EARLY INTERVENTION FOUNDATION

Growing up in the Covid-19 pandemic

An evidence review of the impact of pandemic life on physical development in the early years

November 2021

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About EIF

The Early Intervention Foundation (EIF) is an independent charity established in 2013 to champion and support the use of effective early intervention to improve the lives of children and young people at risk of experiencing poor outcomes.

Effective early intervention works to prevent problems occurring, or to tackle them head-on when they do, before problems get worse. It also helps to foster a whole set of personal strengths and skills that prepare a child for adult life.

EIF is a research charity, focused on promoting and enabling an evidence-based approach to early intervention. Our work focuses on the developmental issues that can arise during a child's life, from birth to the age of 18, including their physical, cognitive, behavioural and social and emotional development. As a result, our work covers a wide range of policy and service areas, including health, education, families and policing.

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What this briefing tells us

Young children in their early years have been adversely impacted by the consequences of the Covid-19 pandemic, such as stay-at-home orders and the closure of services, across a range of physical development domains. The scope of this review focuses on the 'early years,' which includes infants and children aged 0–5 years old. The review found relatively little evidence which specifically examined the impact of the Covid-19 pandemic on children aged 0–5 years in the UK, with much of it focused on older children and conducted outside of the UK, which will have had similar but not identical impacts. The findings stem from studies published since the beginning of the Covid-19 pandemic, January 2020 –April 2021.

Summary of findings

- **Physical activity:** While no UK evidence for under 5s was identified, the majority of studies of older children or studies from other countries report a decrease in physical activity as well as a decrease in positive attitudes towards physical activity as a result of Covid-19, although variability exists across countries suggesting the impact will be contextually dependant.
- **Food security:** All the studies identified indicate that food security has worsened as a result of Covid-19, both globally and in the UK.
- **Diet and micronutrient deficiency:** No UK-based evidence examining the impact of Covid-19 on diet or micronutrient deficiency was identified but evidence from other countries was found. For diet, unhealthy choices in everyday meals and snacking appear to have increased during the pandemic, with some countries since reporting an increase in obesity rates in children and adolescents. For micronutrient deficiency, a limited number of studies report potential vitamin D deficiency as a result of stay-at-home orders, but no evidence was found on other forms of micronutrient deficiency.
- **Breastfeeding:** Evidence regarding breastfeeding was mixed, with both positive and negative impacts for women and their infants reported in the UK. More data is required to establish whether these experiences have translated into increases or decreases in breastfeeding during the Covid-19 pandemic.
- **Oral health:** Relatively little evidence was identified. However, evidence that was identified suggests that oral healthcare for infants has declined as a result of the Covid-19 pandemic, both in the UK and elsewhere. None of the studies looked at the causes or consequences of reduced oral healthcare.
- **Vaccinations:** There is evidence to indicate that routine vaccinations in infants saw a significant reduction as a result of the Covid-19 pandemic in the UK and elsewhere. At the height of the pandemic, evidence suggests that some families in England were unaware that routine vaccinations should continue, and some had difficulty accessing vaccination appointments.
- **Sleep:** While no UK-based evidence on sleep was identified, there were number of studies from other countries. Some of these reported improvement in sleep, however the majority reported decreases, notably for sleep quality.

The impact on vulnerable children

Vulnerable children[S1,1] in particular are at greater risk of adverse physical development outcomes as a result of the Covid-19 pandemic:

- **Physical activity:** While no UK evidence for vulnerable young children aged 0–5 years was identified, evidence for older children and evidence from other countries suggests that children from low income and UK minority ethnic backgrounds (who traditionally have lower levels of physical activity), as well as those with neurodevelopmental conditions, have seen reductions in activity levels. Additional risk factors were identified which included children who have limited outdoor space to play, for example children living in apartment blocks, and those where parents work from home.
- **Food security:** In the UK and globally, children who access free school meals and children from low-income households were at greater risk of food insecurity during the Covid-19 pandemic.
- **Diet and nutrient deficiencies:** While no evidence was found for children aged 0–5, evidence from other countries on older children suggests that during the Covid-19 pandemic, children from poorer families were more likely to rely on cheap, shelf-stable food that is often high in calories and low in nutritional value, contributing to worsening dietary nutrition. The review found no evidence overall on nutrient deficiencies in the UK but did find international evidence on vitamin D deficiency, which has implications for children with darker skin tones in the UK who are at greater risk of vitamin D deficiency.
- **Breastfeeding:** In the UK, women with lower educational attainment, Black and Asian women, and women from minority ethnic groups,[2] women living in more challenging living circumstances,[3] women with suspected Covid-19, and women with worsening perinatal mental health faced additional challenges in relation to breastfeeding during the pandemic, making it more difficult for them to maintain breastfeeding. Available evidence indicates more negative experiences of breastfeeding and higher cessation rates among women from UK ethnic minority groups, and those living in more challenging circumstances.
- **Oral health:** With no evidence from the UK, evidence from other countries suggested that children in households with job/income loss and poorer families were at greater risk of unmet oral health dental needs, particularly in relation to preventative services, during Covid-19.
- **Vaccinations:** In England, caregivers from minority ethnic backgrounds and low-income households were more likely to be unaware that routine vaccinations should continue, with indications that many had difficulty accessing vaccination appointments. They were also more likely to say they would reject a Covid-19 vaccine for their child should they become available for children in future.

S1 Throughout the text, studies referenced in this review are denoted by **S1 – 121**, which correspond to the **full reference list** at the end of this document.

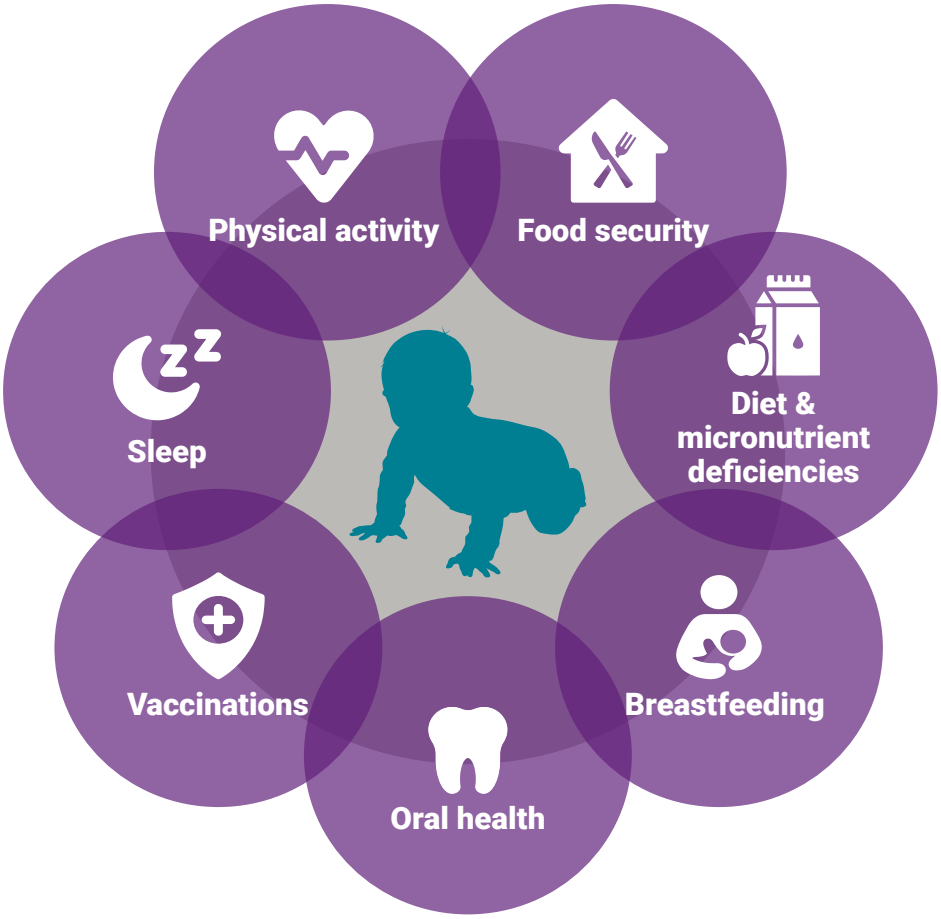
1 Defined as any children at greater risk of experiencing physical or emotional harm and/or experiencing poor outcomes because of one or more factors in their lives.

2 The terminology used throughout this review to refer to ethnicity and ethnic groups reflects the various studies it draws on. **EIF's own guidelines** on language and writing principles relating to equality, diversity and inclusion acknowledge that there is considerable diversity both between and within ethnic groups. As much as possible, we use language that recognises the diversity within broad minority ethnic groups, while reflecting the nature of the data sample or research population being reported on.

3 This included women who did not have access to high-speed internet at home, who did not live in a ground floor flat and/or did not have access to a private garden, and did not live near green space where it was easy to get out for walks/fresh air.

FIGURE 1

Seven factors affecting children's physical development in the early years and explored in this review.



- **Sleep:** While no UK-based evidence was identified, evidence from other countries suggests that children from lower socioeconomic backgrounds and those with neurodevelopmental conditions, were at risk of reduced sleep duration and/or quality during the pandemic. Additional risk factors were also identified which included children who live in apartments and those with less space to play at home.

Available evidence suggests the physical development of young children is likely to have been negatively impacted by the consequences of the Covid-19 pandemic, particularly in the case of vulnerable groups, namely children from low-income families, and those from UK minority ethnic families.

However, relatively little evidence specifically examined the consequences of the pandemic on children aged 0–5 years in the UK with much of it focused on older children. Many studies were also conducted outside of the UK, which will have had similar but not identical impacts, such as the incidents of stay-at-home orders and the closing of services. As a result, evidence is urgently needed to understand both the short- and long-term impact of the pandemic on early physical development in the UK, particularly for vulnerable groups. Collecting nationally representative real-time data on the factors highlighted in this report is therefore critical to understanding ongoing challenges.

While the review considered each factor influencing physical development individually, these factors are not discrete and they interact bi-directionally and on other factors (for example obesity) to influence physical development in the early years and over a child's lifetime.

Future research should therefore examine these factors together and take account of the many wider risk and protective factors that impact on early child development, ranging from financial insecurity and parental mental health to early childhood services and stable family relationships. Longitudinal cohort studies, such as the new Children of the 2020s Study[4] and proposed Early Life Cohort Study,[5] could provide a rich source of data where early physical health factors as well as core risk and protective factors are comprehensively measured.

Without prioritisation of evidence-based policies and services aimed at supporting physical activity and promoting food security, good quality diet and nutrition, breastfeeding, oral health, immunisations and sleep, the long-term impacts of the pandemic are likely to hinder the early physical development of this generation of young children and lead to increased health risks and inequalities in later life.

4 For more information see: https://www.ucl.ac.uk/news/2021/may/new-birth-cohort-study-will-study-children-2020s

5 For more information on the feasibility study see: https://cls.ucl.ac.uk/cls-studies/early-life-cohort-feasibility-study/

Introduction

The early years (0–5 years) are recognised as a crucial time for children's development, impacting on their short- and long-term health and wellbeing. While Covid-19 contraction rates for under-5s have been much lower than for other age groups, the indirect impacts of Covid-19 on young children have been extensive and multifaceted, and the impact on their development is not fully understood. Worryingly, there is growing contemporary evidence to suggest that the impact of lockdown has had a disproportionate impact on families with infants and young children.[S2] As a result, a rapid review of the emerging evidence available to date on the impacts of the Covid-19 pandemic on children's early physical development, such as stay-at-home orders and the closure of services, including for vulnerable children, was warranted.

In this evidence brief, we present the findings of a rapid review of the evidence that examines the impact of the Covid-19 pandemic on early childhood physical development.[6] We pay particular attention to evidence investigating the impact on vulnerable children, including those from low-economic income families and those from minority ethnic groups who, even before the pandemic, were disproportionately at risk of poor physical development outcomes. The review aimed to answer the following research questions:

- What are the key factors known to impact on children's early physical development?
- What is the emerging evidence of the impacts of the Covid-19 pandemic on these factors of children's early physical development, including vulnerable children?

Methods

Identification of key risk and protective factors, and development of consensus statements

An initial scoping search was conducted to identify the key risk and protective factors for early physical development. Key risk and protective factors identified were physical activity, diet, malnutrition, breastfeeding, food security, immunisation, oral health, sleep and sensory development.[7] A search of Google Scholar was then conducted using each factor as a search term in combination with the word 'review' which resulted in the identification of 33 review articles. Fourteen of these reviews, together with five sources of grey literature (including government and NHS reports) known to the research team, were used to inform the writing of consensus statements, which outline how each factor is understood to affect early physical development.

Rapid literature review on the impact of the Covid-19 pandemic on early physical development

The literature review took place between 1 April 2021 and 30 April 2021, and the following databases were searched: Web of Science, Campbell Library of Systematic Reviews and Cochrane library. A search of preprint archives (PsyArXiv, MedRxiv and Preprints), hand

6 The rapid review was conducted as part of a report provided to the (previous) Public Health England in September 2021.

7 The initial search identified sensory development (e.g., sight or hearing) as a key factor important for children's physical development, however the search in Google Scholar revealed no evidence suggesting this was a protective or risk factor for physical development and it was thus excluded as a category from this review.

searches of reference lists of included articles, and hand searches of Google Scholar were also conducted. Policy documents and EIF reports known to EIF staff were also included where they were identified as relevant through consultation.

Topics considered relevant for this review were those related to the impact of Covid-19 on physical development of children aged 0–5 years old, including vulnerable children. The inclusion criteria established for the selection of literature is listed below. Literature that did not meet these criteria was excluded from the review:

1. primary and secondary research, systematic and non-systematic reviews, and grey literature
2. a focus on young children, aged 0–5 years
3. outcomes related to the identified key risk and protective factors noted above, in line with the search terms used
4. work published since the beginning of the Covid-19 pandemic, January 2020 – April 2021; and
5. research in the context of OECD countries and China (given its importance in the context of Covid-19). Work relating to the UK context was of particular interest.

The initial search identified 3,215 potentially relevant articles, and after applying inclusion/exclusion criteria, a total of 146 relevant articles were included in this review. A further 31 sources of evidence, including grey literature, policy documents and EIF published reports, identified through expert/internal consultation, were also included.

Notably, this review did not assess the quality of included/excluded studies, meaning all studies that met the eligibility criteria were included. Additionally, it is important to note that there are multiple risk and protective factors which influence a child's early physical development at individual, family, community and national level, which have not been considered within the scope of this review. In order for the review to be focused, the risk and protective factors with the strongest evidence of their direct impact on early physical development were chosen. This evidence brief therefore provides an overview of the literature, as opposed to a comprehensive analysis of the evidence base Finally, it is important to note that the evidence included in this review reflects a literature base in its infancy due to the timeline of the Covid-19 pandemic. As the pandemic continues over time, we expect more evidence, particularly cohort and longitudinal evidence, to emerge which captures the impact of Covid-19 on children's health and physical development. As such, findings and conclusions of this review are reflective of the evidence available to date.

Findings

Physical activity

What do we mean by physical activity and how does it affect children's early physical development?

Physical activity is broadly understood as any bodily movement that requires energy expenditure.[S3] In the early years, the intensity and type of appropriate physical activity is contingent on the age and physical capacity of the child. Evidence available from systematic reviews consistently shows more physical activity is associated with improved motor development, cognitive development, bone and skeletal health, and physical fitness.[S4–S6] Participating in age-appropriate physical activity allows infants and young children to reach developmental milestones appropriately and earlier than infants who are not exposed to the same level of activity.

Consensus from available evidence shows more physical activity in the early years is consistently and favourably associated with multiple health indicators but there is not enough information available to form evidence-based guidelines that outline the specific amount, intensity, frequency, or type of physical activity needed in the early years between the ages of 0 and 5 years, that is optimal for healthy growth and development in childhood. There is no evidence to suggest increased physical activity in the early years is associated with adverse outcomes, such as injuries requiring medical attention.

What is the emerging evidence on the impact of the Covid-19 pandemic?

This rapid review **identified no UK-based evidence aimed at understanding the impact of the Covid-19 pandemic on children's physical activity in their early years**.[8] Evidence available from studies based in other countries suggests a decline in physical activity as a result of the pandemic. This is consistent with evidence from England and elsewhere which indicates **there has been a decrease in physical activity levels among children older than 5**.[S7–S15] There was also evidence from older children that confidence in taking part in sporting activity has decreased, as well as a decrease in positive attitudes towards physical activity, particularly among minority ethnic pupils.[S13] There is also some evidence to suggest children's physical activity is also related to their diet and nutritional habits, and their sleep,[S16] which have both also been impacted by the pandemic.

Early years evidence from Canada, Italy, Spain, Portugal and Brazil suggests **a significant decline in physical activity levels during the pandemic, compared to pre-pandemic levels**.[S17–S21] Evidence from Spain and Brazil[S21] also suggests that many children were no longer meeting WHO movement guidelines (60 minutes of moderate to vigorous-intense physical activity per day, seven days a week).

Evidence from Spain suggests that activity levels may have varied as a function of age, noting that children in primary education (aged 6–12 years old) reported higher daily levels of physical activity, while children aged 3–5 years reported less, and children aged 0–2 years reported even less daily physical activity.[S17] Evidence from Spain also showed an effect of

8 This review also searched for the impact of the Covid-19 pandemic on motor development, however few studies were identified and are therefore not discussed.

age, although in this study 0–2 year olds presented with the highest percentage of physical activity, followed by the 3–5-, 6–9- and 10–12-year age groups.[S22]

Notably, across a set of studies,[S16,S22,S23] there was evidence to suggest that **having inadequate space to play at home, such as children living in apartment blocks, as well as having all adults working from home,[S22] was associated with worse physical activity levels**. Conversely, living with other children appeared to have a protective effect with greater physical activity levels reported for families where more children were present in the home.

Despite evidence demonstrating a reduction in physical activity levels for young children as a result of the pandemic, there was **evidence from some countries to suggest improvements in physical activity levels, although local context likely contributed to these findings**. In Sweden,[S24] parents reported a significant increase in levels of physical activity for their child, as well as time spent outside on weekdays and weekends. Notably, unlike many countries, preschools, playgrounds and parks in Sweden remained open, and preschools changed their routine to have children outside as much as possible.

What is the impact on vulnerable children?

Relatively little evidence was found on the impact of the pandemic on physical activity among vulnerable children aged 0–5, with none from the UK. For older children in England, the report by Sport England[S13] showed falls in both the proportion of children and young people (aged 5–16 years) who reported being active, and confidence in taking part in sporting activity. Whilst all groups have been impacted, the impact was greater for some groups than others:

- **Gender:** Whilst boys are traditionally more active than girls, they saw a significant decrease in activity, especially for boys aged 9 and older.
- **Income:** Activity levels remained lower for those from less affluent families than for those from the most affluent families, less affluent children also saw higher drops in the proportion of children enjoying and feeling confident in taking part in physical activity.
- **Ethnicity:** Pupils from Black and mixed backgrounds, and to a lesser extent Asian and other backgrounds, saw significant decreases in activity level over the summer term, mainly driven by boys within these groups. Worryingly, these decreases were accompanied by decreases in positive attitudes to physical activity.

As set out above, some of the international studies identified investigated the role of household variables on levels of physical activity during the pandemic.[S16,S22,S23] **These studies highlighted access to outdoor space and space to play at home, which is typically lacking in deprived neighbourhoods, as important factors that positively influence levels of physical activity**. They also note the importance of considering urban versus rural populations, with smaller declines in physical activity levels observed in rural populations, suggesting living in densely populated urban neighbourhoods may adversely impact physical activity. There was also likely a differential impact on the physical activity levels of vulnerable children who were advised by the government to 'shield' due to pre-existing health conditions, or those who shielded as a result of their parents shielding, although we found no evidence examining this at-risk population.

There was also evidence to suggest children with specific neurodevelopmental conditions, such as ADHD and autism also showed reduced physical activity.[S25–S27] However, we found no evidence to suggest greater decreases in physical activity during the pandemic in these populations. More research would be required to establish comparative prevalence.

Food security, diet and micronutrient deficiencies

What do we mean by food security, diet, and micronutrient deficiencies, and how do they affect children's early physical development?

The first five years of life are characterised by substantial growth and development, and food security, that is having access to safe and nutritious food, is an important factor that affects children's health and wellbeing during this period. In line with the WHO definition,[S28] malnutrition during childhood is understood as the inadequate provision of nutrition to support healthy development. Evidence included in this rapid review explores the impact of Covid-19 on the availability of adequate nutrition for children broken down into three factors: food security, diet, and malnutrition from micronutrient deficiencies.

- Household **food insecurity** is understood as the lack of access (physically, socially, economically) to safe and nutritious food to meet individual needs for a healthy and active lifestyle.[S29] This can include an inability to buy food arising from economic hardship, lack of food in shops, or an inability to go out and get food. Available evidence[S30–S32] consistently shows exposure to food insecurity in the early years is associated with poor early childhood development, and negatively impacts children's readiness for school. Specifically, food insecurity had negative impacts on children's cognitive, language, motor, socio-emotional, and behavioural development, and longer exposure to food insecurity increases the negative impact it has on early childhood development.
- **Diet** is understood to mean the qualities, composition, and the effects on health of food and drink consumed. National and international health guidelines set out core recommendations for children's diet to support optimal growth and development in the early years, childhood and beyond.[S33–S35]
- **Micronutrient deficiencies**, a lack of vitamins and minerals, include, for example, calcium, vitamin A, vitamin D and iron. Undernutrition and nutrient deficiencies during the first five years of life contribute to long-term developmental delays in physical, cognitive and behavioural development, as well as reduced immunocompetence and increased morbidity (which are largely irreversible) and mortality.[S28, S33, S35, S36] Effects on cognitive, behavioural and socio-emotional development include, but are not limited to, attentional disorders, reduced social skills, delayed cognitive skills in numeracy and literacy, behavioural difficulties, and delayed language development.

Given its importance and prevalence in the emerging literature identified in this review, the synergistic impacts of Covid-19 and childhood obesity are considered at the end of this section.

What is the emerging evidence on the impacts of the Covid-19 pandemic?

Food security

Evidence available from the UK, along with a number of international studies, suggest **a decline in food security as a result of the Covid-19 pandemic**. This is consistent with evidence including cohorts with wide age ranges, for example 5—25 years, which also indicates there has been a decrease in food security among families with older children.[S38–S41]

Before the pandemic, 5 million people (8%) in the UK were in food insecure households, which included 13% of children.[S42] **Evidence from the UK indicates that food security has worsened as a result of the Covid-19 pandemic**. The Food Foundation (UK) commissioned seven nationally representative surveys,[S43] and found that 4.7 million adults and 2.3 million children lived in a household that experienced food insecurity in the first six-months of the pandemic, including 12% of all households with children. **Food insecurity levels remained higher than pre-Covid levels over a 12-month period** (8% pre-Covid; 10% March to August

2020; 9% August 2020 to January 2021), **with a sharp spike noted in the first two weeks of lockdown** when 16% of households experienced food insecurity. Supply issues contributed to worsening food insecurity early in the pandemic, however as the pandemic progressed economic issues worsened with 2 million adults (53%) reporting economic issues as a cause of their food insecurity in the last month. **Reported food insecurity in households with children was consistently higher than in the general population during Covid-19**. There was also evidence of marked increases in charitable food bank usage and emergency food parcel distribution in the UK.[S44]

Similar trends were identified internationally, namely in the US,[S45] Canada[S18] and Italy[S46] where factors associated with increased risk of food insecurity included households with an unstable economic situation, more than one child, and at least one parent on furlough.

Diet

This rapid review identified no evidence aimed at understanding the impact of the pandemic on the diets of children aged between 0–5 years old. Evidence available from studies of children aged over five indicates there have been **increases in snacking behaviour, increased consumption of processed foods, and increased purchases of preserved food by parents and families**. There is some data to suggest children eating at home in the family environment contributed to an increase in fruit and vegetable intake. It is important to note that these **trends are likely to be affected by food security and household financial stability**.

Studies of over-5s included:

- One systematic review[S47] collating cross-sectional and cohort data from 12 countries which showed **changes in dietary behaviours including increased snacking, increased consumption in sweet foods, and increased consumption of calorific foods**. A small longitudinal observation study from Italy reported that children and adolescents significantly increased the number of meals they ate per day during the regional lockdown, however their daily intake of fruits or vegetables did not change. Instead, their consumption of potato chips, red meat, and sugary drinks increased significantly.
- Another cross-sectional study in the United States[S38] reported on family eating habits pre- and during the pandemic, and **found one third of families increased their purchases of high-calorie snacks and desserts/sweets**. There was also a 47% increase in the purchasing of processed and preserved (non-perishable) foods.
- Two cross-sectional studies[S38, S47] of children and adolescents from the US, Spain, Italy, Brazil, Colombia, and Chile showed **a significant increase in the average consumption of fried foods, high-calorie snack foods, and sweet foods per week during Covid-19 stay-at-home orders**. Households with seven or more people had the lowest consumption of weekly vegetable intake and highest fried food intake during Covid-19 compared to households with fewer people.[S48] Larger families may reduce the availability of resources available per child, meaning the nutritional-density of foods is lower as food is distributed across the household.
- A study from Italy[S49] examined the eating habits of children with obesity, who were enrolled in a nutrition support and education programme prior to the Covid-19 outbreak. Findings showed there was an increase in children feeling hungry, and increased consumption of sweets and biscuits during lockdown compared to pre-pandemic. The study concluded that maintaining a healthy lifestyle, including a diet with adequate fruits and vegetables and minimal sweet and salty snacks was difficult for most families. This is notable because these families were already receiving guided support and intervention prior to and during the lockdown period.

Micronutrient deficiencies

Evidence in this rapid review has highlighted increasing levels of food insecurity throughout the pandemic as well as increasingly poor diets among children and families. Restricted access to healthy and nutritious food is likely to have impacted children's malnutrition beyond micronutrient deficiencies. **However, this rapid review identified minimal evidence, with no UK-based evidence, outlining the impact of lockdown and confinement on micronutrient malnutrition among children**. Evidence was only available for one indicator of micronutrient nutrition status: vitamin D.

- One retrospective cohort study in Korea[S50] compared vitamin D status in the year preceding school closures ('pre-Covid') to the six-months following school closures. Analyses found **a significant decrease in average vitamin D levels during school closures**, suggesting a significant impact of just six months of school closures on young children's micronutrient malnutrition.
- A study in China[S51] examined the impact of Covid-19 measures on 2.5 year olds vitamin D levels and found similar results: **a significant increase in the proportion of children with vitamin D deficiency**[9] in 2020 (8%) compared to 2019 (3%), 2018 (2%), and 2017 (5%). Interestingly, trends in deficiency varied by age. Among infants aged 6–12 months and young children aged 1—3 years, who are recommended daily vitamin D supplements, the proportion of children with vitamin D deficiency was not higher than in previous years. However, **among 3–6 year olds (who are not recommended supplementation) the proportion of children with vitamin D deficiency increased significantly in 2020**.

Despite universal UK recommendations for vitamin D supplementation among infants, young children and mothers, there is currently **no evidence available to indicate the proportions of UK children who receive routine vitamin D supplementation**. Latest UK evidence available suggests 7.5% of children aged 1.5–3 years and 13.9% of children aged 4–10 years are deficient in vitamin D.[S52]

What is the impact on vulnerable children?

Food security

In the UK, available evidence suggests that groups who were at higher risk of poverty and economic food insecurity before the pandemic are at a greater risk of any type of food insecurity, including food security arising from economic hardship, lack of food in shops or inability to go out for food, during the pandemic.[S53] This includes families with children, and families where an adult is unemployed, has a disability, or is from a UK minority ethnic group.

Globally, evidence suggests that the **Covid-19 pandemic has further exacerbated existing food security-related disparities and inequalities**,[S54] with more than 368 million school children worldwide missing out on school meals during the pandemic.[S55, S56] However, the review found little evidence on the impact of Covid-19 on food security for children aged 0–5. In a US survey study of low-income households with children under 18 years of age[S57] 69.4% of respondents were concerned about the availability of food. Notably, their results, along with others,[S58] suggested **that prevalence of food insecurity and reasons for food insecurity varied across ethnic groups**.

In the UK, evidence suggests that food insecurity worsened for specific groups (all data is for children aged 8–17) over the pandemic.[S43]

- 41% of low-income families with children on free school meals (between August 2020 and January 2021) reported food insecurity.

9 Definition of deficiency in China (<50nmol/L) would be classed as 'insufficiency' in the UK where the threshold for deficiency is (<25nmol/L).

- Households with a lone parent were twice as likely to be food insecure, compared with couple households.
- Food insecurity among households with three or more children rose from 12% pre-Covid to 16.2% (retrospectively recalled).
- 21% of those from clinically vulnerable groups reported food security in the first 6 months of the pandemic, compared to 9.7% average.
- **Black, Asian and minority ethnic adults were twice as likely to experience food insecurity compared to White British adults in January 2021 (20% compared to 9%)**.

Synergistic impact of two global pandemics: Covid-19 and childhood obesity

Evidence identified throughout this review has highlighted a collision of two international pandemics: Covid-19 and childhood obesity. This has raised concerns around the synergistic impact this has had on children's health, and will have placed children, particularly already vulnerable children, in a position of considerably increased risk of poor health outcomes.

Specifically, evidence suggests that changes in behaviour and increased exposure to an obesogenic environment* during the pandemic have contributed to an increase in overweight and obesity among children.[S12, S47, S60, S61] Monitoring trends over the course of the pandemic has confirmed this, with many countries having since reported an increase in obesity rates in children and adolescents.

School closures meant many children in the UK lost access to nutritious food available through school meals and opportunities for physical activity that are part of the routine of attending school.[S61] Time spent away from school, for example during school holidays, is known to increase the risk of overweight and obesity. Models from the USA show that during summer holidays, prevalence of obesity increases significantly.[S62, S65, S66] This contributed to an increased prevalence of obesity (8.9% to 11.5%) between when children started kindergarten (aged 5 years) to when they finished second grade (aged 8 years). Extrapolating this data to the context of school closures during the Covid-19 pandemic, projected childhood obesity could increase childhood obesity by 4.25 percentage points over the course of five months.[S62, S65, S66] Simulation models from the USA have mapped the trajectories of childhood obesity prevalence among kindergarteners (aged 4–6 years) through the pandemic and found that the impact of the pandemic increased the prevalence of childhood obesity between 0.64 and 2.73 percentage points.[S65] In the models, **the risk of obesity was worse for Black children and Hispanic children, even under the assumption that the Covid-19 pandemic affected families equally**.[S62, S65, S66] **This has considerable implications for the UK context, because it is known that the impact of the pandemic has not been equal across families** but instead has disproportionately disadvantaged Black, Asian and minority ethnic children and children living in socioeconomic deprivation.[S13, S53]

This review has identified that there have been lifestyle and behaviour changes resulting from lockdown including: decreases in physical activity; increasingly poor diet, that is, increases in processed foods, sweets and salty snacks; increased screen time, and by proxy increased sedentary behaviour; and changes in sleep patterns. These are all recognised risk factors for obesity. In addition, recognised non-behavioural risk factors for obesity, including food insecurity, socioeconomic deprivation, and lack of access to safe outdoor spaces are surfacing as secondary impacts of the pandemic.[S61, S67] These risk factors of obesity are recognised to disproportionately affect children living in socioeconomic deprivation, and minority ethnic children, exacerbating existing health inequalities by further increasing the risk of obesity among children already at risk.[S62, S67]

* Obesogenic environments are the collective physical, economic, policy, social and cultural factors that promote obesity. See https://doi.org/10.1006/pmed.1999.0585.

In England, one of the key policies in reducing food security and dietary inequalities is free school meals (FSMs).[10] On 20 March 2020 as a result of the Covid-19 pandemic, all schools closed in England, except for vulnerable children and children of key workers. During this first wave of lockdown (17–30 April 2020), a longitudinal study surveyed children (aged 4–18 years), eligible for FSMs.[S59] Results found that **49% of children did not receive any form of FSM entitlement in April 2020** and that children in secondary school and junior school, independent of income, were more likely to access FSMs than those in infant school. Additionally, children attending school were almost six times more likely to receive their FSMs, compared to children who could not attend school. Importantly, those who accessed their FSMs entitlement were 14 times more likely to have recently used a food bank.

Diet

Food insecurity impacts the availability of food to children and their families, which has a subsequent knock-on effect on the nutritional quality of children's diets. As outlined above, families living in poverty and economic deprivation (including unemployment), families with children, and minority ethnic groups are more likely to be food insecure. **As a result of increased food insecurity, the nutritional quality of food available to these groups is likely to be worse than groups who do not experience the same level of food insecurity**. For example, evidence identified throughout the review has highlighted that children living in low-income households that have limited access to nutrient-dense foods, such as fresh fruits and vegetables, whole-grains, pulses, are more likely to have diets that rely heavily on calorie-dense, ultra-processed snacks and preserved foods as sources of nutrition, because the cost 'per calorie' is higher for fresh food. [S47, S60–S62] Evidence above has highlighted the impact of Covid-19 on children receiving free school meals. For many children, including children living in low-income households, school meals are typically more nutritious than food available from home. Without access to school, children who are dependent on this source of nutrition may be at risk of poorer health outcomes.[S63]

Finally, children with special educational needs and children with existing health conditions may have experienced a worsening of dietary quality during Covid-19. In one cross-sectional survey, 33% of primary carers of children with neurodevelopmental conditions (including ADHD, autism, intellectual disability, and Tourette's syndrome) reported their child's diet was poorer as a result of Covid-19.[S25]

Micronutrient deficiencies

There was **no direct evidence for the impact of Covid-19 on vitamin D deficiency among specific groups of vulnerable children**. However, skin pigmentation affects the synthesis of vitamin D from sunlight and epidemiological data has consistently shown lower levels of serum vitamin D among people with darker skin pigmentation.[S64]This suggests that **the proportion of children with vitamin D deficiency may be greater among those who have darker skin pigmentation**.

10 Children in full time education who are in households receiving income-related benefits, and all infant school children aged 4–7 years regardless of income, are eligible for FSMs. For more information see https://www.gov.uk/apply-free-school-meals

Breastfeeding

What do we mean by breastfeeding and how does it affect children's early physical development?

The *Global Strategy for Infant and Young Child Feeding*[S68] outlines optimal breastfeeding practices as the early initiation of breastfeeding, exclusive breastfeeding[11] for the first six months of life, and extended breastfeeding for up to two years and beyond once complementary foods are introduced. Infants who are breastfed exclusively for longer durations are significantly less likely to develop, or be admitted to hospital due to, respiratory infections, gastrointestinal infections (including diarrhoeal), and ear infections, and have significantly reduced risk of death attributed to infection, necrotising enterocolitis (NEC) and sudden infant death syndrome (SIDS). Infants who are breastfed exclusively are also less likely to be overweight or obese, and are less likely to develop diabetes later in life.[S69–S71]

What is the emerging evidence on the impacts of the Covid-19 pandemic?

Despite initial uncertainty and caution regarding the health implications Covid-19 and breastfeeding, in May 2020 the WHO[S72] released interim guidance stating women with suspected or confirmed Covid-19 infection should initiate and continue to breastfeed their infants, unless the mother was too ill to care for her child.[S73, S74] Pre-pandemic postnatal breastfeeding support in the UK was already inadequate,[S75–S77] and healthcare practices implemented in the UK in response to the pandemic appear to have presented additional barriers to breastfeeding.[S78, S79] Evidence identified in this rapid review indicates **the pandemic response, including lockdown precautions, impacted breastfeeding both positively and negatively for women and their infants**. However, there is no data available to indicate whether these experiences translated into an increase or decrease in breastfeeding rates during the pandemic.

Prevalence rates

Our rapid review identified evidence from two large UK survey studies.[S78, S79] Findings showed that **breastfeeding initiation rates and the proportion of women exclusively breastfeeding remained high during the pandemic**, in line with data from the last UK infant feeding survey.[S75] Some data suggested initiation rates may have even increased during the lockdown period. For example, 86% of women who gave birth before lockdown initiated breastfeeding compared to 89% of women who gave birth during lockdown when additional precautions and restrictions were in place across maternity care settings.[S79]

Positive experiences

In the UK, the majority (42%) of mothers reported that breastfeeding has been protected as a result of lockdown.[S78] Qualitative analysis of questionnaire data identified six factors that contributed to positive experiences of breastfeeding during lockdown and increasing women's ability to breastfeed. These included:

- having more time to focus on feeding their baby without the need to be or go anywhere
- fewer visitors, leaving more time for recovery and fewer unhelpful opinions
- more privacy to learn how to breastfeed without having to feed in public
- increased responsive feeding rather than having to fit a routine around going places
- increased partner support with partners working from home or furloughed

11 Exclusive breastfeeding is the provision of breastmilk as the only source of nutrition and no other food substances (including water, vitamins, or oral rehydration salts).

- a delayed return to work, meaning women did not have to put their infants into childcare and could continue breastfeeding.

These findings are supported by qualitative data from the USA[S80] where mothers reported the pandemic had a 'silver lining' because the length of their maternity leave had been increased, and/or they were able to work from home, meaning they were afforded more time to continue breastfeeding their infants. **However, it is unclear from available data whether these positive experiences increased the proportion of women who breastfeed over time**.

Barriers to breastfeeding

While breastfeeding may appear to have been protected for a large proportion of women in the UK, data available also highlighted that lockdown presented additional barriers to breastfeeding for women, and negatively impacted women's breastfeeding experiences. Precautionary responses to Covid-19 led to a reorganisation of maternity healthcare services which included telephone appointments replacing face-to-face consultations, the redeployment of health visitors, cancellation of community breastfeeding support groups, and restrictions on partner visits to the postnatal ward. Social distancing guidelines also meant family and friends were restricted from visiting and could not support new parents, which imposed barriers to help-seeking and substantially reduced women's support networks.

As a result, women in the UK reported they struggled to receive breastfeeding support from healthcare professionals and community-based support teams, and lacked support from friends and family.[S78, S79] More specifically, 45% of women who gave birth during lockdown felt they did not receive enough feeding support, and the most common reason attributed to breastfeeding cessation was lack of professional face-to-face support (70%). Qualitative analysis of questionnaire data identified five factors that made breastfeeding more difficult:

1. lack of face-to-face support
2. lack of social support
3. increased stress and isolation caring for older children
4. overwhelming focus on breastfeeding
5. lack of experience breastfeeding in public.[S78]

These findings were reflected in the USA data[S80] where women reported reduced access to family and friend support, including child-care arrangements, had increased postnatal stress and feelings of isolation, making it more difficult to breastfeed and care for their infants. As a result of the reduced availability of support, there may have been a reduction in breastfeeding rates over time, however there was no data available to indicate whether breastfeeding rates had changed over time.

What is the impact on vulnerable children?

Health inequalities in breastfeeding rates were evident in the UK pre-pandemic.[S75] Evidence identified in this rapid review suggests these **inequalities have persisted during the pandemic period and possibly widened**.[S78]

Ethnic inequalities were observed both in breastfeeding rates and support available. According to ethnic definitions provided in the research, Black (Black or Black British) and Asian (Bangladeshi, Indian, Pakistani, Chinese, or Asian British) women, and women from multiple (Mixed or Multiple) and minority ethnic groups (Gypsy/traveller) were significantly less likely to have maintained breastfeeding during the pandemic than White women. To note, this pattern of breastfeeding rates is not typically observed in the UK; outside the pandemic White women in the UK are least likely to start and continue breastfeeding over time.[S75]

This may be partially explained by the variation in availability of support associated with women's ethnicity. **Black and Asian women, and women from UK ethnic minority communities were significantly more likely to cite lack of in-person support as the reason for breastfeeding cessation than White women, suggesting they may have received less support during the pandemic than White women**.[S78] In addition, Black and Asian women, and women from UK ethnic minority communities were significantly less likely to describe the impact of lockdown as having a positive effect on breastfeeding. This may partially be attributed to additional barriers to breastfeeding associated with more challenging living circumstances during lockdown, which disproportionately affect Black women, Asian women, and women from ethnic minority communities. Analyses indicated women who did not have access to high-speed internet at home; who did not live in a ground floor flat and/or did not have access to a private garden; and did not live near green space where it was easy to get out for walks/fresh air were significantly less likely to maintain breastfeeding, and significantly less likely to experience positive impacts of lockdown on breastfeeding. Overall, **UK data available suggests Black women, Asian women, and women from UK ethnic minority communities were less likely to breastfeed, and found breastfeeding more challenging during lockdown**, meaning fewer Black and Asian infants, and infants from UK ethnic minority communities may have been breastfed.

The pandemic, breastfeeding and maternal mental health

Evidence identified throughout this review indicates breastfeeding rates may have been further impacted as a result of worsening perinatal mental health during the pandemic, characterised by increased symptoms of depression and anxiety. A meta-analysis of the most recent data[S81] showed average depression levels among pregnant and postpartum women had increased during the pandemic. This contributes a two-fold risk to infants. Firstly, worsening mental health (increases in depressive and anxiety symptoms) increases the likelihood that women will stop breastfeeding, which in turn prevents infants receiving optimal nutrition. Secondly, poor maternal mental health is a risk factor for early years social, emotional and behavioural development.

A case-control study in Italy[S82] found women who gave birth during the pandemic period in 2020 had significantly lower rates of exclusive breastfeeding (-15%), significantly increased use of supplemental formula-feeding (+20%), and significantly higher depressive symptoms* (+1.45 points on average) than women who gave birth during the same period in 2019. There was also a significant increase in the proportion of women with elevated depression symptoms (+11%).

Similar trends in mental health were reported in an online questionnaire study in Belgium[S83] where women reported their depressive† and anxiety‡ symptoms during the local lockdown period. Findings revealed approximately one in four women had elevated symptoms of depression indicating probable depressive disorder during pregnancy (25%) and postpartum (24%). Although not completely comparable, this is higher than estimates calculated pre-pandemic, which suggest 10-20% of women experience mental health diagnosis during pregnancy and postpartum.[S120, S121]

Covid-19 related quarantine and lockdown measures appear to have had a considerable psychological impact on pregnant and postnatal women, which is a cause for concern not only for themselves but for the subsequent impact this may have on the health of their infants.

* Depressive symptoms measured with Edinburgh Postnatal Depression Scale (EPDS).
† Measured using the Edinburgh Postnatal Depression Scale (EPDS).
‡ Measured using the Generalized Anxiety Disorder 7-item Scale (GAD-7).

Children's oral health

What do we mean by oral health and how does it affect children's early physical development?

Children's early oral health is a key component of their overall health and wellbeing. It means they can eat, speak, sleep and socialise free from disease, pain, and embarrassment or social stigma. Infant's teeth begin to come through (appear) when they are aged between 6 and 12 months, and by the time they are 3 years old they will have a full set of first teeth (or milk teeth). These first teeth are more susceptible to decay than adult teeth, and sugary drinks, prolonged use of baby bottles, and poor oral hygiene contribute significantly to the development of poor oral health (including caries).

Poor oral health in young children, such as caries and premature loss of milk teeth, can result in children experiencing pain, having difficulties chewing and eating, and impact language development. Experiences of dental pain in young children can subsequently lead to reduced appetite, weight loss or delayed growth, disturbed sleep, concentration problems, difficulties socialising, and poorer school performance.[S6, S84–S88]

What is the emerging evidence on the impacts of the Covid-19 pandemic?

Despite the importance of children's oral health in the early years, the review found **relatively little evidence of the impact of Covid-19 on children's oral health, particularly in the UK**. Evidence available from the UK and from studies based in other countries suggests a decline in dental care as a result of the pandemic. This is consistent with evidence including cohorts with wide age ranges (5–25 years), which also indicates there has been a decrease in dental care among older children.[S89]

In England, as a result of the national lockdown, all routine, non-urgent dental care services were stopped and deferred.[S90] As a result, **a group of 365,000 infants (half the birth cohort in the previous year) eligible for their first dental visit did not receive it**.[S91] The halting also included cancelling elective tooth extraction for dental caries under general anaesthetic, which affects 23% of children aged 5 in England, and is a notable measure of health inequality.[S92] From a brief look at recently published NHS data, in the absence of robust analyses, in the 12 months up to 30 June 2020, 6.3 million children were seen by an NHS dentist, whereas in the 12 months up to 30 June 2021, 3.9 million children were seen by an NHS dentist; a decrease of 2.4 million dental visits among children.[S93, S94] Whilst the mechanism behind this reduction is unclear, and the review did not perform any analyses, it is likely that the Covid-19 pandemic contributed to the reduction in NHS dentistry visits across the population in England.

There is evidence that the pandemic impacted early childhood dental care in other countries too. In the US, fluoride utilisation rates at dental visits and medical well-child visits significantly decreased, compared to pre-pandemic levels,[S95] and caregivers reported the greatest unmet child healthcare need during the Covid-19 pandemic was dental care.[S96] Notably, unmet dental care was the greatest unmet child healthcare need before the pandemic, although the results of this study indicate the prevalence was 14% higher compared to pre-pandemic levels.

What is the impact on vulnerable children?

The pandemic has likely further exacerbated oral health-related inequalities. In the US,[S96] the only variable that separated families with unmet child dental care needs versus those without unmet needs was household job loss or decrease in income due to the pandemic: 21% of families with Covid-19-related household job loss or decrease in income reported

unmet need compared to 12% in household with no Covid-19-related income or job loss. This study highlights the i**mportance of how vulnerabilities, such as decreased income or job loss, can further exacerbate health inequalities**. Indeed, even before the pandemic, in England, children from lower socioeconomic backgrounds, looked after children, and children from traveller families had considerably poorer oral health and faced substantial difficulties accessing dental care.[S85]

In Australia, under the Child Dental Benefits Schedule (CDBS), the Australian government provides up to $1,000 of dental care over two years for children aged 2–17 years from low-income families. In a retrospective analysis of Medicare data on utilisation of the CDBS,[S97] there were 881,454 fewer dental services provided to this at-risk group between March and September 2020 compared to the same period in 2019, with the largest decline in preventative and diagnostic services, and a smaller decline in endodontic and oral surgery services. This suggests that **even with targeted provision for children in lower income households, the Covid-19 pandemic is likely to have had a major impact on dental provision**. The reduction in preventative services is concerning given the importance of establishing good preventative behaviours early in children.

Childhood vaccinations

What are vaccinations and how do they affect children's early physical development?

Vaccinations protect against life-threatening disease and reduce infant morbidity and mortality globally. Ensuring infants are fully vaccinated will ensure optimal physical health, growth and development through the reduction of disease and mortality.

What is the emerging evidence on the impacts of the Covid-19 pandemic?

This rapid review identified a notable reduction in routine vaccinations in the early years,both in the UK and elsewhere in the world, as a result of the Covid-19 pandemic. In the early stages of the pandemic in the UK, notably three weeks after social distancing measures were introduced, measles mumps and rubella (MMR) vaccination counts in children were 20% lower and hexavalent vaccination counts were 7% lower, although the latter did show signs of improvement in mid-April, suggesting some catch-up effect.[S98] Recent data collected by Public Health England, January to March 2021 (Public Health England, 2021), on vaccination coverage for children who reach their first, second, or fifth birthday during the evaluation quarter, reported some increases in vaccination coverage, however a large portion decreased. For example, in England, coverage decreased for all the vaccines offered from the first birthday (PCV booster, Hib/MenC booster, MMR1 and MenB booster), coverage for MMR2 decreased and the pre-school booster also decreased.

There were also a number of difficulties reported in accessing vaccination appointments.100 Out of the total surveyed sample (n=1,252), although the majority (76%) agreed that it is important to continue with children's routine vaccinations during the pandemic:

- 26% of respondents were not aware that routine vaccinations should continue as normal
- 5% were unable to attend appointments due to illness
- 20% disagreed with the statement that they felt safe to go to their GP for their appointment
- 27% agreed with the statement that Covid-related restrictions would make it hard to make a vaccination appointment at the GP.

In the US, there was also evidence of decreased routine vaccination for children during the pandemic. In New York, a decrease in childhood vaccination was detected, with the largest decrease observed shortly after a stay-at-home order was issued. In children younger than 24 months, a 62% decrease compared to 2019 was observed, and in children aged 2–18 years, a 96% decrease was observed.[S101] Similar reports of reduced vaccination rates in the US, compared to 2018/2019 rates, have been reported for 0–24-month-olds, with the exception of birth-dose hepatitis B coverage, which is typically administered in the hospital setting.[S102] There was also evidence from parents of children aged 6 months to 5 years,[S103] that those who previously vaccinated their child against influenza before the pandemic (2019–2020) were more likely to vaccinate their child again for influenza (2020–2021) as a result of the pandemic, whereas those who had not previously vaccinated their child were less likely to vaccinate them in the future.

Elsewhere in the world, the WHO reported that at least 30 measles vaccination campaigns were at risk of cancelation and local lockdowns in at least 68 countries has put approximately 80 million children under the age of 1 at risk of contracting preventable diseases, [S104, S105] with reasons for the drop reportedly attributed to parental or healthcare workers fear of contracting Covid-19, limited transport, lockdown and social distancing barriers.[S104]

What is the impact on vulnerable children?

Evidence identified suggests that routine childhood immunisation may have disproportionately affected vulnerable and minority children in England. In one survey,[S100] respondents from minority ethnic backgrounds (Black, Asian, Chinese, mixed or other ethnicity) were almost three times more likely to be unaware of the recommendation that vaccination services should continue, compared to White ethnic groups (White British, White Irish, White Other). Similarly, households reporting an income of less than £35,000 per annum were 1.5 times more likely to be unaware of this recommendation, compared to households with an income of £35,000 to £84,999. Notably, respondents were more likely to be aware of this recommendation after the 2 May 2020 announcement from Public Health England; 70% before versus 79% after.

Regarding the uptake of a Covid-19 vaccine among vulnerable and minority groups, previous work has demonstrated that race and ethnicity contribute to disparities in vaccine take up across age groups.[S106] Indeed, in one survey[S107] in England, respondents of Black, Asian, Chinese, mixed or other ethnicity, when asked if they would accept a vaccine for their child in the future, were 2.47 times more likely to reject a Covid-19 vaccine for their child, compared to White respondents (White British, White Irish, White other). Respondents with an income less than £35,000 were 1.8 times as likely to reject a Covid-19 vaccine for their child, compared to households with an income between £35,000 and £84,999.

Sleep

What do we mean by sleep and how does sleep affect children's early physical development?

Children's early development is enhanced by optimal levels of sleep. A lack of sleep has been linked to a wide range of problems, including self-regulatory difficulties and an increased risk of illness. Conversely, appropriate levels of sleep have been linked to reductions in behavioural problems, enhanced cognitive development, improved language acquisition, and improved executive functioning when children reach preschool. For example, increased night

sleeping during infancy has been linked to improvements in cognitive functioning at age 2 and improved language development at age 5.[12]

What is the emerging evidence on the impacts of the Covid-19 pandemic?

This rapid review identified no UK-based evidence aimed at understanding the impact of the Covid-19 pandemic on children's sleep in the early years. Evidence available from studies based in other countries suggests an alteration in sleep as a result of the pandemic, although not all are adverse. This is consistent with evidence including cohorts with wide age ranges (5–18 years), which also indicates there has been alterations in sleep.[S7, S10–S12, S60, S109, S110] There is also some evidence to suggest children's sleep is related to their physical activity,[S17] which – as evidenced above – has also been impacted by the pandemic.

First, there was evidence that sleep duration and quality (a broad term measured differently across studies, including bedtimes, sleep latency, sleep fragmentation, child appearing tired or rested in the morning, and sleep efficiency) was adversely impacted in the early stages of the pandemic, before eventually stabilising.[S111, S112] Several risk factors for poor quality sleep were identified, including caregivers stress and caregivers being in quarantine, as well as some protective factors, including caregivers engagement in mindfulness techniques, time spent on childcare activities and the presence of siblings or pets.[S112]

Further evidence also reported decreases in sleep duration during the pandemic,[S20, S113] whilst others reported decreases in sleep quality.[S16, S114, S115] Notably, one study reported decreases in sleep duration was associated with those living in apartments or condominiums and decreases in sleep duration were also associated with reductions in sleep quality. Increases in screen time and decreases in physical activity were also associated with decreases in sleep quality and, conversely, increases in sleep quality was associated with increases in sleep time and having available space to play at home.[S16]

However, there were also studies with mixed findings. Two studies reported an increase in sleep duration, with one also reporting decreases in sleep quality.[S21, S23] Notably, one study[S23] reported that children whose families had a higher income reported smaller decreases in sleep quality, children living with four or more people had greater reduction in sleep duration, older children had greater reductions in sleep duration, children living in apartments had greater reductions in sleep quality, children in homes with more square meter per person had a smaller decline in sleep quality, and children who had space to play at home and those living in rural areas had a smaller decline in sleep quality.

As well as evidence showing alterations in sleep duration (increases and decreases) and reductions in sleep quality during the pandemic, there is also evidence to suggest sleep quality and duration were unchanged during the pandemic.[S18, S116] Indeed, in many of the studies reporting alterations in sleep quality discussed above, they also report no change in sleep duration.[S16, S114, S115] One study actually reported some improvement in sleep quality during Covid-19 confinement,[S117] and noted a number of protective factors associated with less sleep disturbances during confinement: room sharing (versus bed-sharing), separate rooms (versus bed-sharing), regular diet, more harmonious family atmosphere, and increased parent-child communication. Time using electronic devices was however predictive of pre-schoolers sleep disturbances.

What is the impact on vulnerable children?

There is some evidence to suggest that vulnerable children have been disproportionately affected by the pandemic, notably evidence that young children with neurodevelopmental

12 References available in: Asmussen, K. & Brims, L. (2018). Available at: https://www.eif.org.uk/report/what-works-to-enhance-the-effectiveness-of-the-healthy-child-programme-an-evidence-update

conditions, including ADHD, autism, intellectual disability and Tourette syndrome, had poorer sleep quality during the Covid-19 pandemic.[S25, S118]

There were also a number of risk factors associated with vulnerability that were linked to alterations in sleep. One study[S16] noted an association between sleep quality and having available space to play at home, which is likely reduced in more economically disadvantaged, and therefore vulnerable, children. Indeed, children from socioeconomically advantaged families had better sleep quality. Interestingly, the same study reported greater decreases in sleep duration in children with more educated caregivers, which the authors suggest may be a consequence of higher educated adults being more likely to have jobs allowing them to work from home during the pandemic. Similarly, one other study mentioned above,[S23] found smaller decreases in sleep quality for children whose family had higher income, for children who had homes with more square meters per person, for children who had more space to play at home, and for children living in rural areas, whereas children who lived in an apartment had greater reductions in sleep quality. One other study also found children who did not have an outdoor exit at home (garden or terrace) were more likely to present sleep alterations.[S19]

Conclusions and implications

Emerging evidence on the impacts of the Covid-19 pandemic

This briefing sought to summarise key factors associated with children's early physical health and development, and the extent to which the Covid-19 pandemic (stay-at-home orders and the closure of services, rather than the impact of children contracting Covid-19) has impacted on these factors and affected children's early physical development, including vulnerable children.

Overall, the evidence has shown the physical development of children is likely to have been negatively impacted by the pandemic across a number of factors critical to early physical development, including:

- decreases in physical activity and increases in sedentary behaviour (screen time)
- changes in diet (increases in processed foods, sweets and salty snacks)
- increased risk of vitamin D deficiency
- increased food insecurity
- positive and negative experiences of breastfeeding
- decreased oral healthcare utilisation
- reduced vaccination rates
- and changes in sleep patterns.

This briefing considered each factor influencing physical development individually. However, each factor is not discrete, and they impact on each other, and with other factors (such as obesity), in multiple ways to influence physical development early in life and over a child's lifetime.

Evidence suggests there have been substantial changes to children's lifestyle and behaviour as a result of the Covid-19 pandemic, as well as increased exposure to non-behavioural risk factors for health, such as food insecurity, socioeconomic deprivation, and lack of access to safe outdoor spaces. This puts children at increased risk of poor physical health outcomes and further exacerbates existing health inequalities. Importantly, lifestyle, attitudinal and behavioural changes initiated during the pandemic, such as attitudes to physical activity, may be enduring and long-lasting, which could have a cumulative adverse impact on child health and development over time.

The impact on vulnerable children

Across each factor influencing physical development the evidence is clear in showing that the Covid-19 pandemic has disproportionately and adversely impacted vulnerable children, meaning they are at greater risk of adverse physical development outcomes as a result of the pandemic. This is the case for each factor individually, and when considered in combination. For example, children from minority ethnic backgrounds and low-income households are at greater risk of food insecurity, which may lead their families to rely on cheaper, shelf-stable food, which is low in nutritional value and may contribute to increased rates of obesity. The

same children are also at greater risk of having unmet oral health needs and low childhood vaccination rates. Similarly, children who live in apartment blocks, more typically found in deprived neighbourhoods, are at greater risk of sleep problems and physical inactivity, which may interact in a cyclical manner amplifying adverse outcomes. Many of the risk factors and vulnerabilities identified are not novel and have been amplified for vulnerable children by the Covid-19 pandemic. Despite this, there is still much we do not know regarding the short- and long-term impact of the Covid-19 pandemic on vulnerable children's early physical development.

While a range of vulnerabilities were identified, evidence was most consistent on the negative impact of the pandemic on children from low-income and UK ethnic minority families. This is particularly worrying given the emerging evidence from the UK that the gap between children from low- and high-income households is even steeper for physical development than it is for other areas of development such as language and socioemotional development.[S119]

Implications for future research and policymaking

Available evidence suggests the physical development of young children is likely to have been negatively impacted by the Covid-19 pandemic, particularly for vulnerable groups, namely children from low-income families and those from UK ethnic minorities.

However, relatively little evidence specifically examined the impact of the Covid-19 pandemic on children aged 0–5 years in the UK, with much of it focused on older children and conducted outside of the UK, which will have had similar but not identical impacts (such as the incidents of stay-at-home orders and the closing of services). As a result, evidence is urgently needed to understand both the short- and long-term impact of the pandemic on early physical development in the UK, particularly for vulnerable groups. Collecting nationally representative real-time data on the factors highlighted in this report is therefore critical to understanding ongoing challenges.

While the review considered each factor influencing physical development individually, these factors are not discrete. Future research should therefore examine these factors together and take account of the many wider risk and protective factors that impact on early child development, ranging from financial insecurity and parental mental health, to early childhood services and stable family relationships. Longitudinal cohort studies, such as the new Children of the 2020s Study[13] and proposed Early Life Cohort Study,[14] could provide a rich source of data where early physical health factors as well as core risk and protective factors are comprehensively measured.

Without prioritisation of evidence-based policies and services aimed at supporting physical activity, promoting food security, good quality diet and nutrition, breastfeeding, oral health, vaccinations, and sleep, the long-term impacts of the Covid-19 pandemic are likely to hinder the early physical development of this generation of young children and lead to increased health risks and inequalities in their later lives.

13 For more information see: https://www.ucl.ac.uk/news/2021/may/new-birth-cohort-study-will-study-children-2020s

14 For more information on the feasibility study see: https://cls.ucl.ac.uk/cls-studies/early-life-cohort-feasibility-study/

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