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Impact of school closures on the health and well-being of primary school children in Wales UK; a routine data linkage study using the HAPPEN survey (2018-2020).

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Abstract

Objectives

This study aimed to explore the impact of school closures on children's health by comparing health and wellbeing outcomes collected during school closures (April – June 2020) via the 'HAPPEN At Home' survey with data from the same period in 2019 and 2018 via the HAPPEN survey.

Setting

The study was conducted online due to COVID-19 restrictions. 161 primary schools across Wales were involved in the 'HAPPEN At Home' survey.

Participants

Data were collected online via the 'HAPPEN At Home' survey, which captured the typical health behaviours of children aged 8 – 11 years between April - June 2020 from 1333 participants across 161 primary schools across Wales. These data were compared with data in 2018 and 2019 also collected between April-June, from HAPPEN [2019 (n=1150) and 2018 (n=475)].

Primary and secondary outcomes measures

Primary outcomes included validated measures of physical activity, sedentary time, diet and dental health, as well as wellbeing, competency and autonomy. Free school meal (FSM) status was used as a proxy for socio-economic deprivation. Analyses were repeated stratifying by FSM.

Results

Comparing responses between April – June in 2020 (n=1068), 2019 (n=1150) and 2018 (n=475), there were improvements in physical activity levels, sleep time, happiness and general wellbeing for children during school closures compared to previous years. However, children on FSM ate less fruit and vegetables (21% (95%CI (5.7% to 37%)) and had lower self-assessed school competence compared to 2019. Compared to those not on FSM they also spent less time doing physical activity (13.03% (95%CI: 3.3% to 21.7%) and consumed more takeaways (16.3% (95%CI: 2%-30%)) during school closures.

Conclusions

This study suggests that schools play are important in reducing inequalities in physical health. The physical health (e.g., physical activity and diet) of children eligible for FSM may be impacted by prolonged school closures.

Article summary

Strengths and limitations of this study

- This study provides evidence of any differences in the health and wellbeing of children prior to and during the COVID-19 enforced lockdown and school closures between March and June 2020. These findings could have a significant impact for the future and support schools to better understand their pupil's physical, psychological, emotional and social health. It also contributes to a significant literature gap regarding the impact of school closures on school-aged children.

- Improvements in physical activity levels, sleep time, happiness and general wellbeing were observed in general for children during school closures compared to previous years. However, children on FSM reported eating less fruit and vegetables and had lower self-assessed school competence compared to 2019. Compared to those not on FSM they also spent less time doing physical activity and consumed more takeaways during school closures. These trends are not evident among children not on FSM. All children reported improvements in wellbeing during lockdown especially on the happiness with family measure.

- Overall, findings suggest schools help to reduce inequalities in physical health for socio-economically deprived children. During school closures children from deprived backgrounds are likely to have poorer physical health (e.g. less time spent doing physical activities and poorer diet) and this is not observed in children who are not in receipt of FSM. This research suggests that school closures will result in widening health inequalities and when schools return measures will need to be in place to readdress the widened gap in physical health.

- Although the 'HAPPEN At Home' survey was made available to all children aged 8-11 across Wales, the findings of this paper only present those who participated in the survey and a subsample who consented to data linkage. However, HAPPEN contributes to a significant gap in the knowledge around the pandemic's impact on children as reported by children and not adults.

Introduction

In early March 2020, the World Health Organisation (WHO) declared the coronavirus disease (COVID-19) to be a global pandemic[1,2]. To reduce the risk of person-to-person transmission, a wide range of public health measures were implemented by governments worldwide. These included the closure of educational settings in order to reduce the number of social contacts between pupils[3,4]. By April 2020, the United Nation's Educational, Scientific and Cultural Organisation (UNESCO) estimated that 138 countries had implemented national school closures, impacting around 80% of children worldwide[4].

There is an ongoing debate regarding the effectiveness of schools closures on transmission rates[4–6] but the fact schools were closed for a long period of time could have had detrimental impacts on pupil's physical and mental health[4,5,7,8]. School closures may have reduced opportunities for physical activity, extracurricular activities, school meals and social interaction [9–12]. Research shows that when children are out of school (e.g. weekends and holidays) they are less physically active, have longer screen time, irregular sleep patterns, less favourable diets, weight gain and a loss of cardiorespiratory fitness[5,13]. This is noted to be particularly detrimental for those from more deprived backgrounds[4,6,10,12].

A report by the Royal Society's Data Evaluation and Learning for Viral Epidemics (DELVE) group highlighted concerns regarding the increased inequalities in children's physical and mental health as a result of school closures[14]. For example, pre-existing inequalities such as food poverty are likely to be exacerbated through reduced access to free school meals[15]. Thus, there is a real possibility that, in addition to a widening of the educational attainment gap, school closures are likely to result in widening inequalities in children's physical health, mental wellbeing, and health related behaviours.

This study aims to; 1) compare children's health and wellbeing during school closures in 2020 with the same period in 2019 and 2018 and, 2) stratify the before and during period of school closures by socio-economic deprivation (as measured by free school meal (FSM) eligibility).

Methods

Study Design

The HAPPEN Wales network was established at Swansea University in 2015 following research with headteachers who advocated for collaboration and a joined up approach to prioritising health and wellbeing within the school setting[16]. The network involves children aged 8–11 years completing the

HAPPEN Survey, an online self-report questionnaire that was developed and designed with children. The survey captures a range of information on health and wellbeing including nutrition, physical activity, sleep, wellbeing and concentration[17]. Prior to school closures, children completed the survey within the school setting during curriculum time. A data collection and feedback system is achieved by sharing group-level results to schools as a school report tailored to the curriculum. Annual reports are also shared with key stakeholders in health and education.

In light of the COVID-19 pandemic, HAPPEN aimed to understand how school closures were affecting the health and wellbeing of children in Wales. Therefore, the original HAPPEN Survey was adapted to the 'HAPPEN At Home' survey to capture changes in health behaviours due to school closures and provide schools the opportunity to gain a better understanding of pupil's health and wellbeing. This enabled schools to plan for and address any concerns they identified within their 'HAPPEN At Home' report during the return to school. The survey was granted ethical approval by Swansea University's Medical School on 15/04/2020 (Reference: 2017-0033B).

Participants

Recruitment of participants and data collection was delivered online due to COVID-19 restrictions. Pre-existing HAPPEN schools were emailed initially inviting them to participate in the 'HAPPEN At Home' survey. Next the survey was then opened wider and all primary schools in Wales were contacted through a number of methods including direct email, a social media campaign (paid advertisement on Facebook and Twitter) and promotion from key stakeholders (e.g. regional education consortia). Schools were invited to share details of the survey (including study aims and information sheet) amongst parents/guardians so that children could complete the survey at home at a convenient time. Communication between schools and parents/guardians was achieved through existing channels such as text messages, newsletters and social media. This is the same sampling method as the 2019 data however, 2018 data was collected in South Wales as the network was not pan-Wales in 2018.

Patient and Public Involvement

The research question was developed as a result of national school closures due to COVID-19 across the UK. The HAPPEN Survey was rapidly adapted to the HAPPEN at Home survey to address a significant gap regarding child-reported behaviours during school closures. The survey development involved input from key stakeholders including regional education consortia and primary school staff to ensure applicability of findings. The adapted HAPPEN at Home survey aimed to capture child-reported health and wellbeing during school closures in order to support schools in tailor health and

wellbeing plans to suit the needs of their learners. Findings from the study will be reported back to schools via a report and social media dissemination.

Data Collection

Primary data were collected via the 'HAPPEN At Home' Survey between April and June 2020. The survey captured the typical health behaviours of children aged 8-11. Items included validated measures of physical activity, sedentary time, diet and dental health[18], as well as wellbeing, competency and autonomy. Items included in the analyses are presented as supplementary information (S1). The full versions of the 'HAPPEN At Home' and original HAPPEN survey can be viewed in the supplementary information (S2 and S3 respectively).

The survey was conducted online and could be completed by children at home or in school (key worker or vulnerable children) via mobile phone, tablet and computer. The process of data coding involved two researchers. The first researcher downloaded the raw data, cleaned the data, checked for duplicates, generated a unique participant ID number and removed identifiable information. This process protects participants' anonymity by ensuring that the second researcher generating the report and conducting the analysis could not identify individuals. Raw data was coded using STATA (version 16) to produce a dataset for the purpose of analyses.

Free school meal (FSM) status was used as a proxy for deprivation[19] and was obtained via the Secure Anonymised Information Linkage (SAIL) Databank[20]. To link the data, the demographic data are separated from the responses and sent to a trusted third party, NHS Wales Informatics Service (NWIS) and the response data goes to SAIL using a secure file upload. A unique Anonymous Linking Field (ALF) is assigned to the person-based record before it is joined to clinical data via a system linking field.

Analysis

Primary analysis looked at whole group mean comparison of all children from 2018 and 2019 (pre-school closures) to 2020 (school closures). Secondary analysis included the subset of children from 2019-2020 stratified by FSM. The 2018 data was used to account for annual trends prior to lockdown.

For this paper, school closure was categorised as the period between 20th March 2020; the date in which the Minister for Education in Wales set for the closure of statutory education provision and 29th June 2020; the date in which schools returned for a phased approach in Wales. The 'HAPPEN At Home' survey was launched in 23rd April 2020 and closed on the 26th June 2020. Analysis was carried

out in November 2020 following data cleaning and SAIL linkage. This involved comparison of means to demonstrate any differences between time points. Presentation of the outcomes give the confidence interval of the difference between groups. The RECORD statement has been used to underpin the reporting of this data.

Results

The 'HAPPEN At Home' survey had 1333 responses, from 161 primary schools across Wales. Following the exclusion process presented in Figure 1 (no consent for linkage, missing FSM data), the final linked data ('HAPPEN At Home' responses and FSM status) for subsequent analysis included 574 participants.

Data were stratified by FSM status and compared with 2019 from the same time period (March to June 2019). A breakdown of demographics by FSM status and time period is presented in Table 1.

Table 1 – Demographics

Demographics		March to June 2018 (n=475)	March to June 2019 (n=1150)	School closures 2020 (n=1068)	Difference (2019 – 2020)
Gender	Boy	233 (49.19%)	594 (51.65%)	535 (50.09%)	-1.56% (-.26 to 5.71)
	Girl	241 (50.65%)	548 (47.65%)	528 (49.44%)	1.79% (-2.37 to 5.94)
	Prefer Not To Say	1 (0.16%)	8 (0.70%)	5 (0.47%)	-.23% (-.04 to .09)
Age	Mean	10.30	10.27	9.99	-.28 (-.36 to -.19)
Year Group	3	NA	NA	92 (8.61%)	NA
	4	69 (14.54%)	303 (26.35%)	373 (34.93%)	8.58% (.47 to 12.39)
	5	233 (49.12%)	403 (35.04%)	283 (26.50%)	-8.54% (.47 to 12.34)
	6	173 (36.35%)	444 (38.61%)	320 (29.96%)	-8.65% (.47 to 12.55)

Differences in health outcomes before (2018-2019) and during school closures (2020)

During school closures there was a significant improvement in physical activity (see Table 2) (4.5% increase in number achieving 60 minutes of physical activity a day (95%CI: 0.95% to 8.14%) and in sleep (10.39% more having the recommended 9 hours sleep). Children also report feeling less tired. There were no significant differences in these variables between 2018 and 2019 suggesting that these findings are associated with lockdown restrictions and school closures as opposed to time trends. Perceptions of general competency and feeling safe in your area (S1) also increased during school closures.

Regarding dietary and dental health behaviours, the amount of daily teeth brushing decreases annually (Table 2) but this is more significant between 2019 and 2020 (-14.92%, CI: -18.62 to -11.21). Interestingly the number of takeaways consumed per week has significantly decreased during 2020 (-20.29%, CI: -24.34 to -16.33) while sugary snack consumption has increased (15.03%, CI: 11.31 to 18.74). However, there appears to be an annual trend in sugary snack consumption when compared to 2019 and 2018 data. A higher proportion of children report eating breakfast during school closures compared to previous years.

Table 2 - Differences between those who took part in the HAH survey and those who have taken part in HAPPEN previously (group comparison between 2018, 2019 and 2020)

	H/WB Indicator	March – June 2018 (n=475)	March – June 2019 (n=1150)	School closures (n=1068)	Difference (2018 – 2019)	Difference (2019 – school closures)
Physical Activity & Sedentary Behaviour	Activity	21.57%	22.78%	27.32%	1.21% (-3.50 to 5.93)	**4.54% (.93 to 8.14)**
	Sedentary	27.94%	33.22%	56.61%	5.28% (.01 to 10.53)	**23.39% (19.37 to 27.43)**
	Sleep	84.31%	80.43%	90.82%	-3.88% (-8.27 to .51)	**10.39% (7.48 to 13.29)**
	Tired	14.22%	15.39%	8.45%	1.17% (-2.87 to 5.22)	**-6.94% (-9.64 to -4.23)**
	Concentrate	26.23%	24.00%	17.46%	-2.23% (-7.09 to 2.64)	**-6.54% (-9.91 to -.31)**
	General Competency	88.35%	84.26%	90.82%	**-4.09% (-7.86 to -.30)**	**6.56% (3.81 to 9.31)**
	Walk To Park*	N/A	88.81%	94.37%	N/A	**5.56% (3.24 to 7.87)**
	Safe in Area	77.21%	69.65%	75.44%	**-7.56% (-12.63 to -2.46)**	**5.79% (2.07 to 9.51)**
Diet & Dental Health	Toothbrushing	83.82%	78.87%	63.95%	**-4.95% (-.45 to -9.45)**	**-14.92% (-18.62 to -11.21)**
	Breakfast	93.87%	92.43%	97.28%	-1.44% (-4.35 to 1.48)	**4.85% (3.00 to 6.69)**
	Fizzy Drink	4.17%	7.22%	5.35%	**3.05% (.28 to 5.81)**	-1.87% (-3.89 to .16)
	Sugary Snack	16.18%	21.30%	36.33%	**5.12% (.61 to 9.64)**	**15.03% (11.31 to 18.74)**
	Takeaway	45.10%	54.09%	33.80%	**8.99% (3.35 to 14.62)**	**-20.29% (-24.34 to -16.22)**
	Fruit/Veg	83.09%	71.30%	69.94%	**-11.79% (-16.68 to -6.88)**	-1.36% (-.5.15 to 2.43)
Wellbeing	Health Score	77.54%	69.22%	79.11%	**-8.32% (-13.14 to -3.50)**	**9.89% (6.26 to 13.53)**
	Family Score	90.04%	88.09%	94.47%	-1.95% (-5.35 to 1.44)	**6.38% (4.03 to 8.74)**
	Friends Score	86.86%	81.82%	81.83%	**-5.04% (-9.03 to -1.04)**	0.01% (-3.20 to 3.22)
	Appearance Score	69.07%	58.52%	75.18%	**-10.55% (-15.73 to -5.35)**	**16.66% (12.79 to 20.53)**
	Life Score	81.99%	74.43%	87.07%	**-7.56% (-12.08 to -3.03)**	**12.64% (9.38 to 15.90)**
	Autonomy	88.35%	89.22%	85.11%	0.87% (-2.49 to 4.23)	**-4.11% (-6.8 to -1.32)**
Mental Health	Emotional Difficulties	14.19%	20.96%	12.17%	**6.77% (2.56 to 10.95)**	**-8.79% (-11.87 to -5.69)**
	Behavioural Difficulties	7.84%	14.78%	8.89%	**6.94% (3.37 to 10.50)**	**-5.89% (-8.58 to -3.19)**
School	School Score	58.05%	53.91%	58.14%	-4.14% (-9.47 to 11.94)	**4.23% (.09 to 8.36)**
	School Competency	89.62%	85.13%	80.99%	**-4.49% (-8.15 to -.82)**	**-4.14% (-7.25 to -1.02)**

*Question not included in HAPPEN in 2018 Survey

**Bold denotes significance

Table 3 - Exploring any differences between those who took part in the HAH survey and those who have taken part in 2019 stratified by FSM

		March – June 2019		School closures 2020			
	H/WB Indicator	No FSM (n=520)	FSM (n=120)	No FSM (n=384)	FSM (n=53)	No FSM Difference	FSM Difference
Physical Activity & Sedentary Behaviour	Activity	25.00%	23.33%	28.12%	15.09%	3.12% (-2.69 to 8.94)	-8.24% (-21.47 to 4.99)
	Sedentary	29.61%	42.50%	60.67%	58.49%	**31.06% (24.84 to 37.28)**	15.99% (-0.18 to 32.16)
	Sleep	81.34%	75.83%	89.84%	83.01%	**8.50% (3.80 to 13.19)**	7.18% (-6.32 to 20.69)
	Tired	14.03%	25.83%	9.11%	20.75%	**-4.92% (-9.19 to -0.64)**	-5.08% (-19.09 to 8.94)
	Concentrate	26.15%	16.66%	16.66%	18.86%	**-9.49% (-14.93 to -4.03)**	2.20% (-10.19 to 14.59)
	General Competency	85.38%	78.33%	92.18%	90.56%	**6.80% (2.57 to 11.03)**	12.23% (-0.18 to 24.65)
	Walk To Park	87.23%	94.06%	94.01%	92.45%	**6.78% (2.85 to 10.70)**	-1.61% (-9.66 to 6.43)
	Safe in Area	72.11%	54.16%	76.82%	62.26%	4.71% (-10.74 to 10.48)	8.10% (-8.08 to 24.27)
Diet & Dental Health	Toothbrushing	83.46%	64.16%	63.80%	47.16%	**-19.65% (-25.22 to -14.08)**	**-17.00% (-32.89 to -1.09)**
	Breakfast	94.03%	86.66%	97.65%	92.45%	**3.62% (0.90 to 6.32)**	5.79% (-4.64 to 16.22)
	Fizzy Drink	5.76%	13.33%	4.68%	7.54%	-1.08% (-4.04 to 1.88)	-5.79% (-16.22 to 4.64)
	Sugary Snack	20.38%	18.33%	36.97%	32.07%	**16.59% (10.79 to 22.39)**	**13.74% (0.21 to 27.26)**
	Takeaway	54.23%	57.50%	34.89%	50.94%	**-19.34% (-25.80 to -12.86)**	-6.56% (-22.80 to 9.68)
	Fruit/Veg	74.23%	66.66%	68.75%	45.28%	-5.48% (-11.41 to 0.45)	**-21.38% (-37.08 to -5.67)**
Wellbeing	Health Score	72.30%	60.83%	78.64%	66.03%	**6.34% (0.62 to 12.04)**	5.20% (-10.63 to 21.04)
	Family Score	89.03%	81.66%	94.01%	92.45%	**4.98% (1.23 to 8.71)**	**10.79% (0.80 to 22.37)**
	Friends Score	83.07%	72.50%	83.33%	71.69%	0.26% (-4.68 to 5.20)	-0.81% (-15.46 to 13.85)
	Appearance Score	60.38%	45.83%	75.78%	66.03%	**15.40% (9.25 to 21.53)**	**20.20% (4.13 to 36.27)**
	Life Score	74.80%	63.33%	89.32%	79.24%	**14.52% (9.41 to 19.61)**	**15.91% (0.85 to 30.97)**
	Autonomy	88.65%	88.33%	85.41%	84.90%	**-3.24% (-7.63 to 11.62)**	-3.43% (-14.32 to 7.46)
Mental Health	Emotional Difficulties	18.65%	26.66%	10.93%	20.75%	**-7.72% (-12.45 to -2.97)**	-5.91% (-20.03 to 8.21)
	Behavioural Difficulties	14.42%	27.50%	6.77%	20.75%	**-7.65% (-11.78 to -3.51)**	-6.75% (-20.96 to 7.47)
School	School Score	66.34%	61.66%	74.47%	56.60%	**8.13% (2.08 to 14.17)**	-5.06% (-21.07 to 10.95)
	School Competency	86.34%	80.00%	79.42%	58.49%	**-6.92% (-11.81 to -.2.02)**	**-21.51% (-35.60 to -7.41)**

*Bold denotes significance

Between 2018 and 2019, wellbeing shows significant decreases in a number of areas including perceptions of health, friends, appearance and life. However, during school closures this trend reversed (table 2). Most notably children reported being happier with their health (9.89%, CI: 6.26 to 13.53), appearance (16.66%, CI: 12.79 to 20.53) and life (12.64%, CI: 9.38 to 15.90). A similar trend is evident in terms of mental health (fewer emotional and behavioural difficulties) (table 2).

Despite being away from the school environment, children report feeling happier with school. Yet their self-reported school competency was reduced during school closures. However, there is an annual decrease since 2018 suggesting a temporal trend in pupils' perception of school ability.

Differences in health outcomes before (2018-2019) and during school closures (2020) stratified by deprivation (FSM eligibility)

Compared to non-FSM children (Table 3), those eligible for FSM walked to the park less, their takeaway consumption showed less decline but their fruit and vegetable consumption significantly declined (-21.28%, CI: -37.08 to -5.67). This decline was not seen in non-FSM children. The decline in perceptions of school competency from 2019 to 2020 was three times higher within the FSM group.

During school closures, there was a significant difference of reported daily physical activity between those on FSM and those not on FSM (13.03% difference, 95% CI: 3.3% to 21.66%). Compared to non-FSM children, a lower proportion of FSM eligible children reported to engage in at least 60 minutes of daily physical activity during school closures (non-FSM: 28.12%; FSM: 15.09%). Children not on FSM showed a significant increase in sedentary time and reported a lower ability to concentrate. This was not a significant trend notices for those on FSM. However, there was an increase from 2019 to 2020 in family wellbeing scores for all children and especially among those eligible for FSM.

Discussion

Improvements during school closures for children included physical activity, sleep, wellbeing (family, health, life) and emotional and behavioural difficulties when considering the group as a whole. Primary school children also report higher wellbeing especially family score, during lockdown. However, aspects which were detrimental during school closures included less tooth brushing for all children. FSM children reported a reduction in the time spent engaged in physical activity, significantly less fruit and vegetable consumption and lower self-assessed school competence than before school closures.

Physical activity and sedentary behaviour

Overall, small improvements to time spent being physically active were seen during school closures. However, this increase is likely to be amongst non-FSM pupils. For those on FSM activity decreased and may be due to less access to safe areas to play compared to those not on FSM.

Recent research around school staff perceptions of the return to school echo this finding. Teachers perceived that their pupils had been less active during lockdown restrictions and observed upon the phased return to school that some children had gained weight[21]. Findings from the current study suggest this may be more pronounced for more deprived pupils. Those eligible for FSM felt less safe in their areas which may be why they were less active.

Non-FSM children were more active. However, non-FSM children's sedentary time was significantly higher during school closures. Their reported daily screen time (>2 hours) doubled compared to the previous year. The delivery of education during school closures was achieved primarily online through home learning and thus, children will have utilized screens (e.g., laptops and tablets) to aid learning. Less deprived families may have better access to these resources and therefore, screen time may be higher in this group. This is supported by research from the Institute for Fiscal Studies[22] where children from less deprived families were spending 30% more time engaging in home learning activities than those more deprived. This may also reflect why perceptions of school competency remains much higher in the less deprived group. This suggests that non-FSM children were more engaged with learning tasks and therefore had perceived higher competence and confidence with learning and development. This may contribute towards the estimated 46% increase in learning gap between disadvantaged children and their peers reported by teachers[23]. With the relationship between education and health well documented, this has implications for children's future health and wellbeing outcomes[24]. Further evidence of this is seen in feeling part of your school community which again is much higher in those not on FSM.

For those eligible for FSM, the amount of sedentary time may appear positive in comparison to non-FSM but could also highlight inequalities relating to digital poverty and contribute to gaps in learning progression. Previous HAPPEN research[21] has highlighted the lack of access to digital equipment, sharing devices and a lack of digital competency in accessing home learning. This is worth noting as while less screen time could be perceived as a benefit to physical health in FSM children, during school closures it could also mean that learning gaps are being widened.

Children not on FSM report to not being able to concentrate as much compared to the previous year. The increased sedentary time may be due to increased screen time/online working for non-FSM pupils

during school closures may have been detrimental to concentration. More research is needed into how screen time was consumed during school closures and the impact this has on health is required.

Diet and dental health

Toothbrushing was significantly lower in children compared to 2019 regardless of FSM status. This meant many children were brushing their teeth less than the recommended guidelines of twice per day. Research shows that lack of routine and structure puts children at risk of poorer dental hygiene[25] which can have long-term impacts. It is possible that school closures disrupted bedtime and wake time routines in which teeth brushing would usually take place, and therefore may account for the lower frequency of teeth brushing. In addition, the lack of access to school-based dental hygiene programmes such as 'Designed to Smile'[26] may have a significant impact on teeth brushing behaviour. This coupled with observed increases in sugary snack consumption through school closures may have a detrimental impact on dental hygiene.

Those on FSM saw the biggest impact on dietary behaviours during lockdown restrictions. Not only was takeaway consumption higher in this group, but FSM children also consumed fewer fruit and vegetables during this time. FSM are a key public health policy to aid in reducing food insecurity and associated negative health and educational inequalities in the UK. It appears that those utilising FSM have been significantly impacted by school closures in not being able to access regular meal provision in a school setting in Wales. Research shows that almost half of all children on FSM were unable to access them during school closures[27].

Providing children with nutritional meals in school helps to narrow health inequalities and the educational attainment gap between the most and least deprived children[29,30]. Findings from this study add further evidence to disparities amongst groups of children from different backgrounds. While the initial lockdown in March 2020 was temporary, the findings of the current study support the mounting evidence that prolonged lockdown periods will affect children's physical health[27].

Wellbeing and mental health

Within this current study, improvements in family wellbeing was observed during school closures for both groups of children. This is likely due to an increased number of parents working from home or being furloughed, enabling some children to spend extra time that they otherwise would not have had with caregivers. School staff acknowledge this, they reported children having more opportunities for walking, exploring and spending time outside, with this contributing to strengthened family relationships[21].

Happiness with life was also significantly higher generally and increased equally in both groups from 2019 data. It is important to note that deprived children still report feeling less happy in general compared to non-FSM children. The findings regarding physical activity may underpin this, with increased opportunities to play and be outdoors, for example having more time during lockdown and feeling safer in their areas. Moreover, behavioural and emotional difficulties reported during school closures was significantly lower. In less deprived children, this number was almost half suggesting a more positive impact in those not on FSM. Interestingly, previous research has found the opposite, with parents and teachers reporting increases in emotional and behavioural difficulties as well as low mood, anxiety and social disconnection[21,31]. It is possible these conflicting findings highlight the difference between child reported and adult external observations.

Limitations

Although the 'HAPPEN At Home' survey was made available to all children aged 8-11 across Wales, the findings of this paper only present those who participated in the survey and a subsample who consented to data linkage. As the survey took place at home due to school closures, those who participated will be from families who have internet access. The difference in inequalities are likely to be much higher among those who could not participate due to lack of access to the internet. While the sampling strategy was the same for 2020 and 2019, 2018 data was sampled more purposefully from South Wales which may have an influence on findings from this year.

There is evidence that FSM status is not a perfect measure of socio-economic deprivation [32] and there are also a number of other factors that contribute to the deprivation levels of a child. However, FSM status does come very close to identifying a group of children who may be at disadvantage due to their socio-economic position[32].

Conclusion

Overall, findings from this study show that, as a group, many things improved during the period of school closures for children including physical activity, sleep and general wellbeing. However, there are significant differences and inequalities when stratified by FSM. Improvements were mostly observed in non-FSM children. For children eligible for FSM, diet (e.g. lower fruit and vegetable intake), physical activity and dental health was significantly impacted. These findings are concerning as they illustrate the importance of the entire school day, including free school meal provision, in attenuating physical health inequalities in children.

This paper shows the short-term effect of school closures on children's health and wellbeing. Furthermore, this research highlights a number of concerns regarding wider physical health inequalities such as obesity. When schools reopen this research suggests there will be a need to address wider physical health inequalities such as obesity, poor dental health, lack of vitamins and minerals and lower fitness in those from deprived backgrounds.

Contributorship statement

MJ wrote the first draft of the paper and all authors provided critical input and revisions for all further drafts. MJ, EM and SB designed data collection and MJ and SB undertook data analysis. MJ, EM, SB, MD and JW aided in interpretation of findings and supervision of study quality. The authors thank key stakeholders from regional consortia and schools for their participation in the development in the 'HAPPEN At Home' survey. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Declaration of Interests

All authors declare no competing interest including no financial and personal relationships with other people or organisations that might have an interest in the submitted work and no other relationships or activities that could appear to have influenced the submitted work.

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Data Sharing Statement

No additional data available.

Figure Permissions

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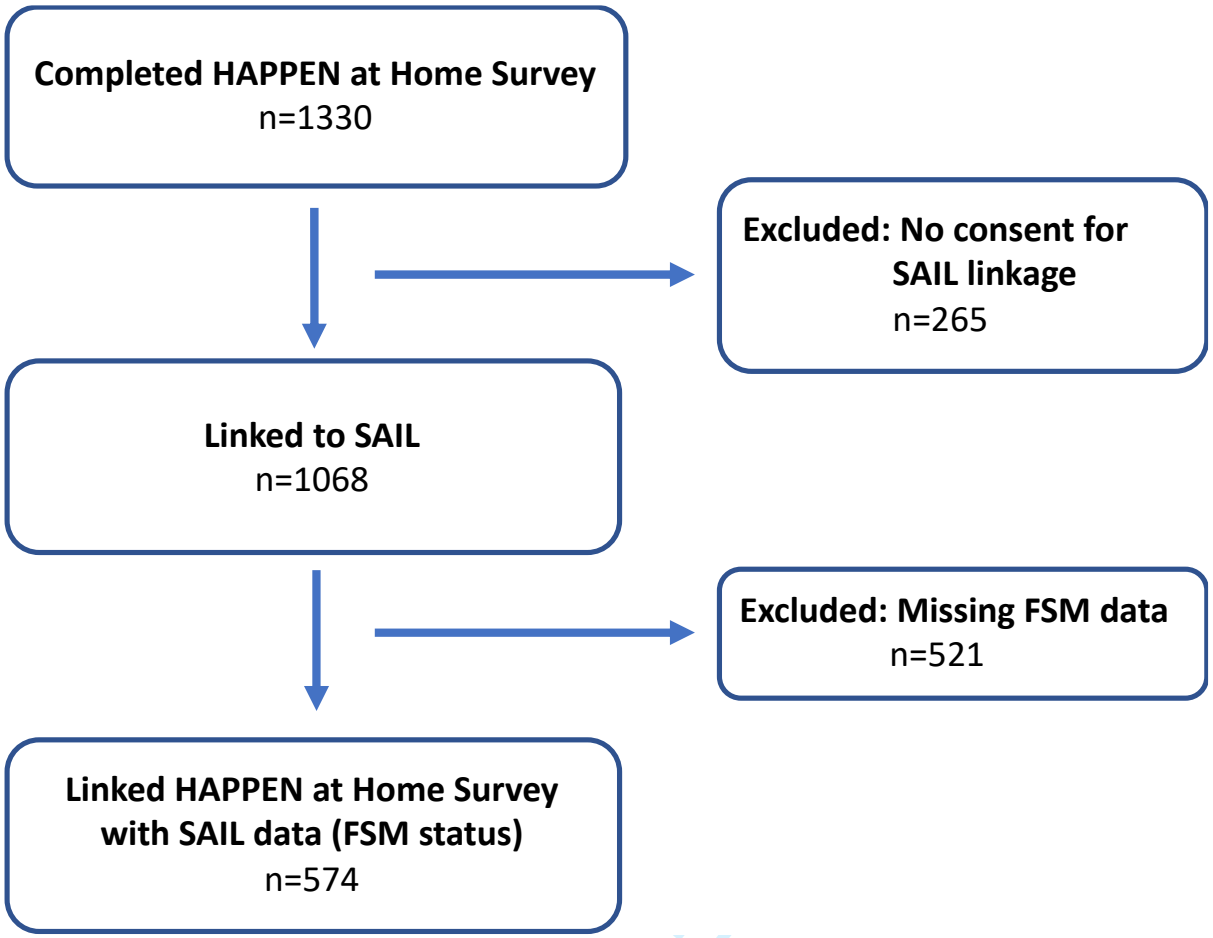
Figure 1

Study Flow Diagram



S1
ITEMS INCLUDED IN THE ANALYSES

Health and wellbeing topic	Item within HAPPEN at Home Survey
Physical activity and sedentary behaviour	*"In the last 7 days, how many days did you do sports or exercise for at least 1 hour in total. This includes doing any activities (including online activities like Joe Wicks) or playing sports where your heart beat faster, you breathed faster and you felt warmer?" (e.g. 5-6 days)* *"In the last 7 days, how many days did you watch TV/play online games/use the internet etc. for 2 or more hours a day (in total)?"* *"What time did you wake up TODAY (to the nearest half hour)?"* *"On a scale of 0 to 10 (0 being not very safe and 10 being very safe), how safe do you feel playing in your area?"*
Diet and dental health	*"How many times did you brush your teeth YESTERDAY?"* *"In the last 7 days, how many days did you drink at least one fizzy drink (e.g. coke, fanta, sprite)?"* *"Did you eat any fruit and vegetables YESTERDAY?"*
Wellbeing	*"On a scale of 0 to 10 (0 being very unhappy and 10 being very happy), how do you feel about:* *Your Health?* *Your Family?* *Your Friends?* *Your Appearance?* *Your Life?"* **From the Good Childhood Index (2010) developed by the Children's Society*
Mental health	*"Remember, there are no right or wrong answers, just pick which is right for you.* *I feel lonely.* *I cry a lot.* *I am unhappy"* **From the Me and My Feelings Questionnaire*
School	*"On a scale of 0 to 10 (0 being very unhappy and 10 being very happy), how do you feel about:* *Your School?"* **From the Good Childhood Index (2010) developed by the Children's Society*

	"Tell us if you agree or disagree with the following: *I am doing well with my school work" (e.g. Strongly agree, agree, don't agree or disagree, disagree, strongly disagree)*

S2
THE 'HAPPEN AT HOME' SURVEY

Consent Form
Before you start please click this link to read the information sheet...

https://happen-wales.co.uk/childrens-information-sheet/

1. I have read the child information sheet and understand that if I take part I can change my mind at any time, and this will not be a problem at all. *
Mark only one oval.

- Yes
- No

2. I am happy for you to use my questionnaire for research. Only the researchers in the team will know my name and will not tell anyone else my answers *
Mark only one oval.

- Yes
- No do not use my questionnaire

3. I am happy for you to look at my school and health records to see how my school is doing (as a group). This is anonymous which means I cannot be identified *
Mark only one oval.

- Yes
- No

If you do not wish to take part in the questionnaire please do not continue.

Please click next to start the questionnaire!

ABOUT YOU

4. First Name*

5. Last Name*

6. Home Post Code*

7. What school do you go to?*

8. Are you still going to your school?*
Mark only one oval.

- No, I am at home
- Yes, most days of the week
- Yes, sometimes
- I am in a different school from my own school

9. Do you have any other children living in your house with you (brothers, sisters) ?
Mark only one oval.

- Yes
- No

10. How many people live in your home with you (including adults)?

- 1
- 2
- 3
- 4
- 5
- 6+

11. What year are you in now?*
Mark only one oval.

- Year 4
- Year 5
- Year 6

12. Gender*
Mark only one oval.

- Boy
- Girl
- Prefer not to say

13. Date of Birth
Year*
Mark only one oval.

- 2007
- 2008
- 2009

- 2010
- 2011
- 2012

14. Month*
Mark only one oval.

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

15. Day *
Mark only one oval.

- 1
- 2
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- 19
- 20
- 21
- 22
- 23
- 24
- 25
- 26
- 27
- 28
- 29
- 30

- 31

YESTERDAY

16. What did you eat for breakfast YESTERDAY?
Check all that apply.

- Nothing
- Cereal like cocopops, frosties, sugar puffs, chocolate cereals
- Healthy cereal like e.g. porridge, weetabix, readybrek, muesli, branflakes, cornflakes
- Snacks like biscuits
- Fruit
- Toast
- Cooked breakfast
- Yoghurt
- Other:

17. Did you eat any fruit and veg YESTERDAY?
Mark only one oval.

- No
- 1 piece
- 2 or more fruit and veg

18. How many times did you brush your teeth YESTERDAY?
Mark only one oval.

- 0
- 1
- 2
- 3

19. What time did you fall asleep YESTERDAY (to the nearest half hour)?
Mark only one oval.

- 6.00pm
- 6.30pm
- 7:00pm
- 7:30pm
- 8:00pm
- 8:30pm
- 9:00pm
- 9:30pm
- 10:00pm
- 10:30pm
- 11:00pm
- 11:30pm
- 12:00am
- 12:30am
- 1:00am
- 1:30am
- 2:00am
- 3:00am
- 3:30am
- 4:00am

20. What time did you wake up TODAY (to the nearest half hour)?
Mark only one oval.

- 5:00am
- 5:30am
- 6:00am
- 6:30am
- 7:00am
- 7:30am
- 8:00am
- 8:30am
- 9:00am
- 9.30am
- 10.00am
- 10.30am
- 11.00am
- 11.30am

THE LAST WEEK
NOW think about what you did in the last 7 days...

21. In the last 7 days, how many days did you do sports or exercise for at least 1 hour in total. This includes doing any activities (including online activities like Joe Wicks) or playing sports where your heart beat faster, you breathed faster, and you felt warmer?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

22. In the last 7 days, how many days did you watch TV/play online games/use the internet etc. for 2 or more hours a day (in total)?
Mark only one oval.

- 0 days
- 1-2 day
- 3-4 days
- 5-6 days
- 7 days

23. In the last 7 days, how many days did you feel tired?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

24. In the last 7 days, how many days did you feel like you could concentrate/pay attention well on your schoolwork?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days
- Don't do school work

25. In the last 7 days, how many days did you drink at least one fizzy drink (e.g. coke, fanta, sprite)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

26. In the last 7 days, how many days did you eat at least one sugary snack (e.g. chocolate bar, sweets)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

27. In the last 7 days, how many days did you eat take away foods (e.g. Chinese takeaway)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

ACTIVITY AND YOUR AREA

28. On a scale of 0 to 10 (0 being not very safe and 10 being very safe), how safe do you feel playing in your area?
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

29. From your house, can you easily walk to a park (for example a field, grassy area)?

Mark only one oval.

- Yes
- No

30. From your house, can you easily walk to somewhere you can play?
Mark only one oval.

- Yes
- No

31. Do you have a garden?

- Yes
- No

32. How often do you go out to play outside?
Mark only one oval.

- Most days
- A few days each week
- Hardly ever
- I don't play

33. Do you have enough time for play?
Mark only one oval.

- Yes, I have loads
- Yes, it's just about enough
- No, I would like to have a bit more
- No, I need a lot more

34. What type of places do you play in?

- In my house
- In my garden
- In the street
- On a local grassy area
- In a place with bushes, trees and flowers
- In the woods near my house
- On a football field near my house
- In my school playground
- Somewhere with water or sand in it
- On the bike or skate park
- Somewhere else:

35. Can you play in all the places you would like to?

- I can play in all the places I would like to
- I can play in some of the places I would like to
- I can only play in a few places I would like to
- I can hardly play in any of the places I would like to

36. Do you have somewhere at home where you have space to relax

- Yes
- Sometimes but not all the time
- No

YOU AND YOUR FEELINGS

This part of the survey is going to ask you how you feel. There are no right or wrong answers. You should just pick the answer which is best for you.

37. Tell us if you agree or disagree with the following:
Mark only one oval per row.

I am doing well with my schoolwork

- Strongly agree
- Agree
- Don't agree or disagree
- Disagree
- Strongly disagree
- I don’t know

- I feel part of my school community Strongly agree
- Agree
- Don't agree or disagree
- Disagree
- Strongly disagree
- I don’t know

I have lots of choice over things that are important to me

- Strongly agree
- Agree
- Don't agree or disagree
- Disagree
- Strongly disagree

There are lots of things I'm good at

- Strongly agree
- Agree
- Don't agree or disagree
- Disagree
- Strongly disagree

38. On a scale of 0 to 10 (0 being very unhappy and 10 being very happy), how do you feel about
*Based on the Good Childhood Index by the Children's Society

39. Your Health
Mark only one oval.

- 0

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

40. Your Family
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

41. Your Friends
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

42. Your Appearance (how you look)
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

- 10

43. Your Life
Mark only one oval.

- 0
- 1
- 2
- 3
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- 9
- 10

ME AND MY FEELINGS
Based on the Me and My Feelings Questionnaire (Deighton, Tymms, Vostanis, Belsky, Fonagy, Brown, Martin, Patalay, & Wolpert, 2012)

44. Remember, there are no right or wrong answers, just pick which is right for you.
Mark only one oval per row.

I feel lonely

- Never
- Sometimes
- Always

I cry a lot

- Never
- Sometimes
- Always

I am unhappy

- Never
- Sometimes
- Always

I feel nobody likes me

- Never
- Sometimes
- Always

I worry a lot

- Never
- Sometimes
- Always

I have problems sleeping

- Never
- Sometimes
- Always

I wake up in the night

- Never
- Sometimes
- Always

I am shy

- Never
- Sometimes
- Always

I feel scared

- Never
- Sometimes
- Always

I worry when I am at school

- Never
- Sometimes
- Always

I get very angry

- Never
- Sometimes
- Always

I lose my temper

- Never
- Sometimes
- Always

I hit out when I am angry

- Never
- Sometimes
- Always

I do things to hurt people

- Never
- Sometimes
- Always

I am calm

- Never
- Sometimes
- Always

I break things on purpose

- Never
- Sometimes
- Always

45. Are you able to keep in touch with your family that you don't live with?
Mark only one oval.

- Yes
- No

46. Are you able to keep in touch with your friends?
Mark only one oval.

- Yes
- No

47. If yes, how are you keeping in touch (tick all that are relevant)?

- Live near them so I can see them (at a social distance)
- By phone (texting, calling or video calling)
- On social media
- On games consoles

SUBMIT

Don't forget to press submit below! Once you've pressed submit you are all done!

If you'd like some additional resources while you're at home during COVID-19, we've put together some here:
https://happen-wales.co.uk/some-resources-for-you/

S3
THE HAPPEN SURVEY

Consent Form
Before you start please click this link to read the information sheet...

https://happen-wales.co.uk/childrens-information-sheet/

1. I have read the child information sheet and understand that if I take part I can change my mind at any time, and this will not be a problem at all. *
Mark only one oval.

- Yes
- No

2. I am happy for you to use my questionnaire for research. Only the researchers in the team will know my name and will not tell anyone else my answers *
Mark only one oval.

- Yes
- No do not use my questionnaire

3. I am happy for you to look at my school and health records to see how my school is doing (as a group). This is anonymous which means I cannot be identified *
Mark only one oval.

- Yes
- No

If you do not wish to take part in the questionnaire please do not continue.

Please click next to start the questionnaire!

ABOUT YOU

4. First Name*

5. Last Name*

6. Home Post Code*

7. What school do you go to?*

8. Do you have any other children living in your house with you (brothers, sisters)?
Mark only one oval.

- Yes
- No

9. What year are you in now?*
Mark only one oval.

- Year 4
- Year 5
- Year 6

10. Do you have a garden?*

- Yes
- No

11. Gender*
Mark only one oval.

- Boy
- Girl
- Prefer not to say

12. Date of Birth
Year*
Mark only one oval.

- 2007
- 2008
- 2009
- 2010
- 2011
- 2012

13. Month*
Mark only one oval.

- January
- February
- March
- April
- May
- June

- July
- August
- September
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- December

14. Day *
Mark only one oval.

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YESTERDAY

15. How did you get to school yesterday?*

- On the bus
- On bike
- In the car/taxi
- Walked
- Ran/jogged
- Scooter
- Skateboarded/Rollerbladed

16. What did you have to eat for lunch yesterday?*

- School dinner
- Packed lunch from home
- Nothing

17. What did you do for most of your breaktimes yesterday?*

- Sat around inside or outside
- Ran around
- Stood around
- Walked around

18. How many friends did you play with yesterday?*

- I like to play on my own
- 1-2
- 3-4
- 5 or more

19. Did you have an afternoon break yesterday?*

- Yes
- No

20. How did you get home yesterday?*

- On the bus
- On bike
- In the car/taxi
- Walked
- Ran/jogged
- Scooter
- Skateboarded/Rollerbladed

AFTER SCHOOL

21. How may portions of fruit and vegetables did you eat yesterday?*

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

22. How many times did you brush your teeth yesterday?*

- 0
- 1
- 2

- 3

23. What time did you fall asleep YESTERDAY (to the nearest half hour)?
Mark only one oval.

- 6.00pm
- 6.30pm
- 7:00pm
- 7:30pm
- 8:00pm
- 8:30pm
- 9:00pm
- 9:30pm
- 10:00pm
- 10:30pm
- 11:00pm
- 11:30pm
- 12:00am
- 12:30am
- 1:00am
- 1:30am
- 2:00am
- 3:00am
- 3:30am
- 4:00am

24. What time did you wake up TODAY (to the nearest half hour)?
Mark only one oval.

- 5:00am
- 5:30am
- 6:00am
- 6:30am
- 7:00am
- 7:30am
- 8:00am
- 8:30am
- 9:00am
- 9.30am
- 10.00am
- 10.30am
- 11.00am
- 11.30am

THE LAST WEEK

25. In the last 7 days, how many days did you do sports or exercise for at least 1 hour in total. This includes doing any activities (this includes any activities or playing sports where your heart beat faster, you breathed faster, and you felt warmer?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days

- 7 days

26. In the last 7 days, how many days did you watch TV/play online games/use the internet etc. for 2 or more hours a day (in total)?
Mark only one oval.

- 0 days
- 1-2 day
- 3-4 days
- 5-6 days
- 7 days

27. In the last 7 days, how many days did you feel tired?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

28. In the last 7 days, how many days did you feel like you could concentrate/pay attention well on your schoolwork?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days
- Don't do school work

29. In the last 7 days, how many days did you drink at least one fizzy drink (e.g. coke, fanta, sprite)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

30. In the last 7 days, how many days did you eat at least one sugary snack (e.g. chocolate bar, sweets)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

31. In the last 7 days, how many days did you eat take away foods (e.g. Chinese takeaway)
Mark only one oval.

- 0 days

- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

SPORT AND ACTIVITY

32. These questions are going to ask you how you feel about physical activity (This includes any activity where your heart beats faster, you breathe faster and you feel warmer)

- I want to take part in physical activity
- I feel confident to take part in lots of different physical activities
- I am good at lots of different physical activities
- I understand why taking part in physical activity is good for me

32. How many times do you take part in sports club outside of school a week?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

33. Can you ride a bike without stabilisers?

- Yes
- No

34. Can you swim 25 metres without a float or armbands? (This is 1 length in a standard swimming pool)

- Yes
- No

YOU AND YOUR FEELINGS

35. Tell us if you agree or disagree with the following:

- I am doing well at school
- I feel part of my school community
- I have lots of choice over things that are important to me
- There are lots of things I'm good at

36. On a scale of 0 to 10 (0 being very unhappy and 10 being very happy), how do you feel about
*Based on the Good Childhood Index by the Children's Society

37. Your Health
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

38. Your School
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

38. Your Family
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

39. Your Friends
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

- 10

40. Your Appearance
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

41. Your Life
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

YOU AND YOUR FEELINGS

This part of the survey is going to ask you how you feel. There are no right or wrong answers. You should just pick the answer which is best for you.

Based on the Me and My Feelings Questionnaire (Deighton, Tymms, Vostanis, Belsky, Fonagy, Brown, Martin, Patalay, & Wolpert, 2012)

42. Remember, there are no right or wrong answers, just pick which is right for you.
Mark only one oval per row.

I feel lonely

- Never
- Sometimes
- Always

I cry a lot

- Never
- Sometimes
- Always

I am unhappy

- Never
- Sometimes
- Always

I feel nobody likes me

- Never
- Sometimes
- Always

I worry a lot

- Never
- Sometimes
- Always

I have problems sleeping

- Never
- Sometimes
- Always

I wake up in the night

- Never
- Sometimes
- Always

I am shy

- Never
- Sometimes
- Always

I feel scared

- Never
- Sometimes
- Always

I worry when I am at school

- Never
- Sometimes
- Always

I get very angry

- Never
- Sometimes
- Always

I lose my temper

- Never
- Sometimes
- Always

I hit out when I am angry

- Never
- Sometimes
- Always

I do things to hurt people

- Never
- Sometimes
- Always

I am calm

- Never
- Sometimes
- Always

I break things on purpose

- Never
- Sometimes
- Always

YOUR LOCAL AREA

43. On a scale of 0 to 10 (0 being not very safe and 10 being very safe), how safe do you feel playing in your area?
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

44. From your house, can you easily walk to school?
Mark only one oval.

- Yes
- No

45. From your house, can you easily walk to a park (for example a field, grassy area)?

Mark only one oval.

- Yes
- No

45. From your house, can you easily walk to a leisure centre/sports centre?
Mark only one oval.

- Yes
- No

46. Can you play in all the places you would like to?

- I can play in all the places I would like to
- I can play in some of the places I would like to
- I can only play in a few places I would like to
- I can hardly play in any of the places I would like to

47. Are you happy with the area that you live in?

- Yes
- No

48. If you could change something to make you and your friends healthier and happier, what would you change... IN SCHOOL?

49. If you could change something to make you and your friends healthier and happier, what would you change... OUT OF SCHOOL?

Don't forget to press submit below!

We have some resources on our website if you would like to learn more or would like to speak to someone... https://happen-wales.co.uk/some-resources-for-you/ (https://happen- wales.co.uk/some-resources-for-you/)

The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	a) P1 b) P2	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	1.1) P1 1.2) P1/2 1.3) P1/2
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	P3		
Objectives	3	State specific objectives, including any prespecified hypotheses	P3		
Methods					
Study Design	4	Present key elements of study design early in the paper	P3		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5		

Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case	a) P5 b) P6	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	6.1) P6 6.2) NA 6.3) P6/Figure 1
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	P6	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Supplementary Information
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Supplementary Information		

Bias	9	Describe any efforts to address potential sources of bias	NA		
Study size	10	Explain how the study size was arrived at	P6		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	P6/7		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	a) P6/7 b) P6/7 c) P6/7 d) NA e) P6/7		
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.	12.1) P6 12.2) P6

				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	P6
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	a) P6 b) P6 c) Figure 1	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	P6
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	a) P6 b) P6 c) NA		
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure	P6		

		category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures			
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	a) P9/10 b) P9/10 c) NA		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	P6/7		
Discussion					
Key results	18	Summarise key results with reference to study objectives	P7 - P11		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	P14	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	NA
Interpretation	20	Give a cautious overall interpretation of results considering objectives,	P11 - 14		

		limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			
Generalisability	21	Discuss the generalisability (external validity) of the study results	P14		
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P16		
Accessibility of protocol, raw data, and programming code		..	Throughout	RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Throughout

*Reference: Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine* 2015; in press.

BMJ Open

The impact of school closures on the health and well-being of primary school children in Wales UK; a routine data linkage study using the HAPPEN survey (2018-2020).

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The impact of school closures on the health and well-being of primary school children in Wales UK; a routine data linkage study using the HAPPEN survey (2018-2020).

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Abstract

Objectives

This study aimed to explore the relationship between initial school closures and children's health by comparing health and wellbeing outcomes collected during school closures (April – June 2020) via HAPPEN (The Health and Attainment of Pupils in a Primary Education Network) with data from the same period in 2019 and 2018 via the HAPPEN survey.

Setting

The study was conducted online with 161 primary schools across Wales involved in the 'HAPPEN At Home' survey.

Participants

Data were collected via the 'HAPPEN At Home' survey capturing the typical health behaviours of children aged 8 – 11 years from 1333 participants across Wales. These data were compared with data in 2018 and 2019 also collected between April-June, from HAPPEN [2019 (n=1150) and 2018 (n=475)].

Primary and secondary outcomes measures

Primary outcomes included validated measures of physical activity, screen time, diet and dental health, as well as wellbeing, competency and autonomy. Free school meal (FSM) status was used as a proxy for socio-economic deprivation. Analyses were repeated stratifying by FSM.

Results

Comparing responses between April – June in 2020 (n=1068), 2019 (n=1150) and 2018 (n=475), there were improvements in physical activity levels, sleep time, happiness and general wellbeing for children during school closures compared to previous years. However, children on FSM ate less fruit and vegetables (21% less at five or more portions of fruit and vegetables (95%CI (5.7% to 37%)) and had lower self-assessed school competence compared to 2019. Compared to those not on FSM they also spent less time doing physical activity (13.03% (95%CI: 3.3% to 21.7%) and consumed more takeaways (16.3% (95%CI: 2%-30%)) during school closures.

Conclusions

This study suggests that schools are important in reducing inequalities in physical health. The physical health (e.g., physical activity and diet) of children eligible for FSM may be affected by prolonged school closures.

Article summary

Strengths and limitations of this study

Strengths

- This study provides a novel exploration of any differences in the health and wellbeing of children prior to and during the COVID-19 school closures between March and June 2020 using linked data.
- This is a pan-Wales study which recruited 1068 participants across Wales contributing to a significant gap in knowledge around the association of school closures with health and wellbeing.
- The exploration uses longitudinal self-report data from children linked with free school meal status as a proxy of deprivation.

Limitations

- Although the 'HAPPEN At Home' survey was made available to all children aged 8-11 across Wales, the findings of this paper only present those who participated in the survey and a subsample who consented to data linkage.

Introduction

In early March 2020, the World Health Organisation (WHO) declared the coronavirus disease (COVID-19) to be a global pandemic[1,2]. To reduce the risk of person-to-person transmission, a wide range of public health measures were implemented by governments worldwide. These included the closure of educational settings in order to reduce the number of social contacts between pupils[3,4]. By April 2020, the United Nation's Educational, Scientific and Cultural Organisation (UNESCO) estimated that 138 countries had implemented national school closures, impacting around 80% of children worldwide[4]. In Wales, schools were required to close for statutory provision of education at the latest on 20th March 2020[5].

There is an ongoing debate regarding the effectiveness of schools closures on transmission rates[4,6,7] but the fact schools were closed for a long period of time could have had a negative association on pupil's mental and physical health[4,6,8,9]. For example, a study from England suggests 53.3% of girls and 44% of boys aged 13 – 18 years reported having anxiety and trauma above normative levels during lockdown enforced school closures[10] while those aged 10 – 17 reported lower life-satisfaction in 18% of participants with 26.9% reported clinically low wellbeing scores[11]. In terms of physical health, school closures may have reduced opportunities for physical activity, extracurricular activities, school meals and social interaction [12–15]. Research shows that when children are out of school (e.g. weekends and holidays) they are less physically active, have longer screen time, irregular sleep patterns, less favourable diets, weight gain and a loss of cardiorespiratory fitness[6,16]. This is noted to be particularly detrimental for those from more deprived backgrounds[4,7,13,15].

A report by the Royal Society's Data Evaluation and Learning for Viral Epidemics (DELVE) group highlighted concerns regarding the increased inequalities in children's physical and mental health as a result of school closures[17]. For example, pre-existing inequalities such as food poverty are likely to be exacerbated through reduced access to free school meals[18]. Thus, there is a real possibility that, in addition to a widening of the educational attainment gap which has been noted by research to be a learning loss of around 3 percentile points, or 1/5th of a school year [19], school closures are also likely to result in widening inequalities in children's physical health, mental wellbeing, and health related behaviours. While school closures were the primary change in children's lives this, coupled with other restrictions such as social distancing, have been noted to result in feelings of isolation, stress, anxiety and unhappiness [20] particularly as support networks (e.g., friends, sports clubs) were unable to operate [21].

This study aims to; 1) compare children's health and wellbeing during school closures in 2020 with the same period in 2019 and 2018 and, 2) stratify the before and during period of school closures by socio-economic deprivation (as measured by free school meal (FSM) eligibility). This study was a rapid response to the initial announcement of school closures in Wales which occurred 9 days after the WHO declared a global pandemic.

Methods

Study Design

HAPPEN (Health and Attainment of Pupils in a Primary Education Network) Wales was established at Swansea University in 2015 following research with headteachers who advocated for collaboration and a joined up approach to prioritising health and wellbeing within the school setting[22]. The network involves children aged 8–11 years completing the HAPPEN Survey, an online self-report questionnaire that was developed and designed with children. The survey captures a range of information on health and wellbeing including nutrition, physical activity, sleep, wellbeing and concentration[23]. Prior to school closures, children completed the survey within the school setting during curriculum time. A data collection and feedback system has been achieved by sharing group-level results to schools as a school report tailored to the curriculum. Annual reports are also shared with key stakeholders in health and education.

In light of the COVID-19 pandemic, HAPPEN aimed to understand how school closures were affecting the health and wellbeing of children in Wales. Therefore, the original HAPPEN Survey was adapted to the 'HAPPEN At Home' survey to capture changes in health behaviours due to school closures and provide schools the opportunity to gain a better understanding of pupil's health and wellbeing. This enabled schools to plan for and address any concerns they identified within their 'HAPPEN At Home' report during the return to school. The survey was granted ethical approval by Swansea University's Medical School on 15/04/2020 (Reference: 2017-0033B).

Participants

Recruitment of participants and data collection was delivered online due to COVID-19 restrictions. Pre-existing HAPPEN schools were emailed initially inviting them to participate in the 'HAPPEN At Home' survey. Next the survey was then opened wider and all primary schools in Wales were contacted through a number of methods including direct email, a social media campaign (paid advertisement on Facebook and Twitter) and promotion from key stakeholders (e.g., regional

education consortia). Schools were invited to share details of the survey (including study aims and a parent information sheet) amongst parents/guardians so that children could complete the survey at home at a convenient time. Communication between schools and parents/guardians was achieved through existing channels such as text messages, newsletters and social media. This gave parents the opportunity to opt their child out from the survey. Child consent was also obtained at the start of the survey. This is the same sampling method as the 2019 data however, 2018 data was collected in South Wales as the network was not pan-Wales in 2018. This opt-out method of recruiting participants aimed to ensure that a representative sample were recruited which could reflect all children in Wales.

Patient and Public Involvement

The research question was developed as a result of national school closures due to COVID-19 across the UK. The HAPPEN Survey was rapidly adapted to the HAPPEN at Home survey to address a significant gap regarding child-reported behaviours during school closures. The survey development involved input from key stakeholders including regional education consortia and primary school staff to ensure applicability of findings. The adapted HAPPEN at Home survey aimed to capture child-reported health and wellbeing during school closures to support schools in tailor health and wellbeing plans to suit the needs of their learners. Findings from the study will be reported back to schools via a report and social media dissemination.

Data Collection

Primary data were collected via the 'HAPPEN At Home' Survey between April and June 2020. The survey captured the typical health behaviours of children aged 8-11. Items included validated measures of physical activity, screen time, diet and dental health[24], as well as wellbeing, competency and autonomy. Items included in the analyses are presented as supplementary information (S1). The full versions of the 'HAPPEN At Home' and original HAPPEN survey can be viewed in the supplementary information (S2 and S3 respectively). The primary difference between the original survey and the 'at home' version was those questions relating to the school day specifically were removed during school closures.

The survey was conducted online and could be completed by children at home or in school (key worker or vulnerable children) via mobile phone, tablet, and computer. The process of data coding involved two researchers. The first researcher downloaded the raw data, cleaned the data, checked for duplicates, generated a unique participant ID number, and removed identifiable information. This process protects participants' anonymity by ensuring that the second researcher generating the report

and conducting the analysis could not identify individuals. Raw data was coded using STATA (version 16) to produce a dataset for the purpose of analyses.

Free school meal (FSM) status was used as a proxy for deprivation[25] and was obtained via the Secure Anonymised Information Linkage (SAIL) Databank[26]. To link the data, the demographic data are separated from the responses and sent to a trusted third party, NHS Wales Informatics Service (NWIS) and the response data goes to SAIL using a secure file upload. A unique Anonymous Linking Field (ALF) is assigned to the person-based record before it is joined to clinical data via a system linking field.

Analysis

Primary analysis looked at whole group mean comparison of all children from 2018 and 2019 (pre-school closures) to 2020 (school closures). Secondary analysis included the subset of children from 2019-2020 stratified by FSM. The 2018 data was used to account for annual trends prior to lockdown. Two sample t-tests with equal variance using groups (years) were used to determine whether there was any significant difference between means for tables 1, 2 and 3. This was carried out in STATA (version 16).

For the analysis, continuous data was dichotomised to bring in line with government guidelines for example physical activity and diet and dental health responses were coded as 1 if participants responded with being active for 7 days and 0 if less. Diet and dental health were coded as 1 if participants reported eating over 5 portions of fruit and vegetables and 1 if they reported brushing their teeth more than twice a day. Wellbeing question responses (including school) were coded as 1 if participants reported a score >=8 and a 1 if less than 7. Mental health questions were coded as 1 if continuous scores equated to clinical emotional or behaviour difficulties[27]. This coding then gave a percentage of participants meeting government guidelines for health behaviours in this age group. S1 provides further information on the variables used in the analysis.

For this paper, school closure was categorised as the period between 20th March 2020; the date in which the Minister for Education in Wales set for the closure of statutory education provision and 29th June 2020; the date in which schools returned for a phased approach in Wales. The 'HAPPEN At Home' survey was launched in 23rd April 2020 and closed on the 26th June 2020. Analysis was carried out in November 2020 following data cleaning and SAIL linkage. This involved comparison of means to demonstrate any differences between time points. Presentation of the outcomes give the confidence interval of the difference between groups. The RECORD statement has been used to underpin the reporting of this data.

Results

The 'HAPPEN At Home' survey had 1333 responses, from 161 primary schools across Wales. Following the exclusion process presented in Figure 1 (no consent for linkage, missing FSM data), the final linked data ('HAPPEN At Home' responses and FSM status) for subsequent analysis included 574 participants. Data were stratified by FSM status and compared with 2019 from the same time period (March to June 2019). A breakdown of demographics by FSM status and time period is presented in Table 1. It is worth highlighting that there are no significant differences between 2019 and 2020 demographics. However, the 2019 cohort was significantly less deprived than 2018 (FSM eligibility: -7.2% 95% CI: -11.39% to -3.01%, WIMD: 301.28 95% CI: 227.61 to 374.96).

Table 1 – Demographics

Demographics		March to June 2018 (n=475)	March to June 2019 (n=1150)	School closures 2020 (n=1068)	Difference (2019 – 2020)
Gender	Boy	233 (49.19%)	594 (51.65%)	535 (50.09%)	-1.56% (-.26 to 5.71)
	Girl	241 (50.65%)	548 (47.65%)	528 (49.44%)	1.79% (-2.37 to 5.94)
	Prefer Not To Say	1 (0.16%)	8 (0.70%)	5 (0.47%)	-.23% (-.04 to .09)
Age	Mean	10.30	10.27	9.99	-.28 (-.36 to -.19)
Year Group	3	NA	NA	92 (8.61%)	NA
	4	69 (14.54%)	303 (26.35%)	373 (34.93%)	8.58% (.47 to 12.39)
	5	233 (49.12%)	403 (35.04%)	283 (26.50%)	-8.54% (.47 to 12.34)
	6	173 (36.35%)	444 (38.61%)	320 (29.96%)	-8.65% (.47 to 12.55)
FSM	Eligible for FSM	9.77%	16.98%	15.75%	1.23% (-.02 to 0.5)
Deprivation*	WIMD Rank	1247.77	946.48	913.52	32.96 (-25.74 to 91.66)

*As measured by the WIMD (Welsh Index of Multiple Deprivation is the official measure of relative deprivation in Wales where 1 = most deprived and 1909 = least deprived)[28]

Differences in health outcomes before (2018-2019) and during school closures (2020)

During school closures there was a significant improvement in physical activity (see Table 2) (4.5% increase in number achieving 60 minutes of physical activity a day (95% CI: 0.95% to 8.14%) and in sleep (10.39% more having the recommended 9 hours sleep, 95% CI: 7.48% to 13.29%). Children also report increases in screen time (23.39%, 95% CI: 23.39% (19.37 to 27.43) and feeling less tired (-6.94%, 95% CI: 9.64 to -4.23). There were no significant differences in these variables between 2018 and 2019 suggesting that these findings are associated with lockdown restrictions and school closures

as opposed to time trends. Perceptions of general competency and feeling safe in your area (S1) also increased during school closures.

Regarding dietary and dental health behaviours, the amount of daily teeth brushing decreases annually (Table 2) but this is more pronounced between 2019 and 2020 (-14.92%, CI: -18.62 to -11.21). Interestingly the number of takeaways consumed per week has decreased during 2020 (-20.29%, CI: -24.34 to -16.33) while sugary snack consumption has increased (15.03%, CI: 11.31 to 18.74). However, there appears to be an annual trend in sugary snack consumption when compared to 2019 and 2018 data. A higher proportion of children report eating breakfast during school closures compared to previous years (4.85%, 95% CI: 3.00 to 6.69).

Table 2 - Differences between those who took part in the HAH survey and previous HAPPEN responses (group comparison between 2018, 2019 and 2020)

	H/WB Indicator	March – June 2018 (n=475)	March – June 2019 (n=1150)	School closures (n=1068)	Difference (2018 – 2019)	Difference (2019 – school closures)
Physical Activity & Screen Time	Activity	21.57%	22.78%	27.32%	1.21% (-3.50 to 5.93)	**4.54% (.93 to 8.14)**
	Screen Time	27.94%	33.22%	56.61%	5.28% (.01 to 10.53)	**23.39% (19.37 to 27.43)**
	Sleep	84.31%	80.43%	90.82%	-3.88% (-8.27 to .51)	**10.39% (7.48 to 13.29)**
	Tired	14.22%	15.39%	8.45%	1.17% (-2.87 to 5.22)	**-6.94% (-9.64 to -4.23)**
	Concentrate	26.23%	24.00%	17.46%	-2.23% (-7.09 to 2.64)	**-6.54% (-9.91 to -.31)**
	General Competency	88.35%	84.26%	90.82%	**-4.09% (-7.86 to -.30)**	**6.56% (3.81 to 9.31)**
	Walk To Park*	N/A	88.81%	94.37%	N/A	**5.56% (3.24 to 7.87)**
	Safe in Area	77.21%	69.65%	75.44%	**-7.56% (-12.63 to -2.46)**	**5.79% (2.07 to 9.51)**
Diet & Dental Health	Toothbrushing	83.82%	78.87%	63.95%	**-4.95% (-.45 to -9.45)**	**-14.92% (-18.62 to -11.21)**
	Breakfast	93.87%	92.43%	97.28%	-1.44% (-4.35 to 1.48)	**4.85% (3.00 to 6.69)**
	Fizzy Drink	4.17%	7.22%	5.35%	**3.05% (.28 to 5.81)**	-1.87% (-3.89 to .16)
	Sugary Snack	16.18%	21.30%	36.33%	**5.12% (.61 to 9.64)**	**15.03% (11.31 to 18.74)**
	Takeaway	45.10%	54.09%	33.80%	**8.99% (3.35 to 14.62)**	**-20.29% (-24.34 to -16.22)**
	Fruit/Veg	83.09%	71.30%	69.94%	**-11.79% (-16.68 to -6.88)**	-1.36% (-.5.15 to 2.43)
Wellbeing	Health Score	77.54%	69.22%	79.11%	**-8.32% (-13.14 to -3.50)**	**9.89% (6.26 to 13.53)**
	Family Score	90.04%	88.09%	94.47%	-1.95% (-5.35 to 1.44)	**6.38% (4.03 to 8.74)**
	Friends Score	86.86%	81.82%	81.83%	**-5.04% (-9.03 to -1.04)**	0.01% (-3.20 to 3.22)
	Appearance Score	69.07%	58.52%	75.18%	**-10.55% (-15.73 to -5.35)**	**16.66% (12.79 to 20.53)**
	Life Score	81.99%	74.43%	87.07%	**-7.56% (-12.08 to -3.03)**	**12.64% (9.38 to 15.90)**
	Autonomy	88.35%	89.22%	85.11%	0.87% (-2.49 to 4.23)	**-4.11% (-6.8 to -1.32)**
Mental Health	Emotional Difficulties	14.19%	20.96%	12.17%	**6.77% (2.56 to 10.95)**	**-8.79% (-11.87 to -5.69)**
	Behavioural Difficulties	7.84%	14.78%	8.89%	**6.94% (3.37 to 10.50)**	**-5.89% (-8.58 to -3.19)**
School	School Score	58.05%	53.91%	58.14%	-4.14% (-9.47 to 11.94)	**4.23% (.09 to 8.36)**
	School Competency	89.62%	85.13%	80.99%	**-4.49% (-8.15 to -.82)**	**-4.14% (-7.25 to -1.02)**

*Question not included in HAPPEN in 2018 Survey

**Bold denotes significance (p=0.05)

Table 3 - Exploring any differences between those who took part in the HAH survey and those who have taken part in 2019 stratified by FSM

		March – June 2019		School closures 2020			
	H/WB Indicator	No FSM (n=520)	FSM (n=120)	No FSM (n=384)	FSM (n=53)	No FSM Difference	FSM Difference
Physical Activity & Screen Time	Activity	25.00%	23.33%	28.12%	15.09%	3.12% (-2.69 to 8.94)	-8.24% (-21.47 to 4.99)
	Screen Time	29.61%	42.50%	60.67%	58.49%	**31.06% (24.84 to 37.28)**	15.99% (-0.18 to 32.16)
	Sleep	81.34%	75.83%	89.84%	83.01%	**8.50% (3.80 to 13.19)**	7.18% (-6.32 to 20.69)
	Tired	14.03%	25.83%	9.11%	20.75%	**-4.92% (-9.19 to -0.64)**	-5.08% (-19.09 to 8.94)
	Concentrate	26.15%	16.66%	16.66%	18.86%	**-9.49% (-14.93 to -4.03)**	2.20% (-10.19 to 14.59)
	General Competency	85.38%	78.33%	92.18%	90.56%	**6.80% (2.57 to 11.03)**	12.23% (-0.18 to 24.65)
	Walk To Park	87.23%	94.06%	94.01%	92.45%	**6.78% (2.85 to 10.70)**	-1.61% (-9.66 to 6.43)
	Safe in Area	72.11%	54.16%	76.82%	62.26%	4.71% (-10.74 to 10.48)	8.10% (-8.08 to 24.27)
Diet & Dental Health	Toothbrushing	83.46%	64.16%	63.80%	47.16%	**-19.65% (-25.22 to -14.08)**	**-17.00% (-32.89 to -1.09)**
	Breakfast	94.03%	86.66%	97.65%	92.45%	**3.62% (0.90 to 6.32)**	5.79% (-4.64 to 16.22)
	Fizzy Drink	5.76%	13.33%	4.68%	7.54%	-1.08% (-4.04 to 1.88)	-5.79% (-16.22 to 4.64)
	Sugary Snack	20.38%	18.33%	36.97%	32.07%	**16.59% (10.79 to 22.39)**	**13.74% (0.21 to 27.26)**
	Takeaway	54.23%	57.50%	34.89%	50.94%	**-19.34% (-25.80 to -12.86)**	-6.56% (-22.80 to 9.68)
	Fruit/Veg	74.23%	66.66%	68.75%	45.28%	-5.48% (-11.41 to 0.45)	**-21.38% (-37.08 to -5.67)**
Wellbeing	Health Score	72.30%	60.83%	78.64%	66.03%	**6.34% (0.62 to 12.04)**	5.20% (-10.63 to 21.04)
	Family Score	89.03%	81.66%	94.01%	92.45%	**4.98% (1.23 to 8.71)**	**10.79% (0.80 to 22.37)**
	Friends Score	83.07%	72.50%	83.33%	71.69%	0.26% (-4.68 to 5.20)	-0.81% (-15.46 to 13.85)
	Appearance Score	60.38%	45.83%	75.78%	66.03%	**15.40% (9.25 to 21.53)**	**20.20% (4.13 to 36.27)**
	Life Score	74.80%	63.33%	89.32%	79.24%	**14.52% (9.41 to 19.61)**	**15.91% (0.85 to 30.97)**
	Autonomy	88.65%	88.33%	85.41%	84.90%	**-3.24% (-7.63 to 11.62)**	-3.43% (-14.32 to 7.46)
Mental Health	Emotional Difficulties	18.65%	26.66%	10.93%	20.75%	**-7.72% (-12.45 to -2.97)**	-5.91% (-20.03 to 8.21)
	Behavioural Difficulties	14.42%	27.50%	6.77%	20.75%	**-7.65% (-11.78 to -3.51)**	-6.75% (-20.96 to 7.47)
School	School Score	66.34%	61.66%	74.47%	56.60%	**8.13% (2.08 to 14.17)**	-5.06% (-21.07 to 10.95)
	School Competency	86.34%	80.00%	79.42%	58.49%	**-6.92% (-11.81 to -.2.02)**	**-21.51% (-35.60 to -7.41)**

*Bold denotes significance (p=0.05)

Between 2018 and 2019, wellbeing shows decreases in a number of areas including perceptions of health (-8.32%, 95% CI; -13.14 to -3.50), friends (-5.04%, 95% CI: -9.03 to -1.04), appearance (-10.55% (-15.73 to -5.35) and life (-7.56% (-12.08 to -3.03). However, during school closures this trend reversed (table 2). Most notably children reported being happier with their health (9.89%, CI: 6.26 to 13.53), appearance (16.66%, CI: 12.79 to 20.53) and life (12.64%, CI: 9.38 to 15.90). A similar trend is evident in terms of mental health (fewer emotional (-8.79% (-11.87 to -5.69) and behavioural difficulties (-5.89% (-8.58 to -3.19).

Despite being away from the school environment, children report feeling happier with school compared to 2019 (4.23% (.09 to 8.36). Yet their self-reported school competency was reduced during school closures (-21.51% (-35.60 to -7.41). However, there is an annual decrease since 2018 suggesting a temporal trend in pupils' perception of school ability (-6.92% (-11.81 to -.2.02).

Differences in health outcomes before (2018-2019) and during school closures (2020) stratified by deprivation (FSM eligibility)

Compared to non-FSM children (Table 3), those eligible for FSM walked to the park less (compared to a 6.78% increase in non-FSM (2.85 to 10.70)), their takeaway consumption showed less decline (-6.54% compared to -19.34% in non-FSM) but their fruit and vegetable consumption significantly declined (-21.28%, CI: -37.08 to -5.67). This decline was not seen in non-FSM children. The decline in perceptions of school competency from 2019 to 2020 was three times higher within the FSM group (-21.51% (-35.60 to -7.41).

During school closures, there was a significant difference of reported daily physical activity between those on FSM and those not on FSM (13.03% difference, 95% CI: 3.3% to 21.66%). Compared to non-FSM children, a lower proportion of FSM eligible children reported to engage in at least 60 minutes of daily physical activity during school closures (non-FSM: 28.12%; FSM: 15.09%). Children not on FSM showed a significant increase in screen time (31.06% (24.84 to 37.28) and reported a lower ability to concentrate (-9.49% (-14.93 to -4.03). However, there was an increase from 2019 to 2020 in family wellbeing scores for all children and especially among those eligible for FSM (non-FSM: 4.98%; FSM: 10.79%). It is worth noting that the majority of differences, particularly improvements, in health behaviours were noted within the non-FSM group suggesting that findings for the overall group during school closures were driven by those who are not eligible for FSM.

Discussion

This study aimed to capture the associations between the initial school closures between March and June 2020 and the health and wellbeing of children. Improvements during school closures for children included physical activity, sleep, wellbeing (family, health, life) and emotional and behavioural difficulties. However, it is likely that these improvements were predominantly because of participants who were not eligible for free school meals according to this study's findings. Highlighting the health inequalities between less and more deprived that existed even prior to the pandemic and school closures. Primary school children report higher wellbeing especially family score, during lockdown. However, aspects which were detrimental during school closures included less tooth brushing for all children. FSM children reported a reduction in the time spent engaged in physical activity, significantly less fruit and vegetable consumption and lower self-assessed school competence than before school closures.

Physical activity and screen time

Overall, small improvements to time spent being physically active were seen during school closures. However, this increase is likely to be amongst non-FSM pupils. For those on FSM activity decreased, recent research around school staff perceptions of the return to school echo this finding. Teachers perceived that their pupils had been less active during lockdown restrictions and observed upon the phased return to school that some children had gained weight[29]. Findings from the current study suggest this may be more pronounced for more deprived pupils. Those eligible for FSM did report feeling less safe in their areas which may be why they were less active. Evidence shows that physical activity is associated with the wider environment including the socioeconomic status of a neighbourhood which underpins the contextual effects of higher social disorder and lower perceived safety as a the status lowers[30]. However, those not eligible for FSM report feeling safer in their local areas. Therefore, this study suggests that the implications of being confined to your local area during periods of restricted movement alongside parents/caregivers may improve perceptions of safety for those less deprived. This in turn, could mean they were happier to be active in their areas which would account for differences in physical activity by deprivation. Due to the lack of significant difference in deprivation levels between 2019 and 2020, it is likely that increased exposure to these environments would account for higher safety scores rather than a difference in cohort demographics.

Non-FSM children were more active. However, non-FSM children's screen time was significantly higher during school closures. Their reported daily screen time (>2 hours) doubled compared to the previous year. This is comparative to similar research which also notes increases in screen time during the pandemic[31]. It has been proposed that this could be because loosening household rules around screen time usage to facilitate entertainment or social connection through computer games or social media[31]. While deprivation is associated with higher screen time in adults[32], it is less clear what that

means for children. This study suggests that less deprived children have higher screen time which is a contrast to adults. It may be that these children have more access to technology which enables screen time.

The HAPPEN survey asks about screen time in reference to "TV, video games, and using the internet". It is possible that children perceived using the internet as the delivery of education through online learning. Thus, children will have utilized screens (e.g., laptops and tablets) to aid learning. Less deprived families may have better access to these resources and therefore, screen time may be higher in this group. This is supported by research from the Institute for Fiscal Studies[33] where children from less deprived families were spending 30% more time engaging in home learning activities than those more deprived. This may also reflect why perceptions of school competency remains much higher in the less deprived group. This suggests that non-FSM children were more engaged with learning tasks and therefore had perceived higher competence and confidence with learning and development. This may contribute towards the estimated 46% increase in learning gap between disadvantaged children and their peers reported by teachers[34]. With the relationship between education and health well documented, this has implications for children's future health and wellbeing outcomes[35]. Further evidence of this is seen in feeling part of your school community which again is much higher in those not on FSM.

For those eligible for FSM, the amount of screen time may appear positive in comparison to non-FSM but could also highlight inequalities relating to digital poverty and contribute to gaps in learning progression. Previous HAPPEN research[29] has highlighted the lack of access to digital equipment, sharing devices and a lack of digital competency in accessing home learning. This is worth noting as while less screen time could be perceived as a benefit to physical health in FSM children, during school closures it could also mean that learning gaps are being widened.

Children not on FSM report to not being able to concentrate as much compared to the previous year. The increased screen time may be due to increased online working for non-FSM pupils during school closures may have been detrimental to concentration. More research is needed into how screen time was consumed during school closures and the impact this has on health is required.

Diet and dental health

Toothbrushing was significantly lower in children compared to 2019 regardless of FSM status. This meant many children were brushing their teeth less than the recommended guidelines of twice per day. Research shows that lack of routine and structure puts children at risk of poorer dental hygiene[36] which can have long-term effects. It is possible that school closures disrupted bedtime and wake time

routines in which teeth brushing would usually take place, and therefore may account for the lower frequency of teeth brushing. In addition, the lack of access to school-based dental hygiene programmes such as 'Designed to Smile'[37] may have a significant impact on teeth brushing behaviour. This coupled with observed increases in sugary snack consumption through school closures may have negative associations with dental hygiene.

Those on FSM saw the biggest effect on dietary behaviours during lockdown restrictions. Not only was takeaway consumption higher in this group, but FSM children also consumed fewer fruit and vegetables during this time. FSM are a key public health policy to aid in reducing food insecurity and associated negative health and educational inequalities in the UK. It appears that those utilising FSM have been significantly affected by school closures in not being able to access regular meal provision in a school setting in Wales. Research shows that almost half of all children on FSM were unable to access them during school closures[38].

Providing children with nutritional meals in school helps to narrow health inequalities and the educational attainment gap between the most and least deprived children[39,40]. Findings from this study add further evidence to disparities amongst groups of children from different backgrounds. While the initial lockdown in March 2020 was temporary, the findings of the current study support the mounting evidence that prolonged lockdown periods will affect children's physical health[38].

Wellbeing and mental health

Within this current study, improvements in family wellbeing was observed during school closures for both groups of children. This is likely due to an increased number of parents working from home or being furloughed, enabling some children to spend extra time that they otherwise would not have had with caregivers. School staff acknowledge this, they reported children having more opportunities for walking, exploring and spending time outside, with this contributing to strengthened family relationships[29].

Happiness with life was also significantly higher generally and increased equally in both groups from 2019 data. It is important to note that deprived children still report feeling less happy in general compared to non-FSM children. The findings regarding physical activity may underpin this, with increased opportunities to play and be outdoors, for example having more time during lockdown and feeling safer in their areas. Moreover, behavioural and emotional difficulties reported during school closures was significantly lower. In less deprived children, this number was almost half suggesting a more positive relationship in those not on FSM. Interestingly, previous research has found the opposite, with parents and teachers reporting increases in emotional and behavioural difficulties as

well as low mood, anxiety and social disconnection[29,41]. It is possible these conflicting findings highlight the difference between child reported and adult external observations.

Limitations

Although the 'HAPPEN At Home' survey was made available to all children aged 8-11 across Wales, the findings of this paper only present those who participated in the survey and a subsample who consented to data linkage. As the survey took place at home due to school closures, those who participated will be from families who have internet access. The difference in inequalities is likely to be much higher among those who could not participate due to lack of access to the internet. This also means we cannot ensure a fully representative sample of children has been recruited across Wales. While the sampling strategy was the same for 2020 and 2019, 2018 data was sampled more purposefully from South Wales which may have an influence on findings from this year. Furthermore, a small subset of participants (n=14) responded at two timepoints to the various HAPPEN surveys. This sample was too small to analyse and therefore, it is not possible to identify the independence which is a limitation of this study.

There is evidence that FSM status is not a perfect measure of socio-economic deprivation [42] and there are also a number of other factors that contribute to the deprivation levels of a child. However, FSM status does come very close to identifying a group of children who may be at disadvantage due to their socio-economic position[42]. With this in mind it is also possible that differences between the three groups are due to sample characteristics (e.g., varying deprivation levels) in conjunction with school closures.

Conclusion

Overall, findings from this study show that, as a group, many things improved during the period of school closures for children including physical activity, sleep and general wellbeing. However, there are significant differences and inequalities when stratified by FSM. Improvements were mostly observed in non-FSM children. For children eligible for FSM, diet (e.g. lower fruit and vegetable intake), physical activity and dental health was significantly affected. These findings are concerning as they illustrate the importance of the entire school day, including free school meal provision, in attenuating physical health inequalities in children.

This paper shows the short-term associations of school closures on children's health and wellbeing and it is worth noting that the long-term impacts of further school closures and national lockdown may have more detrimental impacts on the health and wellbeing of children. This research highlights a number of concerns regarding wider physical health inequalities such as obesity. When schools reopen this research suggests there will be a need to address wider physical health inequalities such as obesity, poor dental health, lack of vitamins and minerals and lower fitness in those from deprived backgrounds.

Figure 1 - Flow of HAPPEN study (exclusion process and data linkage)

Contributorship statement

MJ wrote the first draft of the paper and all authors provided critical input and revisions for all further drafts. MJ, EM and SB designed data collection and MJ and SB undertook data analysis. MJ, EM, SB, MD and JW aided in interpretation of findings and supervision of study quality. The authors thank key stakeholders from regional consortia and schools for their participation in the development in the 'HAPPEN At Home' survey. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Declaration of Interests

All authors declare no competing interest including no financial and personal relationships with other people or organisations that might have an interest in the submitted work and no other relationships or activities that could appear to have influenced the submitted work.

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Data Sharing Statement

No additional data available.

Figure Permissions

Usage rights have been obtained for all figures including those in the supplementary material.

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Figure 1

Study Flow Diagram

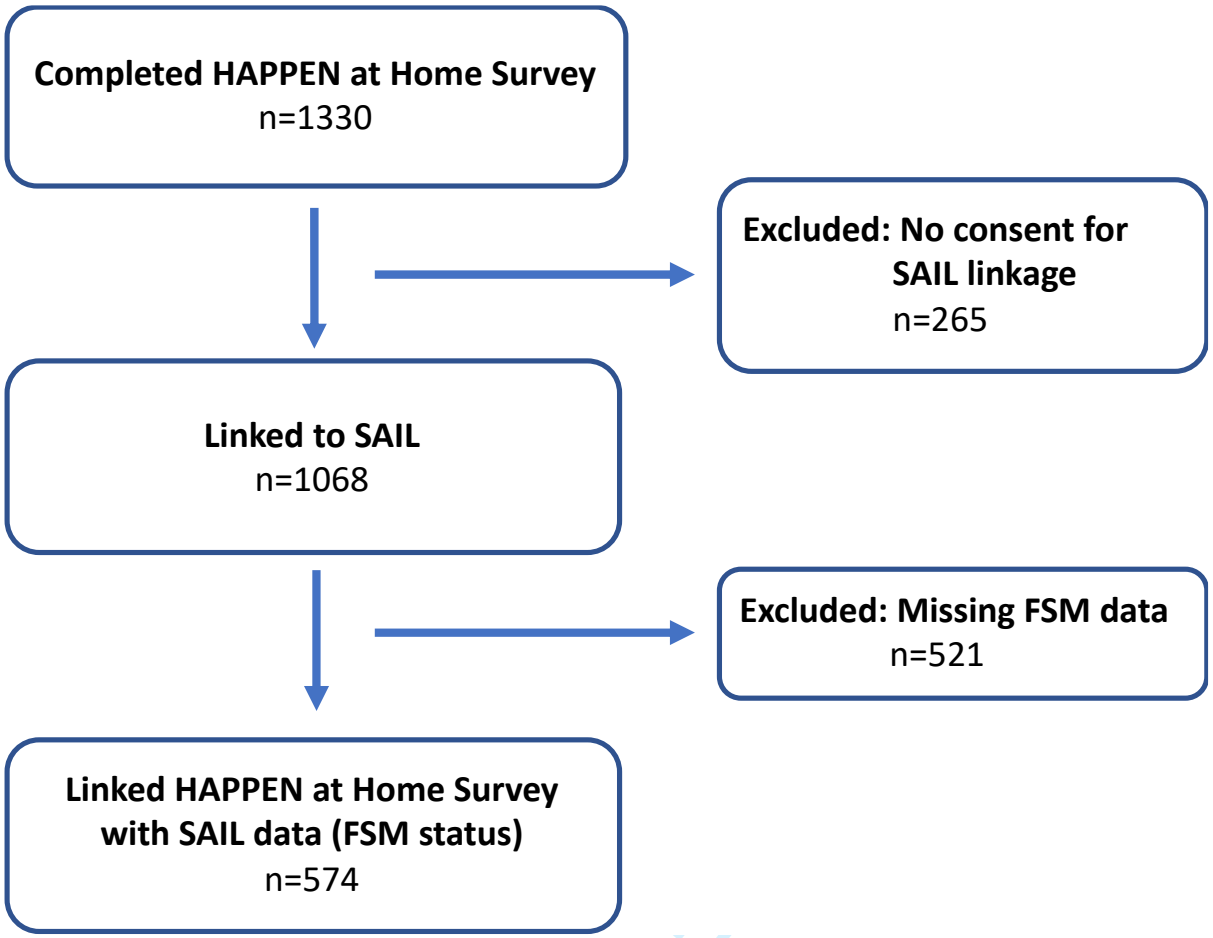

Figure 1 - Flow of HAPPEN study (exclusion process and data linkage)

S1
ITEMS INCLUDED IN THE ANALYSES

Health and wellbeing topic	Item within HAPPEN at Home Survey
Physical activity and sedentary behaviour	*"In the last 7 days, how many days did you do sports or exercise for at least 1 hour in total. This includes doing any activities (including online activities like Joe Wicks) or playing sports where your heart beat faster, you breathed faster and you felt warmer?" (e.g. 5-6 days)* *"In the last 7 days, how many days did you watch TV/play online games/use the internet etc. for 2 or more hours a day (in total)?"* *"What time did you wake up TODAY (to the nearest half hour)?"* *"On a scale of 0 to 10 (0 being not very safe and 10 being very safe), how safe do you feel playing in your area?"*
Diet and dental health	*"How many times did you brush your teeth YESTERDAY?"* *"In the last 7 days, how many days did you drink at least one fizzy drink (e.g. coke, fanta, sprite)?"* *"Did you eat any fruit and vegetables YESTERDAY?"*
Wellbeing	*"On a scale of 0 to 10 (0 being very unhappy and 10 being very happy), how do you feel about:* *Your Health?* *Your Family?* *Your Friends?* *Your Appearance?* *Your Life?"* **From the Good Childhood Index (2010) developed by the Children's Society*
Mental health	*"Remember, there are no right or wrong answers, just pick which is right for you.* *I feel lonely.* *I cry a lot.* *I am unhappy"* **From the Me and My Feelings Questionnaire*
School	*"On a scale of 0 to 10 (0 being very unhappy and 10 being very happy), how do you feel about:* *Your School?"* **From the Good Childhood Index (2010) developed by the Children's Society*

	"Tell us if you agree or disagree with the following: *I am doing well with my school work" (e.g. Strongly agree, agree, don't agree or disagree, disagree, strongly disagree)*

S2
THE 'HAPPEN AT HOME' SURVEY

Consent Form
Before you start please click this link to read the information sheet...

https://happen-wales.co.uk/childrens-information-sheet/

1. I have read the child information sheet and understand that if I take part I can change my mind at any time, and this will not be a problem at all. *
Mark only one oval.

- Yes
- No

2. I am happy for you to use my questionnaire for research. Only the researchers in the team will know my name and will not tell anyone else my answers *
Mark only one oval.

- Yes
- No do not use my questionnaire

3. I am happy for you to look at my school and health records to see how my school is doing (as a group). This is anonymous which means I cannot be identified *
Mark only one oval.

- Yes
- No

If you do not wish to take part in the questionnaire please do not continue.

Please click next to start the questionnaire!

ABOUT YOU

4. First Name*

5. Last Name*

6. Home Post Code*

7. What school do you go to?*

8. Are you still going to your school?*
Mark only one oval.

- No, I am at home
- Yes, most days of the week
- Yes, sometimes
- I am in a different school from my own school

9. Do you have any other children living in your house with you (brothers, sisters) ?
Mark only one oval.

- Yes
- No

10. How many people live in your home with you (including adults)?

- 1
- 2
- 3
- 4
- 5
- 6+

11. What year are you in now?*
Mark only one oval.

- Year 4
- Year 5
- Year 6

12. Gender*
Mark only one oval.

- Boy
- Girl
- Prefer not to say

13. Date of Birth
Year*
Mark only one oval.

- 2007
- 2008
- 2009

- 2010
- 2011
- 2012

14. Month*
Mark only one oval.

- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

15. Day *
Mark only one oval.

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25
- 26
- 27
- 28
- 29
- 30

- 31

YESTERDAY
16. What did you eat for breakfast YESTERDAY?
Check all that apply.

- Nothing
- Cereal like cocopops, frosties, sugar puffs, chocolate cereals
- Healthy cereal like e.g. porridge, weetabix, readybrek, muesli, branflakes, cornflakes
- Snacks like biscuits
- Fruit
- Toast
- Cooked breakfast
- Yoghurt
- Other:

17. Did you eat any fruit and veg YESTERDAY?
Mark only one oval.

- No
- 1 piece
- 2 or more fruit and veg

18. How many times did you brush your teeth YESTERDAY?
Mark only one oval.

- 0
- 1
- 2
- 3

19. What time did you fall asleep YESTERDAY (to the nearest half hour)?
Mark only one oval.

- 6.00pm
- 6.30pm
- 7:00pm
- 7:30pm
- 8:00pm
- 8:30pm
- 9:00pm
- 9:30pm
- 10:00pm
- 10:30pm
- 11:00pm
- 11:30pm
- 12:00am
- 12:30am
- 1:00am
- 1:30am
- 2:00am
- 3:00am
- 3:30am
- 4:00am

20. What time did you wake up TODAY (to the nearest half hour)?
Mark only one oval.

- 5:00am
- 5:30am
- 6:00am
- 6:30am
- 7:00am
- 7:30am
- 8:00am
- 8:30am
- 9:00am
- 9.30am
- 10.00am
- 10.30am
- 11.00am
- 11.30am

THE LAST WEEK
NOW think about what you did in the last 7 days...

21. In the last 7 days, how many days did you do sports or exercise for at least 1 hour in total. This includes doing any activities (including online activities like Joe Wicks) or playing sports where your heart beat faster, you breathed faster, and you felt warmer?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

22. In the last 7 days, how many days did you watch TV/play online games/use the internet etc. for 2 or more hours a day (in total)?
Mark only one oval.

- 0 days
- 1-2 day
- 3-4 days
- 5-6 days
- 7 days

23. In the last 7 days, how many days did you feel tired?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

24. In the last 7 days, how many days did you feel like you could concentrate/pay attention well on your schoolwork?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days
- Don't do school work

25. In the last 7 days, how many days did you drink at least one fizzy drink (e.g. coke, fanta, sprite)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

26. In the last 7 days, how many days did you eat at least one sugary snack (e.g. chocolate bar, sweets)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

27. In the last 7 days, how many days did you eat take away foods (e.g. Chinese takeaway)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

ACTIVITY AND YOUR AREA

28. On a scale of 0 to 10 (0 being not very safe and 10 being very safe), how safe do you feel playing in your area?
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

29. From your house, can you easily walk to a park (for example a field, grassy area)?

Mark only one oval.

- Yes
- No

30. From your house, can you easily walk to somewhere you can play?
Mark only one oval.

- Yes
- No

31. Do you have a garden?

- Yes
- No

32. How often do you go out to play outside?
Mark only one oval.

- Most days
- A few days each week
- Hardly ever
- I don't play

33. Do you have enough time for play?
Mark only one oval.

- Yes, I have loads
- Yes, it's just about enough
- No, I would like to have a bit more
- No, I need a lot more

34. What type of places do you play in?

- In my house
- In my garden
- In the street
- On a local grassy area
- In a place with bushes, trees and flowers
- In the woods near my house
- On a football field near my house
- In my school playground
- Somewhere with water or sand in it
- On the bike or skate park
- Somewhere else:

35. Can you play in all the places you would like to?

- I can play in all the places I would like to
- I can play in some of the places I would like to
- I can only play in a few places I would like to
- I can hardly play in any of the places I would like to

36. Do you have somewhere at home where you have space to relax

- Yes
- Sometimes but not all the time
- No

YOU AND YOUR FEELINGS

This part of the survey is going to ask you how you feel. There are no right or wrong answers. You should just pick the answer which is best for you.

37. Tell us if you agree or disagree with the following:
Mark only one oval per row.

I am doing well with my schoolwork

- Strongly agree
- Agree
- Don't agree or disagree
- Disagree
- Strongly disagree
- I don’t know

- I feel part of my school community Strongly agree
- Agree
- Don't agree or disagree
- Disagree
- Strongly disagree
- I don’t know

I have lots of choice over things that are important to me

- Strongly agree
- Agree
- Don't agree or disagree
- Disagree
- Strongly disagree

There are lots of things I'm good at

- Strongly agree
- Agree
- Don't agree or disagree
- Disagree
- Strongly disagree

38. On a scale of 0 to 10 (0 being very unhappy and 10 being very happy), how do you feel about
*Based on the Good Childhood Index by the Children's Society

39. Your Health
Mark only one oval.

- 0

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

40. Your Family
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

41. Your Friends
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

42. Your Appearance (how you look)
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

- 10

43. Your Life
Mark only one oval.

- 0
- 1
- 2
- 3
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- 10

ME AND MY FEELINGS
Based on the Me and My Feelings Questionnaire (Deighton, Tymms, Vostanis, Belsky, Fonagy, Brown, Martin, Patalay, & Wolpert, 2012)

44. Remember, there are no right or wrong answers, just pick which is right for you.
Mark only one oval per row.

I feel lonely

- Never
- Sometimes
- Always

I cry a lot

- Never
- Sometimes
- Always

I am unhappy

- Never
- Sometimes
- Always

I feel nobody likes me

- Never
- Sometimes
- Always

I worry a lot

- Never
- Sometimes
- Always

I have problems sleeping

- Never
- Sometimes
- Always

I wake up in the night

- Never
- Sometimes
- Always

I am shy

- Never
- Sometimes
- Always

I feel scared

- Never
- Sometimes
- Always

I worry when I am at school

- Never
- Sometimes
- Always

I get very angry

- Never
- Sometimes
- Always

I lose my temper

- Never
- Sometimes
- Always

I hit out when I am angry

- Never
- Sometimes
- Always

I do things to hurt people

- Never
- Sometimes
- Always

I am calm

- Never
- Sometimes
- Always

I break things on purpose

- Never
- Sometimes
- Always

45. Are you able to keep in touch with your family that you don't live with?
Mark only one oval.

- Yes
- No

46. Are you able to keep in touch with your friends?
Mark only one oval.

- Yes
- No

47. If yes, how are you keeping in touch (tick all that are relevant)?

- Live near them so I can see them (at a social distance)
- By phone (texting, calling or video calling)
- On social media
- On games consoles

SUBMIT

Don't forget to press submit below! Once you've pressed submit you are all done!

If you'd like some additional resources while you're at home during COVID-19, we've put together some here:
https://happen-wales.co.uk/some-resources-for-you/

S3
THE HAPPEN SURVEY

Consent Form
Before you start please click this link to read the information sheet...

https://happen-wales.co.uk/childrens-information-sheet/

1. I have read the child information sheet and understand that if I take part I can change my mind at any time, and this will not be a problem at all. *
Mark only one oval.

- Yes
- No

2. I am happy for you to use my questionnaire for research. Only the researchers in the team will know my name and will not tell anyone else my answers *
Mark only one oval.

- Yes
- No do not use my questionnaire

3. I am happy for you to look at my school and health records to see how my school is doing (as a group). This is anonymous which means I cannot be identified *
Mark only one oval.

- Yes
- No

If you do not wish to take part in the questionnaire please do not continue.

Please click next to start the questionnaire!

ABOUT YOU

4. First Name*

5. Last Name*

6. Home Post Code*

7. What school do you go to?*

8. Do you have any other children living in your house with you (brothers, sisters)?
Mark only one oval.

- Yes
- No

9. What year are you in now?*
Mark only one oval.

- Year 4
- Year 5
- Year 6

10. Do you have a garden?*

- Yes
- No

11. Gender*
Mark only one oval.

- Boy
- Girl
- Prefer not to say

12. Date of Birth
Year*
Mark only one oval.

- 2007
- 2008
- 2009
- 2010
- 2011
- 2012

13. Month*
Mark only one oval.

- January
- February
- March
- April
- May
- June

- July
- August
- September
- October
- November
- December

14. Day *
Mark only one oval.

- 1
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YESTERDAY

15. How did you get to school yesterday?*

- On the bus
- On bike
- In the car/taxi
- Walked
- Ran/jogged
- Scooter
- Skateboarded/Rollerbladed

16. What did you have to eat for lunch yesterday?*

- School dinner
- Packed lunch from home
- Nothing

17. What did you do for most of your breaktimes yesterday?*

- Sat around inside or outside
- Ran around
- Stood around
- Walked around

18. How many friends did you play with yesterday?*

- I like to play on my own
- 1-2
- 3-4
- 5 or more

19. Did you have an afternoon break yesterday?*

- Yes
- No

20. How did you get home yesterday?*

- On the bus
- On bike
- In the car/taxi
- Walked
- Ran/jogged
- Scooter
- Skateboarded/Rollerbladed

AFTER SCHOOL

21. How may portions of fruit and vegetables did you eat yesterday?*

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

22. How many times did you brush your teeth yesterday?*

- 0
- 1
- 2

- 3

23. What time did you fall asleep YESTERDAY (to the nearest half hour)?
Mark only one oval.

- 6.00pm
- 6.30pm
- 7:00pm
- 7:30pm
- 8:00pm
- 8:30pm
- 9:00pm
- 9:30pm
- 10:00pm
- 10:30pm
- 11:00pm
- 11:30pm
- 12:00am
- 12:30am
- 1:00am
- 1:30am
- 2:00am
- 3:00am
- 3:30am
- 4:00am

24. What time did you wake up TODAY (to the nearest half hour)?
Mark only one oval.

- 5:00am
- 5:30am
- 6:00am
- 6:30am
- 7:00am
- 7:30am
- 8:00am
- 8:30am
- 9:00am
- 9.30am
- 10.00am
- 10.30am
- 11.00am
- 11.30am

THE LAST WEEK

25. In the last 7 days, how many days did you do sports or exercise for at least 1 hour in total. This includes doing any activities (this includes any activities or playing sports where your heart beat faster, you breathed faster, and you felt warmer?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days

- 7 days

26. In the last 7 days, how many days did you watch TV/play online games/use the internet etc. for 2 or more hours a day (in total)?
Mark only one oval.

- 0 days
- 1-2 day
- 3-4 days
- 5-6 days
- 7 days

27. In the last 7 days, how many days did you feel tired?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

28. In the last 7 days, how many days did you feel like you could concentrate/pay attention well on your schoolwork?
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days
- Don't do school work

29. In the last 7 days, how many days did you drink at least one fizzy drink (e.g. coke, fanta, sprite)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

30. In the last 7 days, how many days did you eat at least one sugary snack (e.g. chocolate bar, sweets)
Mark only one oval.

- 0 days
- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

31. In the last 7 days, how many days did you eat take away foods (e.g. Chinese takeaway)
Mark only one oval.

- 0 days

- 1-2 days
- 3-4 days
- 5-6 days
- 7 days

SPORT AND ACTIVITY

32. These questions are going to ask you how you feel about physical activity (This includes any activity where your heart beats faster, you breathe faster and you feel warmer)

- I want to take part in physical activity
- I feel confident to take part in lots of different physical activities
- I am good at lots of different physical activities
- I understand why taking part in physical activity is good for me

32. How many times do you take part in sports club outside of school a week?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

33. Can you ride a bike without stabilisers?

- Yes
- No

34. Can you swim 25 metres without a float or armbands? (This is 1 length in a standard swimming pool)

- Yes
- No

YOU AND YOUR FEELINGS

35. Tell us if you agree or disagree with the following:

- I am doing well at school
- I feel part of my school community
- I have lots of choice over things that are important to me
- There are lots of things I'm good at

36. On a scale of 0 to 10 (0 being very unhappy and 10 being very happy), how do you feel about
*Based on the Good Childhood Index by the Children's Society

37. Your Health
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

38. Your School
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

38. Your Family
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

39. Your Friends
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

- 10

40. Your Appearance
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

41. Your Life
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

YOU AND YOUR FEELINGS

This part of the survey is going to ask you how you feel. There are no right or wrong answers. You should just pick the answer which is best for you.

Based on the Me and My Feelings Questionnaire (Deighton, Tymms, Vostanis, Belsky, Fonagy, Brown, Martin, Patalay, & Wolpert, 2012)

42. Remember, there are no right or wrong answers, just pick which is right for you.
Mark only one oval per row.

I feel lonely

- Never
- Sometimes
- Always

I cry a lot

- Never
- Sometimes
- Always

I am unhappy

- Never
- Sometimes
- Always

I feel nobody likes me

- Never
- Sometimes
- Always

I worry a lot

- Never
- Sometimes
- Always

I have problems sleeping

- Never
- Sometimes
- Always

I wake up in the night

- Never
- Sometimes
- Always

I am shy

- Never
- Sometimes
- Always

I feel scared

- Never
- Sometimes
- Always

I worry when I am at school

- Never
- Sometimes
- Always

I get very angry

- Never
- Sometimes
- Always

I lose my temper

- Never
- Sometimes
- Always

I hit out when I am angry

- Never
- Sometimes
- Always

I do things to hurt people

- Never
- Sometimes
- Always

I am calm

- Never
- Sometimes
- Always

I break things on purpose

- Never
- Sometimes
- Always

YOUR LOCAL AREA

43. On a scale of 0 to 10 (0 being not very safe and 10 being very safe), how safe do you feel playing in your area?
Mark only one oval.

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

44. From your house, can you easily walk to school?
Mark only one oval.

- Yes
- No

45. From your house, can you easily walk to a park (for example a field, grassy area)?

Mark only one oval.

- Yes
- No

45. From your house, can you easily walk to a leisure centre/sports centre?
Mark only one oval.

- Yes
- No

46. Can you play in all the places you would like to?

- I can play in all the places I would like to
- I can play in some of the places I would like to
- I can only play in a few places I would like to
- I can hardly play in any of the places I would like to

47. Are you happy with the area that you live in?

- Yes
- No

48. If you could change something to make you and your friends healthier and happier, what would you change... IN SCHOOL?

49. If you could change something to make you and your friends healthier and happier, what would you change... OUT OF SCHOOL?

Don't forget to press submit below!

We have some resources on our website if you would like to learn more or would like to speak to someone... https://happen-wales.co.uk/some-resources-for-you/ (https://happen- wales.co.uk/some-resources-for-you/)

The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	a) P1 b) P2	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	1.1) P1 1.2) P1/2 1.3) P1/2
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	P3		
Objectives	3	State specific objectives, including any prespecified hypotheses	P3		
Methods					
Study Design	4	Present key elements of study design early in the paper	P3		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	P5		

Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case	a) P5 b) P6	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	6.1) P6 6.2) NA 6.3) P6/Figure 1
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	P6	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Supplementary Information
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Supplementary Information		

Bias	9	Describe any efforts to address potential sources of bias	NA		
Study size	10	Explain how the study size was arrived at	P6		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	P6/7		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	a) P6/7 b) P6/7 c) P6/7 d) NA e) P6/7		
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.	12.1) P6 12.2) P6

				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	P6
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	a) P6 b) P6 c) Figure 1	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.,* study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	P6
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	a) P6 b) P6 c) NA		
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure	P6		

		category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures			
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	a) P9/10 b) P9/10 c) NA		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	P6/7		
Discussion					
Key results	18	Summarise key results with reference to study objectives	P7 - P11		
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	P14	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	NA
Interpretation	20	Give a cautious overall interpretation of results considering objectives,	P11 - 14		

		limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			
Generalisability	21	Discuss the generalisability (external validity) of the study results	P14		
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P16		
Accessibility of protocol, raw data, and programming code		..	Throughout	RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Throughout

*Reference: Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine* 2015; in press.