Exploring parents' physical activity motivation during the COVID-19 pandemic: a mixed-methods study from a self-determination theory perspective

Lydia Emm-Collison,[1*] Robert Walker,[1] Ruth Salway,[1,2] Danielle House,[1] Kate Sansum,[1] Katie Breheny,[2] Sarah Churchward,[3] Joanna G Williams,[2,4] Frank de Vocht[2,5] and Russell Jago[1,2,5]

[1]Centre for Exercise, Nutrition & Health Sciences, School for Policy Studies, University of Bristol, Bristol, UK
[2]Population Health Sciences, Bristol Medical School, University of Bristol, Bristol, UK
[3]Independent Public Member of the Project Team
[4]Communities and Public Health, Bristol City Council, Bristol, UK
[5]The National Institute for Health Research, Applied Research Collaboration West (NIHR ARC West), University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, UK

[*]Corresponding author

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Abstract

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Lydia Emm-Collison,[1*] Robert Walker,[1] Ruth Salway,[1,2] Danielle House,[1] Kate Sansum,[1] Katie Breheny,[2] Sarah Churchward,[3] Joanna G Williams,[2,4] Frank de Vocht[2,5] and Russell Jago[1,2,5]

[1]Centre for Exercise, Nutrition & Health Sciences, School for Policy Studies, University of Bristol, Bristol, UK
[2]Population Health Sciences, Bristol Medical School, University of Bristol, Bristol, UK
[3]Independent Public Member of the Project Team
[4]Communities and Public Health, Bristol City Council, Bristol, UK
[5]The National Institute for Health Research, Applied Research Collaboration West (NIHR ARC West), University Hospitals Bristol and Weston NHS Foundation Trust, Bristol, UK

[*]Corresponding author Lydia.Emm-Collison@bristol.ac.uk

Background and objectives: The COVID-19 lockdowns impacted physical activity for all, but especially parents, because they had to balance home, work and leisure activities. Motivation for exercise is consistently shown to be associated with physical activity levels. Self-determination theory provides a framework through which the motivation for exercise and its social-contextual antecedents can be explored. The purpose of this study is to explore the role of motivation in determining physical activity in parents and carers of English primary school children before, during and after the COVID-19 lockdowns.

Design, setting and participants: This study uses a mixed-methods design combining quantitative data and individual interviews. Participants were all parents/carers of children in year 6 (aged 10–11 years) at English primary schools in the United Kingdom.

Methods: Quantitative data were collected on three occasions: between March 2017 and May 2018 (Wave 0, *N* = 1296), between May and December 2021 (Wave 1, *N* = 393) and between January and July 2022 (wave 2, *N* = 436). Motivation for exercise was assessed using the Behavioural Regulations in Exercise Questionnaire-2 and moderate-to-vigorous physical activity was estimated via waist-worn accelerometers. Data were analysed via regression models. Interviews with a subsample of parents (*N* = 43) were conducted on two occasions: between September and December 2021 and between February and July 2022. Interviews covered the impact of the pandemic on children and parents' physical activity and changes over time. This study focuses on discussions around the parents' own physical activity behaviour and their motivation. The framework method was used for analysis.

Results: In separate linear regression models, intrinsic and identified regulation were associated with higher moderate-to-vigorous physical activity in waves 0 and 2. Amotivation was associated with lower moderate-to-vigorous physical activity in waves 0 and 2. In fully adjusted multivariable regression models, identified regulation was associated with a 4.9-minute increase in moderate-to-vigorous physical activity and introjected regulation was associated with a 2.3-minute decrease in moderate-to-vigorous physical activity at wave 0. Associations with moderate-to-vigorous physical activity were different in wave 2, with introjected regulation changing direction and a negative association with amotivation, although confidence intervals were wide due to smaller sample sizes. In the interviews,

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parents spoke of the effects that the COVID-19 lockdowns had on their motivation to be physically active in four theoretically driven themes: (1) motivation for physical activity, (2) perceived autonomy for physical activity, (3) perceived competence for physical activity and (4) perceived relatedness for physical activity.

Limitations: The smaller sample sizes for waves 1 and 2 may have limited the ability to identify associations between behavioural regulations and moderate-to-vigorous physical activity post pandemic. Across all waves, parents were predominantly active, females, white and from higher socioeconomic areas and therefore may not reflect broader experiences.

Conclusions and future work: Autonomous motivation, especially enjoyment and the importance for mental and physical well-being, was a key driver in keeping parents active during lockdowns and remains important for physical activity post lockdown, with introjected regulation potentially playing an increased role. Parents' interviews highlighted that while for some the lockdowns *promoted* autonomous motivation for exercise, others had enduring *negative* influences on their autonomy, competence and relatedness, which could be detrimental to their well-being. Strategies that focus on offering a range of novel activities for parents and that bring parent groups together may be effective.

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Plain language summary

What was the question?

The COVID-19 pandemic affected parents' ability to be active. Motivation is important for taking part in physical activity. We wanted to know how motivation for exercise had changed since before the pandemic and how it might still impact parents' physical activity.

What did we do?

We asked groups of parents of children in year 6 (aged 10–11 years) to complete a questionnaire and wear a device that measures physical activity. One group did this before the pandemic and two groups did this after the lockdowns. We also spoke to parents two times after schools reopened. We asked about their physical activity, what they felt helped or stopped them being active and how this changed during the pandemic.

What did we find?

Motivation plays a part in how much physical activity parents do. Enjoying activities, being active because it is part of your identity and being active due to health make parents more active. Some parents felt they were more active in the first lockdown, as they had more time, freedom and a choice of new and exciting activities, while others felt the lockdowns led to them being less active. This was due to a loss of connection with other people and feeling less confident in their physical activity.

What does this mean?

This means that

- it is important that parents are well-supported in their physical activity post pandemic
- efforts to help parents be active should focus on creating opportunities for parents to try new activities
- opportunities for parents to be active together might lead to more physical activity, improved connections with others and better well-being.

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Background

Physical activity is positively associated with physical health and well-being.[1,2] In the UK it is recommended that adults aged 19–64 years engage in at least 150 minutes of moderate-to-vigorous physical activity (MVPA) or 75 minutes of vigorous physical activity per week.[3] However, there is consistent evidence to show that many adults do not meet these recommendations.[4–6] Around 42% of the UK adult population are parents of dependent-age children.[7] Evidence indicates that parents of dependent-age children are less active than non-parents[8,9] and promoting more physical activity in parents could also have health benefits for the child.[10] Identifying appropriate routes to promote greater physical activity engagement in parents is, therefore, a key public health objective.

Low levels of physical activity may be due to low motivation or inconsistent self-regulatory processes.[11,12] Self-determination theory (SDT) is a theory of human motivation that conceptualises motivation as a multidimensional construct and offers a framework to explore the impact of motivation quality on behaviour,[13] including physical activity.[14] Within SDT, it is proposed that motivation exists on a continuum where different types of motivation differ in the extent to which they are *autonomous* and *controlled*.[15,16] More autonomous forms of motivation are intrinsic motivation, characterised by enjoyment and satisfaction from being physically active; integrated regulation, when being physically active aligns with an individual's identity; and identified regulation, characterised by personally valuing being active.[13] More controlled forms of motivation are introjected regulation, where behaviour is driven by internal pressures such as avoiding feelings of guilt, and external regulation, where behaviour is driven by external pressures such as rewards.[15] A lack of motivation is referred to as amotivation.[13] Evidence shows that more autonomous motivation is associated with higher self-reported and accelerometer-assessed physical activity[17,18] and is central to facilitating long-term behaviour change leading to long-term physical activity engagement.[19–22]

Autonomous motivation is facilitated when the three basic psychological needs are satisfied: (1) autonomy (feelings of volition, ownership and the self-endorsement of actions),[23] (2) competence (a sense of mastery over behaviour)[13] and (3) relatedness (feeling connected, involved and cared for).[13] Supportive environments contribute to the satisfaction of psychological needs and subsequently facilitate more autonomous motivation, whereas environments that thwart psychological needs contribute to the frustration of these needs and inhibit autonomous motivation.[24–27]

The COVID-19 pandemic led to nationwide lockdowns in England, which limited physical activity opportunities for all. Data collected during the lockdowns indicate that activity levels reduced among adults.[28–31] However, our findings suggest that parent's MVPA returned to pre-pandemic levels shortly after lockdowns were lifted and has potentially increased a year following the easing of restrictions.[32] Evidence from a SDT perspective indicates that associations between behavioural regulations and physical activity may have been tempered by the COVID-19 lockdowns.[33] However, this was based on retrospective reporting and so there is a need for data from more robustly designed studies to explore the changing associations between motivation and MVPA. Many of the movement restrictions during the COVID-19 lockdowns have the potential to thwart the basic psychological needs (e.g. less choice about daily activities, a loss of structure and less social connection). However, there has been little exploration of individuals' experiences of lockdown restrictions from a SDT perspective. Furthermore, evidence suggests that parents were disproportionally adversely affected by the lockdowns in terms of their physical activity levels, physical activity motivation and well-being.[34] It is important to understand the psychological mechanisms underpinning the impact that lockdown restrictions had on parents' motivation for physical activity and their physical activity engagement to inform the development of strategies to support parents' physical activity.

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Aims and objectives

This study aims to explore the changing role of motivation in determining physical activity in parents/carers of English primary school children before, during and after the COVID-19 lockdowns. Using a combination of quantitative and qualitative methods we will:

1. examine cross-sectional associations between behavioural regulations and parents' accelerometer-estimated physical activity before and after COVID-19 lockdowns in UK
2. explore parents' perceptions of their physical activity motivation during and after the COVID-19 lockdowns
3. explore the psychological mechanisms through which the COVID-19 lockdowns may have affected physical activity motivation and engagement.

Methods

This study provides quantitative data from two related studies. The B-Proact1v study[35,36] involved 1296 parents/carers of 10- to 11-year-old children recruited from 50 schools in England between March 2017 and May 2018 (wave 0). Active-6 is a follow-up study to explore the impact of the COVID-19 pandemic on the physical activity of 10- to 11-year-old children and their parents. In Active-6 study, 50 B-Proact1v schools were invited to participate between May and December 2021 (wave 1) and again between January and July 2022 (wave 2) with 23 and 27, respectively, schools participating; 393 parent/carers took part in wave 1 and 436 took part in wave 2. Qualitative interviews with a subsample of parents took place on two occasions: between August and September 2021 (wave 1) and between February and July 2022 (wave 2). In this study, we report cross-sectional comparisons of parents' motivation for physical activity before and after the COVID-19 lockdowns, using parent data from all three waves. We also report parents' qualitative perspectives on their motivation for physical activity during and after the COVID-19 lockdowns, using data from both waves 1 and 2.

Quantitative measures

Parents/carers completed a questionnaire which included their gender, height, weight and motivation for exercise. In wave 0, date of birth was used to calculate parent age and in waves 1 and 2 parents were asked to report their age category. Across all waves, height and weight were used to calculate body mass index (BMI). The Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2) was used to assess motivation for exercise.[37] This 19-item measure assesses five forms of behavioural regulations: intrinsic regulation (e.g. *I enjoy my exercise sessions*), identified regulation (e.g. *It's important to me to exercise regularly*), introjected regulation (e.g. *I feel ashamed when I miss an exercise session*), external regulation (e.g. *I feel under pressure from family/friends to exercise*) and amotivation (e.g. *I don't see the point in exercising*). Responses were given on a 5-point Likert scale ranging from 0 (not true for me) to 4 (very true for me) and an average of items within the same subscale was taken to represent each behavioural regulation. The subscales showed very good internal consistency across all waves (see *Tables S1–S3*, *Report Supplementary Material 1*).

Parents were asked to wear a waist-mounted accelerometer (ActiGraph wGT3X-BT, ActiGraph, LLC, Pensacola, FL, USA) for 5 days, including 2 weekend days, in wave 0 and 7 days, including 2 weekend days, in waves 1 and 2. Accelerometer data from all waves were processed using a script written in R software available from the Open Science Framework.[38,39] Data between midnight and 6 a.m. were excluded and analysis was restricted to participants who provided at least 3 valid days of data, including at least 1 weekend day. A valid day was defined as at least 500 minutes of data after excluding intervals of at least 60 minutes of zero counts (indicating non-wear time) but allowing up to 2 minutes of interruptions.[40,41] Average MVPA minutes per day were derived for each participant using population-specific cut-off points for adults (≥ 2020 counts per minute).[42] As specified in the Active-6 protocol,[43] we used continuous MVPA as the outcome because this has more statistical power than a dichotomised variable and focuses on linear associations between motivation and physical activity, consistent with the motivation literature.

Quantitative analysis

Analyses were conducted in STATA MP version 17.[44] Only parents with valid accelerometer data and complete BREQ-2 data were included in the analyses (see *Table S4*, *Report Supplementary Material 1*). Cross-sectional linear regression models were used to examine associations between behavioural regulations and MVPA separately for each wave. First, regression analyses were conducted to explore the individual associations between each of the behavioural regulation types and average daily MVPA (separate motivation models). Next, multiple regression analyses were conducted with all five behavioural regulation types included in the model (combined motivation models). All models were

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adjusted for age, gender and BMI.[41,45] Considering the broader study design, robust standard errors were used to account for clustering within schools, and residuals for all regression models were explored visually to check model assumptions.

Qualitative interviews

The qualitative phases of the Active-6 project are explained in detail elsewhere.[46,47] The data used in this study are taken from two phases of semistructured interviews with parents that took place between September and December 2021 (wave 1: 21 parents) and between February and July 2022 (wave 2: 22 parents). The interviews were conducted by RW (waves 1 and 2), TR (wave 1) and BT (wave 1). A variety of topics were covered, including the role of motivation (e.g. *To what extent do you feel that your motivation for physical activity changed at this time?*) and social influences (e.g. *To what extent did social distancing and not being able to see other people influence your/your child's physical activity*?). The present study uses qualitative data from these discussions that was concerned with parent's own physical activity engagement and motivation during different stages of the COVID-19 pandemic. Convenience sampling was used to recruit parents. Across the two waves of interviews, 36 parents were females, 33 were white British (5 white other), 36 were educated to degree level or higher and 34 were from less-deprived areas [higher Index of Multiple Deprivation (IMD) decile]. The sample were largely active with 14 classified as having medium activity and 23 classified as having high activity compared to other parents within the same school.

Qualitative analysis

The framework method was used to support qualitative data analysis with the aim of identifying commonalities among the qualitative data, exploring relationships between different parts of data and drawing explanatory conclusions based on themes.[48] There were seven stages to analysis: (1) verbatim transcription by a university-approved transcription service, (2) data familiarisation, (3) coding, (4) developing a working analytical framework, (5) applying the analytical framework, (6) charting data into the framework matrix and (7) interpreting the data. In the third stage, two transcripts were independently coded by three researchers (wave 1: RW, BT, TR, DH or KS; wave 2: RW, DH and KS). Interview content and interpretations were discussed and codebooks were developed inductively. These codebooks were then applied to the remaining transcripts. Coding was performed independently to facilitate researcher reflexivity and to support a more nuanced and deeper interpretation of the data. Following this, all codes were reviewed to determine whether they could be interpreted as aligning with the behavioural regulation types proposed within SDT or whether they could hold aspects of autonomy, competence and relatedness. These codes were then charted into a deductive, SDT-informed, framework matrix. Verbatim quotes are used to illustrate each of the subthemes. Quotes are presented alongside parent number, gender and data collection wave.

Patient and public involvement

The Active-6 project has been designed with patient and public involvement (PPI) at its centre. Year 6 children, parents, teachers and school staff in a variety of roles have been involved in all stages of the project including the research design, development of study materials and plans for dissemination. This has included parent representatives being active members of study governance groups, running child PPI group sessions at schools to review data collection methods and dissemination materials, and sharing early school-level results with schools and participating families.

Equality, diversity and inclusion

Equality, diversity and inclusion (EDI) were considered during participant recruitment for this study. Recruitment for each wave involved the monitoring of parent and school-level demographics, with some targeted recruitment in order to increase study inclusion (e.g. to increase the proportion of fathers in the qualitative interviews). For recruitment to the interviews in waves 1 and 2, parents were categorised as low, medium, or high MVPA level based on their accelerometer measured weekday MVPA in comparison to their school group, and their IMD score (based on home postcode), age, ethnicity and highest level of educational qualification were all noted. Intentional sampling helped to achieve a greater balance in wave 2 regarding parent gender.

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Results

Quantitative results

Descriptive statistics for all study variables are presented in *Table 1*, correlations between variables are presented in *Tables S1–S3* (*Report Supplementary Material 1*) and a summary of missing data is presented in *Table S4* (*Report Supplementary Material 1*). Across waves, missing data were predominantly due to insufficient accelerometer data. In wave 0, the final sample consisted of 710 parents (73% were females) with an average BMI of 25.9 [standard deviation (SD) = 4.8]. In wave 1, the final sample consisted of 218 parents (77% were females) with an average BMI of 25.8 (SD = 5.0). In wave 2, the final sample consisted of 237 parents (77% were females), and average BMI was 25.7 (SD = 5.0). Across all waves, most parents were either aged 40–44 years (34–39%) or >45 years (35–38%). Average daily MVPA was highest in parents who participated in wave 2, with 56.4 minutes (SD = 27.5) compared to 51.8 minutes (SD = 25.6) in wave 0. The mean and SDs for motivation variables were largely consistent across each wave, with high levels of intrinsic and identified regulation and low levels of external regulation and amotivation. Correlations between behavioural regulation types were consistent across waves, with a strong positive association between identified and intrinsic regulation, moderate associations between amotivation and external regulation and between identified and introjected regulation, and moderate negative correlation between amotivation and identified/intrinsic regulation.

In separate motivation models, adjusted for age, gender and BMI, intrinsic and identified regulations were associated with higher MVPA in waves 0 and 2 (*Table 2*). Amotivation was associated with lower MVPA in waves 0 and 2 (see *Table 2*), with a larger association in wave 2. Combined motivation models

TABLE 1 Characteristics of participants and descriptive statistics of subscales in the cross-sectional regression analysis

	Wave 0 (%)	Wave 1 (%)	Wave 2 (%)
Age (years)			
< 39	23	30	28
40–44	39	35	34
> 45	38	35	38
Gender			
Female	73	77	77
Male	27	23	23
	M (SD)	M (SD)	M (SD)
BMI	25.86 (4.80)	25.79 (5.03)	25.74 (5.04)
MVPA (average minutes per day)	51.79 (25.55)	54.68 (25.00)	56.43 (27.47)
Motivation			
Intrinsic	2.50 (1.12)	2.67 (1.02)	2.65 (0.99)
Identified	2.63 (0.96)	2.79 (0.88)	2.75 (0.87)
Introjected	1.31 (1.06)	1.39 (1.06)	1.33 (1.07)
External	0.33 (0.55)	0.45 (0.71)	0.39 (0.62)
Amotivation	0.26 (0.55)	0.30 (0.64)	0.29 (0.59)

Note
Responses for motivation measures were provided on a scale of 0–4.

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TABLE 2 Cross-sectional linear regression with MVPA

	Wave 0			Wave 1			Wave 2		
	β	*p*-value	CI (lower, upper)	β	*p*-value	CI (lower, upper)	β	*p*-value	CI (lower, upper)
Intrinsic	3.38	0.00	1.64 to 5.11	1.62	0.34	−1.83 to 5.07	4.84	0.05	0.11 to 9.58
Identified	4.72	0.00	2.53 to 6.92	2.11	0.33	−2.25 to 6.47	6.04	0.03	0.78 to 11.31
Introjected	−0.14	0.87	−1.85 to 1.58	−0.79	0.67	−4.58 to 3.00	3.46	0.13	−1.11 to 8.04
External	−2.29	0.21	−5.88 to 1.30	0.01	0.98	−3.70 to 3.71	−1.89	0.62	−9.56 to 5.79
Amotivation	−4.32	0.04	−8.39 to −0.25	−3.71	0.25	−10.28 to 2.84	−7.35	0.05	−14.80 to 0.10

Note
Models are adjusted for parents' gender, age, BMI and school clustering.

TABLE 3 Cross-sectional multiple regression between motivation variables and MVPA in fully adjusted models

	Wave 0			Wave 1			Wave 2		
	β	*p*-value	CI (lower, upper)	β	*p*-value	CI (lower, upper)	β	*p*-value	CI (lower, upper)
Intrinsic	0.77	0.55	−1.80 to 3.35	0.05	0.99	−5.33 to 5.42	1.96	0.50	−3.94 to 7.87
Identified	4.92	0.01	1.28 to 8.56	2.39	0.58	−6.43 to 11.21	2.37	0.43	3.67 to 8.42
Introjected	−2.31	0.04	−4.47 to −0.15	−2.04	0.38	−6.79 to 2.71	2.89	0.27	−2.32 to 8.10
External	0.25	0.91	4.16 to 4.66	2.59	0.33	−2.82 to 8.01	−1.44	0.77	−11.26 to 8.37
Amotivation	−1.39	0.58	−6.41 to 3.63	−4.08	0.41	−14.11 to 5.95	−4.67	0.29	−13.54 to 4.20

Note
Models are adjusted for parents' gender, age, BMI and school clustering.

(*Table 3*) found a positive association between identified regulation and MVPA in wave 0, with a one-unit increase in identified regulation associated with a 4.9-minute [95% CI (1.3 to 8.6)] increase in MVPA (adjusting for other forms of motivation), and a negative association between introjected regulation and MVPA, with a one-unit increase in introjected regulation associated with a 2.3-minute decrease in MVPA [95% CI (0.2 to 4.5)]. Small sample sizes mean that there was no evidence for an association between any types of behavioural regulation at wave 1 or 2, when adjusting for other types of behavioural regulation, although estimates for amotivation were larger in wave 2 compared to wave 0 and estimates for introjected regulation changed sign. Overall, the combined motivation model accounted for 8% of the total variance in MVPA at wave 0, 10% of the variance in MVPA at wave 1 and 11% of the variance in MVPA at wave 2, suggesting a slight increase in the overall role of motivation in parent physical activity post COVID-19 lockdowns. Residual plots did not reveal any issues with model assumptions.

Qualitative results

Parents spoke of their motivation for physical activity fluctuating through the course of the COVID-19 pandemic and identified several motivational factors that align with the regulation types specified within SDT. They also highlighted many features of the pandemic and associated lockdowns that impacted their motivation to be active, which can be mapped onto the basic psychological needs of autonomy, competence and relatedness. The qualitative results are presented in four theoretically driven themes with data-driven subthemes within each: (1) motivation for physical activity, (2) perceived autonomy for physical activity, (3) perceived competence for physical activity and (4) perceived relatedness for physical activity (see *Table 4* and *Figure 1* for subthemes).

TABLE 4 Themes and subthemes generated through qualitative work

Theoretically driven theme	Data-driven subtheme
1 Motivation for physical activity	1.1 Maintaining physical health
	1.2 Promoting mental well-being
	1.3 Enjoying physical activity
	1.4 Physical activity as part of identity
2 Perceived autonomy for physical activity	2.1 Access to activities
	2.2. Being creative with activity
	2.3 The luxury of time
	2.4 Repetitiveness of activities and increased pressures
3 Perceived competence for physical activity	3.1 Loss of structure
	3.2 Seeking challenge
4 Perceived relatedness for physical activity	4.1 Being active with others
	4.2 Being part of an active community
	4.3 Keeping connected at a distance

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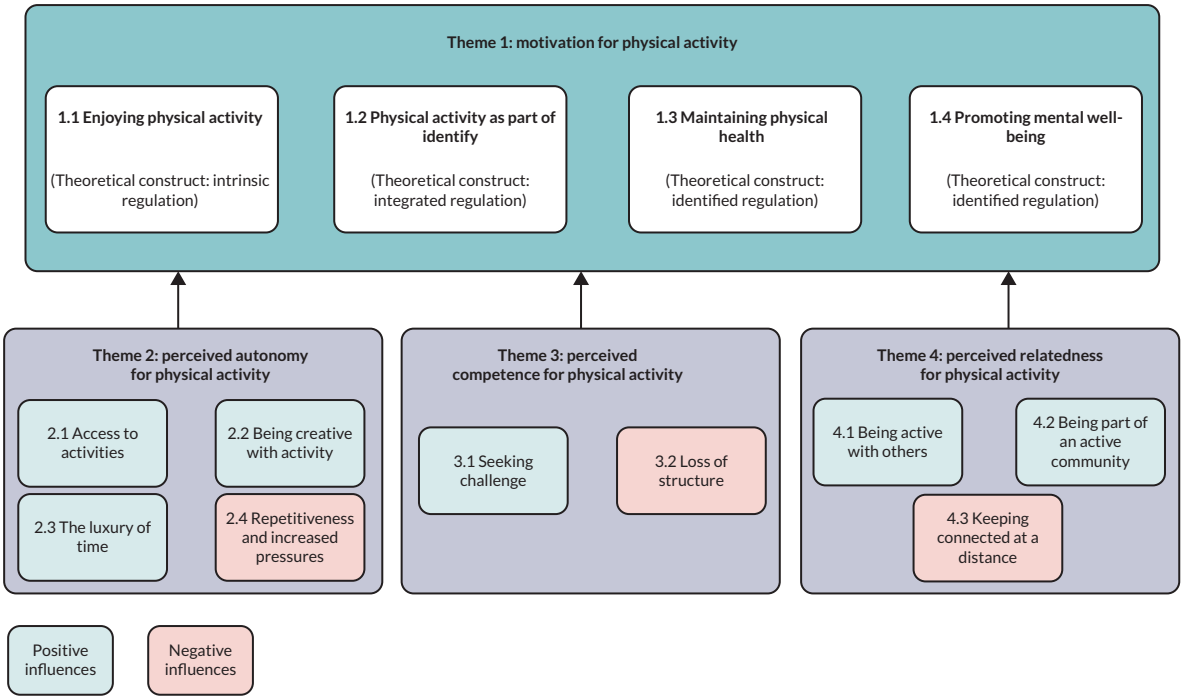

FIGURE 1 Thematic map with theoretical relationships between themes.

Theme 1: motivation for physical activity

Reflecting on the COVID-19 lockdowns in England, there were very different perspectives on the impact that the lockdowns had on parents' motivation to be physically active. Most parents spoke of fluctuating motivations during the pandemic related to the restrictions at the time, the weather and as the novelty of lockdowns waned (Theme 2). Some parents felt that the lockdowns pushed them to be more active.

> *Activity levels and motivation fluctuated a lot, particularly with motivation at an all-time low in the second lockdown.*
>
> *Parent 2, female, wave 2*

> *I made a conscious decision that I wanted to be more active in lockdown, my body probably told me that it needed to be more active. I think the more that you do the more you want to do.*
>
> *Parent 6, male, wave 2*

Participants spoke of a variety of reasons for engaging in physical activity during the COVID-19 lockdowns.

Maintaining physical health

In line with the identified regulation facet of SDT, many parents discussed their physical health, specifically focusing on maintaining or improving physical activity and avoiding adverse health outcomes:

> *If you're the type of person that understands the benefit to health of physical activity, you're going to want to do that regardless of obstacles. If you don't see the benefit then you're not going to do it anyway.*
>
> *Parent 2, female, wave 2*

A focus on physical health was often related to wanting to avoid adverse physical health that parents had seen in family members or wanting to control their own body weight, particularly during the pandemic:

> *For me, personally, my mum died when she was 49 with heart problems and a bad stroke, so I want to keep myself healthy.*
>
> *Parent 2, female, wave 1*

> *I did a big walk around the area. I was getting out, getting fresh air, getting some exercise. I think it was just because I felt like I had done a lot of sitting around, and a lot of not doing stuff. And I felt I'd put on a little bit of weight. I just didn't feel as fit as I did before [the pandemic].*
>
> *Parent 20, female, wave 1*

One parent reflected on how the pandemic raised public awareness of the importance of physical activity for maintaining well-being, suggesting that the pandemic has had a beneficial impact on motivation and subsequent physical activity levels:

> *… fitness for life and health thing is much bigger than things like wanting to play sport or lose weight. I think the pandemic really raised the awareness of how physical activity is crucial on those parts of your wellbeing, including mental and social health, as well.*
>
> *Parent 1, male, wave 2*

Promoting mental well-being

Also in line with identified regulation many parents used physical activity as a way of maintaining and promoting mental health and well-being. Primarily, the COVID-19 lockdowns and spending more time inside and at home led many parents to prioritise their exercise time as a way of preserving their mental health:

> *Once that first lockdown hit, I got into a routine where I prioritised that exercise because there were days where you wouldn't go outside. I would logout of everything and go on to that session because that was really important to me that I kept up that level of physical activity, and that was my absolute lifeline in lockdown for my sanity.*
>
> *Parent 15, female, wave 1*

For some parents, being outside in nature, through walks or spending time at their allotments, was particularly beneficial for their well-being, while for others the positive impact of physical activity on their mental health was attributed to the routine that their exercise time gave them:

> *I think I'm still feeling the effects of the second lockdown physically and in my attitude towards exercise. I think I benefit mentally and physically from being outside particularly in nature quite a lot.*
>
> *Parent 14, male, wave 2*

> *Myself and my partner have always been into fitness … A lot of it is for routine and mental health. If I don't feel like I've done anything, I do get really restless.*
>
> *Parent 11, female, wave 2*

Enjoying physical activity

Parents generally spoke of engaging in physical activity that they enjoyed during the COVID-19 lockdowns, either through continuing their previous pursuits, starting or restarting an activity (sometimes as a family). In line with intrinsic regulation within SDT, enjoyment of activities was the main driver for parents to continue to be active throughout the lockdowns, and those who began a new activity, enjoyment led them to continue the activity once restrictions were lifted. Parents who engaged in physical activity on their own saw this to be a valuable time to be themselves:

> *We got started doing more big long walks during the pandemic and we realised we quite enjoyed it, so we're continuing with that. You just feel the benefits of it, it's quite energising.*
>
> *Parent 2, female, wave 2*

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> *The pandemic made me start something new, not being able to do anything else and with the gym closed. I would never have done it because I don't see myself as a runner. I do it at my own pace but I still enjoy it. I love being outside now and doing more walking and running rather than going back in the gym.*
>
> *Parent 12, female, wave 2*

However, some parents spoke of not inherently enjoying physical activity, meaning that they engaged in activity less frequently. While some parents spoke of not necessarily enjoying the activities, but their awareness of the benefits of certain activities meant that they still engaged in them:

> *I like swimming, and know it's good for me. I like walking the dog each day. I'm not sure if I enjoy Pilates but I know that it's good for me so I do that.*
>
> *Parent 13, female, wave 2*

Physical activity as part of identity

For some parents, being physically active is so engrained in who they are that there was never a consideration that the pandemic and associated lockdowns, closure of facilities and social distancing measures would lead to them being less active. The nature of physical activity becoming part of one's identity aligns with integrated regulation within SDT. This was related to their enjoyment of activity as well as learning from previous experience of major life changes where activity remained important to them throughout:

> *I've always done sport, I've always been physically active, and I have continued right through my teens into my twenties. So all of those different transition points where there may have been times where I decided that wasn't for me, as people hit their teens, as they have children, as they get married, etc., it always was something that still remained important to me. So for me, [during the pandemic] it was never a consideration to stop.*
>
> *Parent 15, female, wave 1*

> *I just love being outside in the weather and elements. We've got two dogs, so that is all part of it. I love going to beautiful places. I love that feeling when you're physically tired rather than mentally drained. It feels so, I suppose, integral to who I am.*
>
> *Parent 19, female, wave 2*

Theme 2: perceived autonomy for physical activity

Parents spoke of several positive aspects of the lockdowns that increased their physical activity-related autonomy. Some parents felt they had more choice about the activities they undertook, but this depended on the facilities they had access to, the geography of their local area, their access to exercise equipment and the increased amount of free time that they experienced as a result of the COVID-19 lockdowns. Parents felt that some parts of the lockdowns inhibited their perceptions of autonomy and had a negative impact on their physical activity motivation. In particular, throughout the winter lockdown the need to balance less-flexible working with periods of homeschooling as well as the novelty of the newer activities wearing off had a negative impact on parent's physical activity.

Access to activities

Having access to different activities kept many parents and families active during the pandemic, as it allowed them to ensure variety and choice over their daily activities (a key characteristic of autonomy). For some parents, this led to taking up new activities based on their location, while for others it was discovering new places to walk in their local area:

> *We live near the coast, so it's so opened our eyes to water-sports. Paddleboarding, surfing. Again, right on our doorstep.*
>
> *Parent 14, female, wave 1*

> *It was really good, actually because we found loads of walks around where we live, where we've lived all our lives, but we'd forgotten or didn't know were there. So, we just did all sorts of different walks with the dog, different places we hadn't been or not been for a long time.*
>
> *Parent 9, female, wave 1*

However, access to activities was seen to be a perpetuator of health inequalities during the pandemic. Parents recognised that specialist equipment within the home, or being able to afford certain activities, was a luxury that many families did not, and still do not, have access to:

> *I think the pandemic has just created even more of a gulf between those that have and those that haven't. I certainly think there are huge swathes of society that are in a far worse place than they were beforehand.*
>
> *Parent 1, male, wave 2*

However, the limitations that COVID-19 restrictions imposed also negatively impacted some parents' motivation to be physically active, such as the rule of only leaving the house for exercise once a day. This was particularly the case for parents who valued going for a daily walk as a family but then felt unable to engage in their usual exercise routines:

> *It was harder to maintain my activity levels in the very first lockdown, when you were officially only meant to go out once. If we'd been out for a family walk I didn't officially feel like I could go for an additional run or bike ride.*
>
> *Parent 10, female, wave 2*

Being creative with activity

The loss of previous routines and structures (theme 3), as well as a reduction in choice of activities, meant that parents were forced to be more creative with their physical activities. Parents spoke of thinking beyond their normal activities, considering what was available to them in their very local area as well as integrating indoor, and often screen-based, physical activity into their daily lives. Particularly in the first lockdown, the need to be creative and the novelty of new activities supported parents' autonomy and meant that enjoyment in being physically active increased:

> *Me and my friends were really bored with all online exercises, and we just ended up finding MTV Hip Hop workout videos from the '80s and things, just something that was a bit different. That was fun.*
>
> *Parent 17, female, wave 1*

> *[During the lockdowns] you didn't have the choice of the gym, or swimming pools and that kind of thing, so you had to find different resources. I've never used an app or done any exercise class stuff online. For myself, I just thought this is what I need to do. Now I've just got into that routine …*
>
> *Parent 7, female, wave 2*

The luxury of time

For many parents, the aspects of the lockdowns that had a positive impact on their autonomy and subsequent motivation, such as the ability to be creative with their physical activities, were directly related to an increase in free time. One parent described the first lockdown as *an extended summer holiday* with several parents highlighting that the loss of routine and structure (theme 3) during this time allowed them to be more flexible and spend quality time together being active as a family:

> *I think the first lockdown, if we're quite honest, we quite enjoyed as a family. We had time together, which we've never really had before. I mean we obviously had our moments where it wasn't utopian but it was a nice time. The weather was nice and we enjoyed being out and cycling and walking. Life felt very unpressurised.*
>
> *Parent 18, female, wave 1*

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Repetitiveness of activities and increased pressures

Despite several aspects of the lockdowns having a positive impact on parent's perceived autonomy in the short term, the flexibility and novelty of the first lockdown started to wane as the pandemic progressed and restrictions stayed in place for longer than parents had anticipated. Physical activities that had previously been fun and exciting became repetitive, and perceived autonomy and motivation to maintain activity levels reduced. This was particularly discussed in relation to home workouts:

> *There were definitely motivational issues at the time for home workouts because it was like, 'Do we [whole family] have to do this again?'*
>
> *Parent 7, female, wave 1*

For parents in particular, as the pandemic progressed pressures increased from balancing working from home with the pressures of homeschooling. Thus, during the second winter lockdown, more effort was required to choose physical activity over more sedentary behaviours, and maintaining happiness and well-being meant that physical activity often reduced:

> *The second lockdown was a very dark time. I was expected to be working, while the children weren't at school with quite a lot of schoolwork pressure, without the support to do that. I spoke with the school as they only provided website stuff, no online lessons or anything. It was cold, dark, miserable and we couldn't go out and do stuff. You either decided to keep yourself healthy and get through this, or ride it through with the odd drink, loads of food, whatever it takes to be happy. I probably fluctuated between those.*
>
> *Parent 2, female, wave 2*

Theme 3: perceived competence for physical activity

Several subthemes discussed by parents align with aspects of physical activity-related competence. A loss of perceived physical activity competence during and after the lockdowns was felt due to the loss of daily structure and a subsequent loss of confidence in the activities they engaged in prior to the pandemic. Despite this, some parents mentioned trying to combat the loss of routine by seeking activity-related challenges, which they felt helped to keep them motivated in their activities, perhaps through supporting their need for competence.

Loss of structure

The loss of daily structure and routine was a key aspect of the lockdowns that parents highlighted as impacting their physical activity. This impacted on incidental activity, such as through commuting or normal work activities. This loss of structure had differing impacts on parents, with some able to replace this activity with another form of being active, while for others it made their overall day more sedentary:

> *I have started going in some days per week, back into work, and that means half an hour's walk each direction. I think for me, the not being able to go into work; that was a massive impact. I'm lucky that I can work from home, but it made it more urgent to replace the hour's walk each day, with something else.*
>
> *Parent 3, female, wave 1*

> *I made the effort, in my head mentally, to try and do more, because I realised that I was not doing the exercise, the incidental exercise, that I used to. So I did make an effort to, sort of, go out on the allowed hour's walk for the day.*
>
> *Parent 4, female, wave 1*

The loss of daily routine, and associated loss of structured physical activity for many parents, made the return to their previous activities more difficult, possibly due to the loss of physical activity habits that were a result of the lockdowns and associated restrictions:

> *A lot of the friends that I swim with are just dads from school. After a year and a half off, they've got out of the habit of it, so they've just not got back into it. I still go sometimes and try to coordinate with one of the other dads, but the rest have lost interest in swimming or gone their separate ways.*
>
> *Parent 5, male, wave 2*

In response to the loss of daily routine, parents spoke of trying to build and implement their own structures while largely based at home. This included integrating regular periods of physical activity into their daily routine, such as exercising first thing in the morning before work:

> *In Autumn 2020, we continued to work from home, so that made it necessary to carry on with the self-discipline of going for a run in the morning, or going to the gym, so it's a mixture of that.*
>
> *Parent 3, female, wave 1*

Seeking challenge

During the pandemic, many parents sought out physically active challenges to help them stay motivated and active. Feeling challenged in ones' pursuits, and having the structure in place to build on and overcome these challenges, is a key component of competence in SDT. Having an element of personal challenge to their activities and seeing personal improvement was something that several parents felt kept them motivated. These included daily walking challenges and programmes such as 'couch-to-5k'.

> *I'm not really a runner, but I did take on this year 5k for the Stroke Association in memory of my mum. I did a 5k at a school thing a few years ago and that nearly killed me. That was more peer pressure. But this time I trained. I went out in the rain, in the snow, in the hail and everything and really pushed myself mentally. Because I had a goal … I've tried to keep that up a little bit, on, off.*
>
> *Parent 2, female, wave 1*

> *We did the BRIT Challenge, so got to raise £2021 for universities. It's not competitive, but we had targets to try and do so many miles walking every week. I think that was quite motivating as well. So, it really encouraged me to go out running and walking and record those totals.*
>
> *Parent 5, female, wave 1*

Theme 4: perceived relatedness for physical activity

Issues related to social connection were frequently discussed in relation to aiding or inhibiting physical activity during the lockdowns and subsequent easing of restrictions. The importance of relatedness was highlighted by most parents talking of preferring to be active with friends and family, and, for some, the need to be active while meeting during lockdowns led to ongoing activity that continued as the pandemic eased. However, many physical activity-related connections from before COVID-19 lockdowns were not re-established once restrictions were eased. Some parents also spoke of finding social situations more overwhelming than before the lockdowns, which implicates their physical activity behaviour.

Being active with others

Parents frequently spoke of being active with other people, including friends and family, as being important for their motivation because of having increased connections and accountability. Parents reflected that being active with others is motivating; for example, it encourages walking further and building fitness. Several of these active relationships were established during the lockdowns and have remained in place:

> *The only one change that actually has remained [post lockdown], for me, is my best friend and I would all catch up. We used to go to each other's houses and go to the pub once a week, but, actually, during the lockdown we took to walk around our local business park quite a few times, having a chat and catching up*

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> *that way, because we could not go into each other's houses, could not go anywhere, apart from outside. It is one habit that we have retained.*
>
> *Parent 4, female, wave 1*

> *We played tennis and five-a-side football a fair bit in between lockdowns when we could do socially, with friends and acquaintances. There're physical benefits but it's more the fun social thing. I guess that kind of innate blokey competitiveness as well. It gives you a bit of mental space to go off with some quite good friends, you've got your thing that you do.*
>
> *Parent 14, male, wave 2*

Being active with family was seen as a good parental practice, as it helps to make physical activity normal and a regular part of life. This led to several parents taking up a specific activity with their children:

> *We have just started a CrossFit parent and kid session in our CrossFit gym, encouraging more family participation in things. I think there's an opportunity around that, to help families that are struggling to be active.*
>
> *Parent 18, female, wave 2*

Although many parents valued the opportunity to be active with other people, some highlighted a lack of provision for working parents who want to meet others like them:

> *You see them all with their mat under their arm and tinkering off to the village hall. On a Monday, it's the ladies, and on a Tuesday, it's the gentlemen, and on a Wednesday, it's a mixed group. A big part of it is socialising, isn't it? It's just a shame that there isn't that for my generation.*
>
> *Parent 9, female, wave 2*

Being part of an active community

Parents reflected on the communities that they spend time in and felt that what was typical activity for their community impacted on how active they were during the pandemic. In some communities, this led to a reduction in activity, whereas for others spending time with people who valued being active encouraged them to maintain their activity levels throughout the lockdowns:

> *In my experience, it's sort of within the community, a lot of people didn't want to do exercise, and so, I think that was a total switch-off for people.*
>
> *Parent 6, female, wave 1*

> *A lot of the circles of people that I spend time with are probably quite similar mindset, so those people continued to exercise throughout lockdown, they've continued to exercise since. The majority of them anyway have continued with a pattern of something even if they've changed their activity, they've still continued to do something.*
>
> *Parent 15, female, wave 1*

Embedding themselves in an active community, such as joining an active sports club, helped many parents to continue being active even when the activity itself was not able to continue.

> *When you're used to being part of that team and your values and you've got responsibility and they're dependent on you turning up, [you get] that bit of a mindset of you just bite the bullet and go with it, even if you are a bit tired, even if you can't be bothered. You know, if you don't go, you're going to let people down.*
>
> *Parent 15, female, wave 1*

Keeping connected at a distance

Maintaining social connection throughout the pandemic was important to all parents and screens became the predominant way to do so. This also translated to their physical activity as many activities moved online, and the opportunity to connect with others in this way increased parents' perceptions of relatedness:

> *That hour of sport a day over Zoom was my time, and that was when everybody in the house knew that it doesn't matter what was going on, that's my gym time. It was a social connection. There were a lot of us that went to it. A lot of us that went on to those sessions were similar people of a similar background, similar age. It was just that support network of people that was someone different, that weren't your family that were living and breathing this with you. It was other people, and people that could push you as well.*
>
> *Parent 15, female, wave 1*

Although this helped some parents feel connected to others, for many being active online was not motivating and the online interaction that was relied on during the lockdowns was not an appropriate substitute for in-person socialising:

> *Personally, just the way I am. I am really not motivated to do exercise at home. Even having the accountability of somebody on Zoom, it is not really the same. It is not as fun.*
>
> *Parent 17, female, wave 1*

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Discussion

This study presents a mixed-methods exploration of physical activity motivation and physical activity behaviour in parents of English primary school children during the COVID-19 pandemic and in the short- and medium-term recovery periods. The quantitative findings suggest that the role of motivation for exercise in determining physical activity engagement remains important following the COVID-19 pandemic and associated lockdowns, but differences in the magnitude of the estimates indicate that the impact of the lockdowns on behavioural regulations is complex. Qualitative interviews with parents highlighted several positive and negative impacts that the COVID-19 lockdowns had on their motivation for physical activity directly and on the motivational precursors of the basic psychological needs. In terms of negative impacts, there appears to be enduring negative influences on competence and relatedness satisfaction, which should be addressed in order to support parents to be physically active and to maintain their well-being. Conversely, parents who enjoyed physical activity (intrinsic regulation), were mindful of the physical and mental health benefits of being active (identified regulation) and felt that being active was part of their identity (integrated regulation) identified these as key drivers for themselves in maintaining physical activity levels throughout the lockdowns and in the recovery period.

The role of motivation for exercise in parent physical activity engagement remains important following lockdowns, with autonomous forms of motivation (intrinsic and identified regulation) and amotivation both appearing to be slightly more strongly associated with MVPA post lockdowns (wave 2). While post-lockdown sample sizes make it difficult to draw firm conclusions, introjected regulation may also be positively associated with MVPA in wave 2. This is in contrast to previous evidence that suggested behavioural regulations have become less important in determining physical activity behaviour in adults over the course of the pandemic.[33] However, the findings of the present study are based on accelerometer-estimated physical activity measured after the lockdowns and do not rely on retrospective self-report data. Moreover, our study specifically focuses on parents (the majority of whom are females) and so may not be indicative of all adults. Motivation is multidimensional in nature, with our findings highlighting that, individually, the behavioural regulations have both positive and negative associations with MVPA. Differences between waves in the multiple regression model, when behavioural regulation types are mutually adjusted for each other, suggest that there may be complex differences in how motivation types are associated with each other, particularly the role of identified and introjected regulations and amotivation. Previous analyses have emphasised how motivations can combine in different ways, leading to differential impacts on physical activity outcomes.[49,50] This is particularly the case for introjected regulation, which has been shown to combine with both more autonomous regulations and more controlled regulations, leading to very different motivation profiles and different levels of MVPA.[49] While interpretation is not straightforward, especially as behavioural regulation types are correlated with each other, it is possible that this reflects a post-lockdown increase in physical activity motivated by introjected regulation, for example, driven by internal pressures such as guilt. As previous evidence suggests that autonomous motivation is a better facilitator for more sustainable long-term behaviour change,[21] it is therefore possible that the increase in MVPA observed among parents may not last.

The qualitative data support the notion that there were complex changes to physical activity-related motivation during the COVID-19 lockdowns with some aspects of the pandemic having long-lasting effects on their motivation through the basic psychological needs of autonomy, competence and relatedness. Despite the lockdown restrictions, some parents felt that an increase in free time and opportunity to discover new ways to be physically active in their neighbourhood was facilitative of activity engagement and enjoyment during the first lockdown (starting in March 2020), but this novelty had worn off by the second lockdown (November 2020). Novelty satisfaction has been explored quantitatively and been shown to be positively associated with autonomous motivation for exercise, effort and enjoyment.[51] From SDT perspective, intrinsic regulation predicts physical activity engagement through inherent interest and enjoyment in the activity,[52–54] which novel activities have also been

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shown to promote.[55] Relatedly, it has been hypothesised that novelty could be incorporated into SDT as a fourth basic psychological need highlighting the importance of this construct in promoting more autonomous forms of behavioural regulation.[56,57] The regular introduction of novel physical activity opportunities may therefore increase enjoyment and interest in being physically active and, as we emerge from the COVID-19 pandemic, it is imperative that there are opportunities for parents to try new activities.

Parents highlighted that the change in daily routines that occurred due to the lockdowns has had a long-lasting negative effect on their motivation to be physically active. Lockdowns resulted in a reduction in commuting, physical shopping trips and use of leisure facilities that previously helped parents to be active during the day, and evidence suggests that in the UK these behaviours have not returned to pre-pandemic patterns, with more online shopping and hybrid working patterns being prevalent.[58,59] Some systems for arranging organised physical activities that have remained in place following the COVID-19 restrictions, such as limited numbers and advance booking, have led to a loss of spontaneity.[47] Parents felt that attendance at organised activities became less predictable as the lockdowns eased and therefore planning their weekly schedules became more difficult. This, combined with a loss of confidence in their exercise abilities, may have inhibited some parents from re-establishing the physical activity routines and habits that were established pre COVID-19.[60,61] Many parents spoke of engaging in physical activity behaviours that were more informal and do not require booking, such as walking, cycling and running, which may indicate that the type of activities that parents engage in post COVID-19 have changed. This is in contrast to patterns seen in children, where organised active clubs have become the mainstay of activity for children following lockdowns,[47] particularly active clubs based at the child's school, but this has been socio-demographically patterned.[46,47,62,63]

The qualitative discussions highlighted the importance of social connection during the pandemic for increasing enjoyment and effort in physical activity. Connecting with others was often one of the main reasons for engaging in online physical activity and going for walks with friends. Quantitative evidence indicates that online physical activity platform use increased during the COVID-19 lockdowns and was associated with adults meeting physical activity recommendations.[64] However, it is evident that this online connection may not have been sufficient to satisfy the basic psychological need of relatedness, with many parents highlighting that they felt more isolated, with a feeling of social overwhelm as life post COVID-19 lockdowns resumed. More specific opportunities for parents of school-aged children to meet to be physically active are needed in order to support their well-being and increase social connectivity in this population.

Lessons learnt and future research

These findings suggest that there is a need for more targeted strategies to support parents of primary school children in their physical activity following COVID-19 to help maintain not only their own physical activity levels and well-being but also those of their children. Specifically, this study has three key findings and implications (*Table 5*). Strategies should aim to increase social connectivity and perceived competence through the use of novel physical activity opportunities. This may include group

TABLE 5 Key findings and implications

Key finding	Implication
Enjoyment of physical activity has decreased during lockdowns due to limited options	Promote a broad range of novel activities to increase enjoyment and autonomous forms of motivation
Many parents reported feeling socially isolated and overwhelmed	Harness physical activity as a means for parents of school-aged children to socially reconnect after the pandemic
Perceived competence for physical activity has decreased over the pandemic	Physical activities that allow parents to rebuild their perceived competence post pandemic are needed

activities that change location or activity type on a regular basis and that can be adapted to a lower intensity if needed. For example, our participants described sports/exercise clubs and walking groups as activities that they found beneficial.

However, in order to develop more targeted interventions, there is a need for more in-depth quantitative exploration of the role of individual behavioural regulations post pandemic, accounting for the multidimensional nature of motivation as to whether motivational profiles have changed as a result of the COVID-19 pandemic. While physical activity levels may have been maintained in this population – and for some parents the pandemic promoted more autonomous motivation for exercise – the COVID-19 restrictions appear to have had some enduring negative influences on parent's physical activity-related autonomy, competence and relatedness which, if sustained in the long term, could have a detrimental influence on parents' well-being.[13] Future research should therefore seek to work collaboratively with parents in order to identify what they would like in terms of physical activity opportunities. Additionally, there needs to be more exploratory work conducted into how best to promote autonomy, competence and relatedness satisfaction in parents. From the qualitative discussions presented in this study, harnessing the potential for novel activities by ensuring parents have regular opportunities to try a variety of new physical activities may offer potential. Providing opportunities for parents to meet together to be physically active may also help to increase social connection.

Limitations

This study extends previous studies that have explored the quantitative associations between motivation and physical activity during the pandemic by using accelerometer-assessed physical activity estimates and combining with qualitative data to provide an in-depth exploration of how lockdowns impacted parents' physical activity motivation. However, it is important to highlight several limitations. Firstly, the samples of parents in waves 1 (N = 218) and 2 (N = 237) are smaller than the pre-pandemic wave 0 (N = 710), which may mean that we lack power to identify associations between behavioural regulations and MVPA post pandemic. Because we used a continuous measure of MVPA as the outcome, we are unable to explore associations between behavioural regulation types and whether the parent meets current physical activity guidelines, as this would have reduced power still further. While the mean values of key variables were consistent across waves, it is also possible that the post-pandemic samples do not capture the breadth of parents that were involved pre pandemic. Additionally, the convenience sampling used for the qualitative parts of the study has led to a very active parent sample that is predominantly female, white and from higher socioeconomic areas. The findings therefore may not reflect the broader parent population, but reflect the opportunities and challenges among those who are striving to be active, rather than barriers among those who are inactive. The interviews asked parents to reflect back on their physical activity during the lockdowns, yet the quantitative data were collected post lockdowns, which means that the quantitative and qualitative data do not follow the same timeline. Lastly, it is important to highlight that the BREQ-2 measure refers specifically to exercise behaviour, whereas MVPA and the discussions with parents reflect physical activity more broadly. The qualitative discussions are therefore referring to physical activity behaviours more broadly than the quantitative data.

Conclusions

Motivation appears to play a stronger role in physical activity behaviour post pandemic, and parents highlighted many motivational factors that they perceive to be important for supporting their physical activity. The COVID-19 lockdowns have had a long-term negative impact on some aspects of autonomy,

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competence and relatedness in relation to physical activity, and there is a need for future strategies to support parents not only to ensure physical activity levels are maintained but also facilitate well-being in this population. There is a need to work collaboratively with parents to identify key strategies; however, those that focus on offering a range of novel activities and those that bring parents together may hold potential.

Additional information

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Contributions of authors

Lydia Emm-Collison (https://orcid.org/0000-0002-5493-3223) (Lecturer in Physical Activity and Behaviour Change) oversaw data collected in wave 0, conducted the analysis of all models and led the writing of the manuscript.

Robert Walker (https://orcid.org/0000-0001-9901-5285) (Qualitative Research Associate) supported the development of the manuscript and edited it for intellectual content.

Ruth Salway (https://orcid.org/0000-0002-3242-3951) (Senior Research Associate, Statistics) advised on statistical analysis and interpretation and edited the manuscript for intellectual content.

Danielle House (https://orcid.org/0000-0001-6171-9922) (Senior Research Associate, Study Manager) oversaw data collection in wave 2, managed the project and edited the manuscript for intellectual content.

Kate Sansum (https://orcid.org/0000-0003-3392-6750) (Fieldworker) conducted wave 2 data collection, supported the development of the manuscript and edited it for intellectual content.

Katie Breheny (https://orcid.org/0000-0001-6886-4049) (Senior Research Associate, Health Economics) supported the development of the manuscript and edited it for intellectual content.

Sarah Churchward (https://orcid.org/0009-0007-7765-3682) (PPI member of the Study Management Group) supported the development of the manuscript and edited it for intellectual content.

Joanna G Williams (https://orcid.org/0000-0002-4737-1760) (Consultant in Public Health) supported the development of the manuscript and edited it for intellectual content.

Frank de Vocht (https://orcid.org/0000-0003-3631-627X) (Professor in Epidemiology and Public Health) supported the development of the manuscript and edited it for intellectual content.

Russell Jago (https://orcid.org/0000-0002-3394-0176) (Principal Investigator, Professor of Physical Activity and Public Health) led the project, oversaw all aspects of study design and interpretation, supported the development of the manuscript and edited it for intellectual content.

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Disclosure of interests

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Data-sharing statement

All data requests should be submitted to the corresponding author for consideration. Access to anonymised data may be granted following review.

Ethics statement

Ethical approval was gained from the School of Policy Studies Ethics Committee at the University of Bristol, UK (Ref SPSREC/20-21/150) on 9 March 2021. The project was listed on the Research Registry www.researchregistry.com/browse-the-registry#home/registrationdetails/604b4760d539c90020642be6/.

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Study registration

This study is registered as research registry (project 6646).

About this article

The contractual start date for this research was in April 2021. This article began editorial review in April 2023 and was accepted for publication in August 2023. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The PHR editors and publisher have tried to ensure the accuracy of the authors' article and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this article.

This article reports on one component of the research award Exploring parents' physical activity motivation during the COVID-19 pandemic: a mixed-methods study from a self-determination theory perspective. For more information about this research please view the award page https://www.fundingawards.nihr.ac.uk/award/NIHR131847

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List of supplementary material

Report Supplementary Material 1 Supplementary tables

Supplementary material can be found on the NIHR Journals Library report page (https://doi.org/10.3310/KPKW8220).

Supplementary material has been provided by the authors to support the report and any files provided at submission will have been seen by peer reviewers, but not extensively reviewed. Any supplementary material provided at a later stage in the process may not have been peer reviewed.

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List of abbreviations

BMI	body mass index	IMD	Index of Multiple Deprivation
BREQ-2	Behavioural Regulations in Exercise Questionnaire version 2	MVPA	moderate-to-vigorous physical activity
COVID-19	coronavirus disease 2019	PPI	patient and public involvement
EDI	equality, diversity and inclusion	SDT	self-determination theory

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