001	2.15 (1.65, 2.79)	<0.001

* Unemployed/ Unable to work/Student/Retired

Loneliness and social isolation

The Cohen's kappa test between the direct and indirect measures of loneliness (UCLATIS and DMOL) suggested lack of agreement (kappa= -0.34) and therefore it was deemed important to explore the two scores separately. On the UCLATILS which collected was an indirect measure of loneliness, forty six percent (46.3%) of respondents felt they lacked companionship, whereas 52.4% reported having feelings of being left out, and 58% reported feeling isolated from others (**Table 1; Supplementary table)**. More than half (58.9%) reported they felt lonely often or most of the time on the direct measure (DMOL). Parents reported that 58.5%, 71.0% and 72.2% of children felt they lacked companionship, had feelings of being left out, or feeling isolated from others in that same order, whereas 46.9% showed signs of feeling lonely often or most of the time on DMOL. Overall, 43.3% of respondents confirmed that their children were experiencing feelings of social isolation. More than two thirds (68.8%) felt that video calls where their child could see their teacher could help reduce feelings of social isolation, whereas 60.6% felt this could reduce feelings of loneliness. Overall, 43.9% and 33.0% felt that the lockdown and school closures respectively had caused them and their child to feel significantly more depressed **(Supplementary table).**

UCLA three-item Loneliness Score (UCLATILS)

The multivariable ordinal logistic model suggested that the main factors associated with significantly higher odds of having a higher level of UCLATILS (the indirect measure of loneliness) were female gender of the respondent, having a child with special needs, lack of a dedicated space, a change in the child's sleeping patterns, and having low or medium physical activity during the lockdown **(table 2).** The univariably significant association of age, level of schooling (primary or secondary education) and access to technology with UCLATILS were attenuated and became non-significant in the multivariable model. Compared to male respondents, females were 82% more likely to have a higher score on UCLATILS. Parents of children who had special needs, and those who lacked a dedicated space to study had 44.0% and 33% higher odds of scoring higher on UCLATILS respectively. Parents with a low or medium level of physical activity had 53% and 45% higher odds of reporting a higher UCLATILS respectively compared to respondents who had high levels of physical activity during lockdown **(table 2).** Households who reported a disruption in the sleeping pattern of their children were 90% more likely to report a higher UCLATILS.

Direct Measure of Loneliness (DMOL)

The factors associated with higher DMOL (the direct measure) were gender, employment status, physical activity level, household size, having children with special needs, having dedicated space to study and changes in sleeping patters during the lockdown (**table 3).** In particular, female respondents and those who were unemployed were 52.0% and 70.0% more likely to report a higher DMOL in that same order. Respondents with low or medium levels of physical activity during the lockdown had a 53% increase in the odds of scoring a higher DMOL. Having a child with special needs increased the odds of scoring higher on DMOL by 45%, whereas single parent families and those whose children changed their sleeping patterns had 2.1-fold higher odds of scoring a higher DMOL.

Households who reported a lack of a dedicated space to study scored 59.0% higher on DMOL (**table 3).** The associations of other parent and child characteristics that

were significantly associated in the univariate analysis with a DMOL (age, education, level of schooling, access to technology and distance learning) were attenuated and became nonsignificant in the multivariable model.

General perceptions about lockdown, school closures, cancellation of exams and student preparedness for next academic year

Two thirds of respondents (66.2%) said they were indifferent that end-of-year exams were being cancelled, compared to 10.8% who were happy, and 23.0% who said they were unhappy with this decision. Parents felt that only 30% of children preferred exams to be online as opposed to face-to-face. Fifty six percent of parents of secondary education children felt that their child would not be adequately prepared to sit exams if they were to be taken online. Twenty one percent reported they would be unhappy or very unhappy to send their child back to school should the lockdown be lifted and schools re-open again before the end of the academic year 2019/2020.

DISCUSSION

We collected data for 6 weeks during the first 100 days of lockdown in the UK and found that female gender, lower levels of physical activity, parenting a child with special needs, lower levels of education, unemployment, reduced access to technology, not having a dedicated space where the child can study and the disruption of the child's sleep patterns during the lockdown are the main factors associated with a significantly higher odds of parents reporting feelings of loneliness.

Our findings are consistent with the results of other studies (54, 55) and reviews (56, 57) including those that tracked the mental health of adults, children and young people aged 4-16 years throughout the COVID-19 crisis and showed that parents reported an increase in their child's emotional, behavioural, and restless/attentional difficulties (21, 58). It is also corroborates existing data which shows that access to personal computers, smartphones and tablets varies widely in relation to income levels, with private schools being significantly more likely to provide children with adequate equipment including laptops and tablets (7). It is unsurprising that appropriate access to technology has direct implications on the efficiency of online schooling since remote learning relies on digital access and electronic devices that the child can use at home (59).

Another major issue with online provision and remote learning is access to a dedicated space for the child at home that will facilitate such learning. Our study highlighted a significant association between the lack of a dedicated space and increased measures of loneliness in adult respondents using both the direct and indirect measures of loneliness. The lack of a dedicated space may be a proxy-measure for lower income in families who are more likely to live in an overcrowded environment (60). The pre-existing attainment gap which loomed between the poorest and richest children showed that children from disadvantaged backgrounds were twice as likely to leave formal education without GCSEs in English and Maths compared to their peers who live in less deprived areas or whose parents have a higher total household income (61). The Education Endowment Foundation has also suggested that school closures could reverse the progress made in the last decade to narrow this gap (62) as children

from better-off families will have received as much as 35% more home learning than children from the poorest households (63). This raises particular concerns for parents of low-income who are less likely to be in a position to assist their children's studies with financial resources and this can play a significant role in a child's learning (64). School closures have thus shed a light on the subsequent social and economic consequences of the pandemic including a rise in inequalities and those factors that could be considered as a proxy-measure of income deprivation such as digital exclusion, reduced access to tablets and smartphones or a dedicated space where the child can study (33).

A recent study established that disruption of good sleep hygiene practices could lead to a behavioural profile of social withdrawal and loneliness (65), whereas loneliness is a known independent risk factor for physical inactivity (66). This was reflected in the findings of our study which showed that both modifiable risk factors (lower physical activity levels and disruption of sleep patterns) were independently associated with higher loneliness. Pertinently, both of these personal risk factors are modifiable and could be addressed through self-care practices. For example, exercise has long been associated with better sleep, and evidence is accumulating on the efficacy of exercise as a nonpharmacologic treatment option for disturbed sleep (67). Physical activity interventions in particular have also been shown to reduce loneliness and improve psychological wellbeing (68, 69).

Social interaction and physical activity are also known key factors in promoting a healthy state of physical and mental wellbeing (70-72), but the unprecedented social distancing and lockdown measures have forced the vast majority of the UK population to stay at home for long periods of time. This significantly limited routine opportunities for social interactions with peers, while the closure of schools, gyms and some parks and play areas significantly reduced physical activity levels, including those of parents of school-age children since this group remains largely understudied. Many households were also faced with various issues including concern over job security coupled to the increased need to supervise their children's learning and homework when one or both parents are required to work from home. Our study showed that these factors are likely to adversely affect the mental health of individuals, and in particular by increasing the prevalence of social isolation and loneliness in households.

Our UK study illustrated an increasing trend in the prevalence of social isolation and loneliness in parents of school-age children during the lockdown as was evidenced among emergency workers and other the quarantined populations (73, 74). However, this is the first study that investigated the level of loneliness in a population of parents with school-age children in the UK using both a direct and an indirect measure of loneliness.

The findings of this study may be used to direct interventions aimed at reducing feelings of social isolation and loneliness and to promote good mental health of parents with school-age children. COVID-19 lockdown can be deemed as a period of crisis that has dramatically affected the dynamics of households with school-age children. It is very important to look into the needs of this population during the lockdown as studies have shown that crises, quarantining and restrictions among school-age children have both short and long-term effect on their mental health which

may affect the mental health of their parents(75)(76). Future studies should investigate the effect of remote education on the mental health of children taking into account the findings of Martin et. al who found that more than two hours of daily screen exposure can negatively affect the mental health of young children (77).

The prevailing assumption that a resurgence of COVID-19 cases is expected in the winter months shortly after schools re-open in September has led to the development of a range of preparedness and risk mitigation strategies (78). Recent modelling studies predict that school closures alone would only prevent 2–4% of deaths, which is significantly less than other social distancing interventions (79). Thus, whereas school closures present an apparently logical method of reducing virus transmission as evidenced from previous influenza outbreaks, they pose a dilemma for policy makers seeking measures to protect populations (79). This is reflected in the findings of our study which showed that one in five respondents may be unwilling to send their child back to school should schools re-open again for this academic year. Because school closures have a significant impact on public mental health and wellbeing (20) and may exacerbate inequalities (62, 63), this should be taken into account when considering future risk mitigation strategies to minimise virus transmission in the community and educational settings.

The principal limitation of our study was the lack of follow-up, and not recording information about household income and demographic and lifestyle factors such as nutrition, smoking, use of alcohol and recreational drugs which may have enabled a fuller exploration of the factors that could influence the primary outcome measures examined. Further, the demographic profile of study participants largely consisted of white and employed female parents implying that this cross-section may not be representative of the wider UK parent population. We also acknowledged that since this was an online survey, we may have excluded parents with little or no digital access. These limitations restrict the generalisability of our findings to the wider population of parents across the UK. In spite of these limitations, our findings echo the results of other studies which show that lockdown measures are negatively impacting the public mental health of individuals across all age groups and may be significantly increasing the prevalence of social isolation and loneliness (18-20).

Parents of school-age children remain an understudied population, especially in that they are raising the “next generation” of yound adults. The mental health of parents during the lockdown is of major importance because it can significantly impact the psycho-social development and mental health of their children. The extraordinary measures introduced to control the COVID-19 pandemic have exacerbated pre-existing inequalities within society (80). When coupled with social distancing measures, the school closures have negatively impacted the mental health of school children and their parents and increased the prevalence of social isolation and loneliness in the community setting.

Conclusions

School closures and social distancing measures implemented during the first 100 days of the COVID-19 lockdown significantly impacted the daily routines of many people and influenced various aspects of government policy. Policy prescriptions and public health messaging should promote the adoption of good health-seeking self-care behaviours such as increased levels of physical activity and the maintenance of good

sleep hygiene practices to help prevent or reduce the risk of social isolation and loneliness, and this applies in particular where there is a single parent. Policy makers need to balance the impact of school closures on children and their families, and any future risk mitigation strategies should ideally not be a further disadvantage to the most vulnerable groups in society.

Acknowledgements: The authors thank Mr David Collins (Head Teacher) and the Governing Board of Brackenbury Primary School for disseminating the survey

Author Contributors: All authors provided substantial contributions to the conception (AEO, CVH, HM), design (AEO, EB, CVH), acquisition (IW, AA, ER), and interpretation (EB, IW, HM, AM) of study data and approved the final version of the paper. AEO took the lead in planning the study with support from co-authors. EB carried out the data analysis with support from AA. AEO is the guarantor.

Data sharing statement: The data that support the findings of this study are available from the corresponding author, AEO, upon reasonable request

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors. Austen El-Osta & Azeem Majeed are supported by the National Institute for Health Research (NIHR) Applied Research Collaboration (ARC) North West London. The views expressed are those of the authors and not necessarily those of the NHS or the NIHR or the Department of Health and Social Care

Competing interests: None declared.

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Supplementary table 1: Prevalence of low, moderate and high levels of loneliness (UCLATILS and DMOL) in relation to respondent characteristics

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
PARENT CHARACTERISTICS																
How many children do you have									0.35							0.24
1	251	(100.0)	80	(31.9)	67	(26.7)	104	(41.4)		126	(50.2)	89	(35.5)	36	(14.3)	
2	649	(100.0)	222	(34.2)	184	(28.4)	243	(37.4)		351	(54.7)	222	(34.6)	69	(10.7)	
3	244	(100.0)	(86	(35.2)	70	(28.7)	88	(36.1)		130	(54.2)	73	(30.4)	37	(15.4)	
4	50	(100.0)	14	(28.0)	11	(22.0)	25	(50.0)		23	(46.9)	18	(36.7)	8	(16.3)	
5+	18	(100.0)	5	(27.8)	2	(11.1)	11	(61.1)		7	(38.9)	6	(33.3)	5	(27.8)	
Does partner work?									0.09							<0.001
Yes	995	(100.0)	348	(35.0)	284	(28.5)	363	(36.5)		560	(56.9)	318	(32.3)	107	(10.9)	
No	146	(100.0)	43	(29.5)	36	(24.7)	67	(45.9)		56	(38.9)	56	(38.9)	32	(22.2)	
Key worker									0.07							0.03
Yes	213	(100.0)	77	(36.2)	65	(30.5)	71	(33.3)		121	(57.6)	69	(32.9)	20	(9.5)	
No	394	(100.0)	125	(31.7)	100	(25.4)	169	(42.9)		201	(51.1)	124	(31.6)	68	(17.3)	
Physical activity levels before the lockdown									0.08							0.02
Low	63	(100.0)	27	(42.9)	13	(20.6)	23	(36.5)		41	(66.1)	14	(22.6)	7	(11.3)	
Medium	626	(100.0)	215	(34.4)	186	(29.7)	225	(35.9)		347	(56.2)	196	(31.7)	75	(12.1)	
High	505	(100.0)	161	(31.9)	129	25.5)	215	(42.6)		241	(48.0)	192	(38.3)	69	(13.8)	
Videocall reduces SI									<0.001							0.02
Yes	825	(100.0)	245	(29.7)	238	(28.9)	342	(41.5)		411	(50.2)	296	(36.2)	111	(13.6)	
No	375	(100.0)	159	(42.4)	91	(24.3)	125	(33.3)		219	(59.0)	110	(29.7)	42	(11.3)	
Videocall reduces loneliness									<0.001							<0.001
Yes	712	(100.0)	194	(27.3)	204	(28.7)	314	(44.1)		339	(48.0)	266	(37.6)	102	(14.4)	
No	464	(100.0)	201	(43.3)	121	(26.1)	142	30.6)		285	(62.0)	128	(27.8)	47	(10.2)	
Depression due to lockdown									<0.001							<0.001
Yes	523	(100.0)	82	(15.7)	124	(23.7)	317	(60.6)		151	(29.0)	236	(45.3)	134	(25.7)	

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
No	672	(100.0)	316	(47.0)	207	(30.8)	149	(22.2)		477	(72.1)	166	(25.1)	19	(2.9)	
Cancelation of the exams									0.77							0.04
Unhappy	276	(100.0)	89	(32.3)	77	(27.9)	110	(39.9)		126	(45.8)	104	(37.8)	45	(16.4)	
Neutral	793	(100.0)	267	(33.7)	215	(27.1)	311	(39.2)		429	(54.8)	260	(33.2)	94	(12.0)	
Happy	130	(100.0)	49	(37.7)	37	(28.5)	44	(33.9)		76	(58.9)	41	(31.8)	12	(9.3)	
Preference of online exams									0.38							0.86
Yes	494	(100.0)	158	(32.0)	140	(28.3)	196	(39.7)		261	(53.3)	164	(33.5)	65	(13.3)	
No	644	(100.0)	231	(35.9)	176	(27.3)	237	(36.8)		347	(54.6)	211	(33.2)	78	(12.3)	
Sending child to school after lockdown									0.20							0.09
Very unhappy	100	(100.0)	39	(39.0)	23	(23.0)	38	(38.0)		54	(55.7)	28	(28.9)	15	(15.5)	
Unhappy	158	(100.0)	59	(37.3)	48	(30.4)	51	(32.3)		89	(58.2)	48	(31.4)	16	(10.5)	
Neither unhappy nor happy	230	(100.0)	86	(37.4)	64	(27.8)	80	(34.8)		130	(57.0)	69	(30.3)	29	(12.7)	
Happy	363	(100.0)	108	(29.8)	95	(26.2)	160	(44.1)		170	(46.8)	149	(41.0)	44	(12.1)	
Very happy	353	(100.0)	115	(32.6)	101	(28.6)	137	(38.8)		193	(54.8)	111	(31.5)	48	(13.6)	
CHILD CHARACTERISTICS																
Type of school									0.38							0.07
State school	1082	(100.0)	356	(32.9)	302	(27.9)	424	(39.2)		559	(52.2)	366	(34.2)	146	(13.6)	
Private school	128	(100.0)	50	(39.1)	32	(25.0)	46	(35.9)		77	(60.6)	41	(32.3)	9	(7.1)	
Private tuition									0.94							0.08
Yes	115	(100.0)	40	(34.8)	32	(27.8)	43	(37.4)		70	(60.9)	37	(32.2)	8	(7.0)	
No	1095	(100.0)	366	(33.4)	302	(27.6)	427	(39.0)		566	(52.3)	371	(34.3)	146	(13.5)	
Time spent studying									0.04							<0.001
≤2 hours	439	(100.0)	130	(29.6)	112	(25.5)	197	(44.9)		195	(44.8)	157	(36.1)	83	(19.1)	
2-4 hours	365	(100.0)	124	(34.0)	109	(29.9)	132	(36.2)		202	(55.8)	119	(32.9)	41	(11.3)	
≥4 hours	386	(100.0)	146	(37.8)	108	(28.0)	132	(34.2)		231	(60.5)	124	(32.5)	27	(7.1)	
Boredom									<0.001							<0.001

	Total		UCL three-item loneliness scale (UCLATILS)							ONS Direct measure of loneliness (DMOL)						
			No		Moderate		High			No		Moderate		High		
	N	(%)	n	(%)	n	(%)	n	(%)	p-value	n	(%)	n	(%)	n	(%)	p value
Low	74	(100.0)	40	(54.1)	16	21.6)	18	(24.3)		50	(68.5)	18	(24.7)	5	(6.8)	
Medium	396	(100.0)	165	(41.7)	117	(29.5)	114	(28.8)		250	(63.5)	116	(29.4)	28	(7.1)	
High	734	(100.0)	200	(27.2)	199	(27.1)	335	(45.6)		334	(45.9)	273	(37.6)	120	(16.5)	
Stress									<0.001							<0.001
Low	213	(100.0)	115	(54.0)	54	(25.4)	44	(20.7)		159	(75.7)	41	(19.5)	10	(4.8)	
Medium	531	(100.0)	190	(35.8)	158	(29.8)	183	(34.5)		308	(58.6)	177	(33.7)	41	(7.8)	
High	457	(100.0)	98	(21.4)	120	(26.3)	239	(52.3)		166	(36.4)	188	(41.2)	102	(22.4)	
Signs of depression									<0.001							<0.001
Yes	146	(100.0)	30	(20.5)	35	(24.0)	81	(55.5)		54	(37.0)	59	(40.4)	33	(22.6)	
No	297	(100.0)	128	(43.1)	85	(28.6)	84	(28.3)		194	(65.8)	87	(29.5)	14	(4.7)	
Children complaining of feeling social isolated or lonely									<0.001							<0.001
Yes	521	(100.0)	85	(16.3)	137	(26.3)	299	(57.4)		170	(32.8)	231	(44.6)	117	(22.6)	
No	685	(100.0)	321	(46.9)	196	(28.6)	168	(24.5)		466	(68.9)	175	(25.9)	35	(5.2)	
Physical activity levels before the lockdown									0.27							0.30
Low	17	(100.0)	3	(17.6)	6	(35.3)	8	(47.1)		10	(62.5)	3	(18.8)	3	(18.8)	
Medium	281	(100.0)	108	(38.4)	77	(27.4)	96	(34.2)		159	(57.0)	86	(30.8)	34	(12.2)	
High	901	(100.0)	290	(32.2)	247	(27.4)	364	(40.4)		462	(51.7)	317	(35.5)	115	(12.9)	
Physical activity levels during the lockdown									0.44							0.62
Low	174	(100.0)	56	(32.2)	41	(23.6)	77	(44.3)		83	(48.3)	66	(38.4)	23	(13.4)	
Medium	715	(100.0)	231	(32.3)	203	(28.4)	281	(39.3)		376	(53.0)	246	(34.6)	88	(12.4)	
High	304	(100.0)	111	(36.5)	85	(28.0)	108	(35.5)		168	(55.8)	92	(30.6)	41	(13.6)	
Readiness to undertake exams									<0.001							<0.001
Ready	217	(100.0)	83	(38.2)	51	(23.5)	83	(38.2)		285	(46.2)	233	(37.8)	99	(16.0)	
Neutral	279	(100.0)	123	(44.1)	71	(25.4)	85	(30.5)		184	(66.2)	77	(27.7)	17	(6.1)	
Unready	627	(100.0)	178	(28.4)	186	(29.7)	263	(41.9)		126	(58.3)	65	(30.1)	25	(11.6)	

Appendix 1: Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

Item Category	*Checklist Item*	*Page Number*	*Description*
Design	Study design	4	The target population were adult (aged 18 years and over) parents and legal guardians of children who were attending primary or secondary education in the UK.
IRB (Institutional Review Board) approval and informed consent process	IRB approval	6	The study was given ethical approval by the Head of Imperial College London PCPH Department, Professor Azeem Majeed, and by the Joint Research Compliance Office under the Imperial College Research Ethics Committee process (approval 20IC5978 ICREC HOD JRCO)
	Informed consent	4 and 5	The link to the Participant Information Sheet was accessible on the eSurvey page and sent to heads of schools who were contacted. The PIS included information regarding the study such as the protection of the participants' personal data, their right to withdraw from the study at any time, the length of time of the survey, which data were stored, where and for how long, who the investigator was, and the purpose of the study. They were informed this was a voluntary survey without any monetary incentives but with offering the possibility to access the results and underlying the potential collective benefits of taking parts in terms of knowledge and policies. The first question of the survey asked participants to confirm their consent to participate in the eSurvey.
	Data protection	5	The data collected were stored on the Imperial secure database and only the team researchers could access the eSurvey results.
Development and pre-testing	Development and testing	4 and 5	The study protocol and online survey were developed in collaboration with the Governing Board of Brackenbury Primary School in the London Borough of Hammersmith & Fulham. The online survey technical functionality was tested before being published.
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	4	This was an open survey using a snowball sampling.
	Contact mode	4	Part of the potentially eligible participants received an invitation email from the head teacher of schools where study information was disseminated including the Participant Information Sheet and link to the survey. The researchers' personal and professional networks were also mobilized through email and other messaging applications such as WhatsApp to respond and further disseminate the eSurvey among eligible participants.
	Advertising the survey	4	The study was advertised through head teachers of schools and researchers' networks
Survey	Web/E-mail	4	The survey was hosted by the Imperial College Qualtrics platform.

Administration	Context	p 10	The Head Teacher of Brackenbury Primary School disseminated the survey to parents of that school to give parents the opportunity to reflect on an issue that is important to them given the nature of the study. This was a 'right-in-time' study earmarked for recruitment *during* the lockdown
	Mandatory/voluntary	5	This was a voluntary survey
	Incentives	4 and 5	Participants were informed in the PIC that no monetary incentives were offered but non-monetary incentives such as the possibility to access the results and the potential collective benefits of taking parts in terms of knowledge and policies were mentioned.
	Time/Date	4	The survey was accessible for a period of 9 weeks from 14 May 2020 to 4 July 2020.
	Randomization of items or questionnaires	-	No randomization of items was used.
	Adaptive questioning	-	No adaptive questioning of items was used.
	Number of Items	5	The survey comprised a total of 51 questions.
	Number of screens (pages)	5	All questions were displayed on one page and was accessible using a personal computer or smartphone.
	Completeness check	4	Most items provided a non-response option such as "not applicable" or "rather not say", though not all. Selection of a response option to questions was not forced but were all fully completed. Analysis was conducted on fully completed questionnaires.
	Review step	5	Participants could review their answers before submitting them.
Response rates	Unique site visitor	-	Not applicable as response rates were not calculated.
	View rate	-	Not applicable as response rates were not calculated.
	Participation rate	-	Not applicable as response rates were not calculated.
	Completion rate	-	Not applicable as response rates were not calculated.
Preventing multiple entries from the same individual	Cookies used	-	No cookies were used.
	IP check	-	Qualtrics registered the IP address of respondents and did not allow a respondent for completing another survey from the same IP address for a period of one week.
	Log file analysis	-	No log files analysis.
	Registration	-	No registration.
Analysis	Handling of incomplete questionnaires	-	Only completed questionnaires were included in the final dataset.

	Questionnaires submitted with an atypical timestamp	-	Not applicable
	Statistical correction	-	None