

Schools Interventions: guidance around the academic evidence

Background

As part of the development of their Childhood Obesity Programme, Guy's & St Thomas' Charity commissioned their evaluation partner The Behavioural Insights Team to conduct a literature review of the existing evidence base around what has been tried and tested in schools to tackle childhood obesity. This note sets out available evidence from academic literature about what schools-based activities seem to have the biggest impact on childhood obesity; the strength of that evidence, and how easy different activities would be to scale and replicate on a wider level.

Guy's and St Thomas' Charity are sharing this as a resource for anyone delivering, or interested in, activities aimed at supporting healthy weight that take place within a school setting.

Key recommendations

In addition to other spaces where children and families spend their time, efforts to combat childhood obesity should include interventions in Schools. In order to encourage **healthier diets** among children we believe there are a number of evidence-based interventions which if implemented in Lambeth and Southwark could have a meaningful impact.

Intervening early is crucial, as the impact of interventions is much greater than at later ages. A meta-analysis of studies including almost 28,000 children found that intervention effects gets smaller as children get older.¹ The intervention effect for children aged 0-5 was about three times as large as interventions aimed at 12-16 year olds. This finding, which is supported by other meta-analyses,² shows the importance of intervening early and preventatively.

Children spend a significant amount of their time at school, and the school presents a **food environment** that influences what children eat. In general, there is evidence that changes to the 'choice architecture' (the way that choices are presented to people) can lead to healthier choices. In **schools' food settings** we believe the following interventions should be prioritised:

- **Change the choice architecture around food:**
 - Hide unhealthy choices from sight, while presenting healthy choices

attractively.

- Include prompts and labels to encourage healthy choices.
- Make healthy choices the easiest by considering opportunity costs and friction costs.
- **Remove unhealthy items from schools**; particularly by replacing sugary drinks in canteens and vending machines with tap water options. Some schools already ban sugary drinks and other unhealthy food items, and we recommend that this be scaled more broadly.
- **Banning unhealthy items in lunchboxes**; extending the impact of removing items from schools by including packed lunches.
- **Preordering**; asking children to pre-order their lunches can lead to healthier choices, as they are less swayed by present bias in their food choices.
- Test **incentive schemes** to discourage unhealthy eating. This appears particularly effective among older primary school children.

Other intervention areas include educational programmes and physical activity programmes. Evidence for these is mixed, and while both approaches are important for broader knowledge, wellbeing, and physical health, neither seems independently effective at addressing childhood obesity.

Effective **implementation** of interventions is as important as the theory or evidence behind it. The specifics of implementation will depend on schools, but consideration should be given to the role of school catering companies. In addition, schools' systems such as pre-paid food ordering cards can allow for testing of innovative new approaches. Interventions lasting one year or longer are more effective in reducing the prevalence of overweight and obesity, and the interventions should therefore be designed in a way that is sustainable over time.³

Structure

- **Section 1** briefly outlines why and how the **school environment matters** to our consumption and physical activity patterns.
- **Section 2** contains the **evidence based interventions** which have been previously testing and where the likely effects are relatively well-known:
 - In schools as food environments:
 - **Change the choice architecture around food**
 - **Incentivise healthy eating**
 - Education to counter obesity:
 - **Nutritional education to increase awareness**
 - **Lifestyle programmes**

- Physical activity:
 - **Activity in schools**
 - **Active travel to and from school**
- **Section 3** reviews the (limited) literature on **who interventions work best for**.
- **Section 4** outlines **why some interventions work** (and others don't).
- **Section 5** contains some **evidence based ideas**, these are ideas for interventions where direct evidence is lacking but we see potential.
- **Section 6** contains a table of the most **impactful interventions** and the **evidence base** behind them.

1 Why the environment matters

The school environment, which makes up a significant part of a child's life, can have a strong influence on both the foods that the child consumes and the level of physical activity the child engages in. Importantly, the level of control a school can exert on its environment is stronger than many other environments. Below we outline a few channels through which school environments influence child behaviour related to consumption and physical activity.

School as a development environment

Social cues: The social as well as the physical environment influences decision making. Children in schools are part of social cohorts, and in many ways their behaviour is shaped by that of their peers.^{4 5} When their friends are active during breaktime, they may be more likely to join. If their friends skip lunch in favour of vending machine snacks, they may do the same.

Habit: We form habits through repeatedly associating situations or cues with specific actions or behaviours.⁶ Since many of the cues and situations we experience are dictated by our environment it is likely that our environment influences the habits we develop. For example, children who pass a vending machine between classes every day may be more likely to buy a snack or soda regularly.

Education: An important part of eating healthily revolves around being able to determine what is healthy, or not. Teaching children about nutrition and about the importance of physical activity is likely a necessary (although not sufficient) element.⁷ Increasing the educational offering on nutrition can also help signal the importance of the topic to children.

School as a food environment

Convenience: We generally like to minimise effort. Therefore, we are likely to choose an option in our immediate vicinity. This means that we are more likely to consume products that are more easily accessible around us.⁸ The foods available in and around schools, where children spend most of their time, should therefore be healthy ones.

Non-conscious or sensory cues: Numerous studies have found that subtle environmental cues can change consumer behaviour. School cafeterias, where food is displayed for children, form an environment in which such cues can be leveraged.⁹

Informational cues: Information in our environment can serve to attract our attention and/or change our perception or preferences.¹⁰ For example, nutritional information could attract our attention and/or it might change how we perceive a product. In schools, where information provision is the goal, tailored nutritional information can help children understand the impact of their diet on their health.

2 Evidence based interventions

The school environment forms a major part of children's day-to-day life, and provides authorities with a touchpoint with almost all children which can be shaped relatively easily. For these reasons, many studies seeking to address childhood obesity have focused on the school environment. This section outlines the evidence behind these interventions.

School as food environment

The presence of food and food cues in our environments have a surprising influence on our eating habits. This is equally true in schools, where many pupils consume one or two meals every day (often from canteens designed and organised in the schools). Interventions to directly influence consumption in schools has often focused on amending the choice architecture around food, or on directly incentivising healthier eating.

Choice architecture

The way that choices are presented, the "choice architecture," can influence decisions.¹¹ A recent meta-analysis of field studies concluded that action-based interventions such as changes to food choice architecture are more effective ($d=.48$) than 'interest' interventions (e.g. healthy eating cues) or 'attention' interventions (e.g. nutritional labelling) ($d=.33$ and $d=.14$ respectively).¹²

The idea behind choice architecture interventions is to encourage healthy eating (and discourage unhealthy eating) by changing the **ease and convenience** of certain foods over others. Considering this, a review of behavioural approaches to improving diets in schools recommends:¹³

- **prompting** children to choose healthy options such as fruit and vegetables,
- reducing the impact of **impulse choices based on sensory cues** by serving healthy options before the unhealthy options are available,
- reducing the handling costs (or **friction costs**) associated with eating fruit and vegetables (e.g. by serving sliced fruit), and
- reducing the **opportunity costs** of eating healthily (e.g. by scheduling recess before lunch instead of after).

Other changes to the physical food environments in schools can also help promote healthier eating. For example, this could mean **prominently displaying healthy food options** in canteens or **changing the location or offering of vending machines** in the school.¹⁴ A study at a secondary school in Yorkshire tested changes in the choice architecture of the school canteen aimed at increasing the consumption of plant-based foods.¹⁵ The interventions included presenting vegetarian daily specials in disposable pots, adding stickers with a winking face on healthy sandwiches, adding signage and posters for items that are "good for you," and presenting who fruit more attractively (in a pyramid stand).¹⁶ Choice of the plant-based foods more than doubled during the intervention period (from 1.4% to 3.0%), and this effect persisted somewhat after the intervention ended (when 2.2% of items chosen were plant-based). This finding is supported by another study in the US, which found that advertising vegetables (by means of a vinyl banner on the salad bar and a television

segment with health education delivered by vegetable characters) significantly increased the proportion of children who chose vegetables.¹⁷ While these results are interesting, we should note that the effect size is small, and that such interventions on their own are unlikely to meaningfully impact at a population level.

Sugar-sweetened beverages are a high source of sugar, and one where high consumption does not actually reduce appetite or saturation.¹⁸ **Replacing consumption of fizzy drinks with healthier options such as water** can therefore be an easy way to reduce average calorie intake.¹⁹ Some schools already ban sugary drinks, and well as other unhealthy snacks, as per the recommendation in the School Food Standards.²⁰

If schools can adequately implement bans on unhealthy sugary drinks, and provide students with healthier options, this could make an important contribution to reducing childhood obesity. A randomised controlled trial across 32 elementary schools in socially deprived areas in two cities in Germany tested the impact of installing water fountains and providing classroom lessons on the benefits of drinking water.²¹ The intervention led to a reported increase in the amount of water consumed, although there was no effect on consumption of less healthy beverages (such as juice and soft drinks). If such an intervention is paired with a reduced availability of the unhealthy options, however, the impact is likely to be amplified. By encouraging consumption of water, and removing sugar-sweetened beverages from the environment, this would also signal to the children that sugar-sweetened beverages are not desirable.

In addition to bans on sugary drink sales in school, some schools extend this approach to food children bring from home (e.g. in their lunchbox).²² A clustered Randomised Control Trial of 89 primary schools in the UK found that providing children with lunch boxes paired with information for parents about what foods to give their children found that after a year lunches the intervention schools contained fewer crisps and more fruit.²³ There is not much previous research about the impact of bans on unhealthy items in lunchboxes specifically, but insofar as it leads to reduced consumption of unhealthy items on a daily basis it is likely to have a positive effect (or neutral at worst). A **prompt** at the point of decision can be an effective way to disrupt choice. Such a prompt could take the form of a member of staff in the canteen asking each child if they want more vegetables, for example. A study in a university canteen found that written messages encouraging healthier food choices led to healthier choices, but only for the third of students who reported noticing the signs.²⁴ As opposed to signs, a direct question is difficult to ignore. A school-based study found that when children were asked “would you like fruit or juice with your lunch?” 90% took a serving of fruit, compared to 60% in schools where there was no prompt.²⁵

Box 1: Smarter Lunchrooms

In 2009, two professors with an interest in healthy eating behaviours founded the Smarter Lunchroom movement in the US. It sought to help schools implement and test behavioural approaches to encourage healthier eating, mostly by leveraging choice architecture. The movement reports significant successes in increasing sales and consumption of fruits and vegetables (see: www.smarterlunchrooms.org/about/research). However, doubt has been cast over these findings after one of the movement's founders, Dr. Brian Wansink, seemingly admitted to data misrepresentation. While the results from the Smarter Lunchroom movement are promising and likely directionally accurate, real-world effects will probably be much lower.

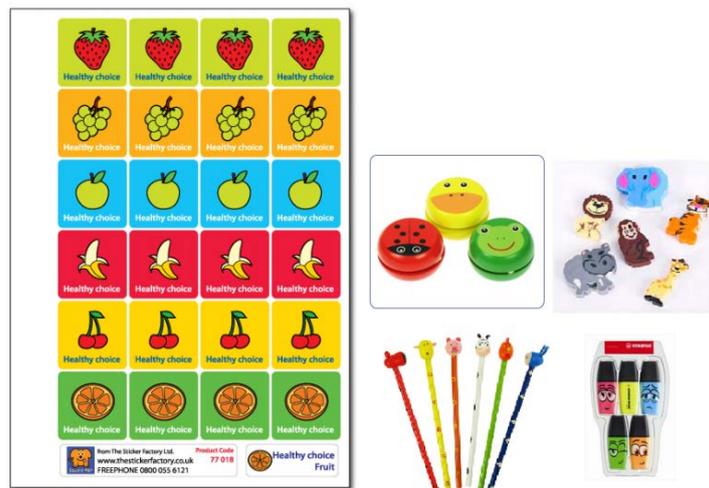
Incentivising healthy eating

Another approach that has been tested in different contexts is to provide **incentives for children to eat healthily**. Using incentives to temporarily increase healthy eating can lead to 'habit formation', which would lead to results that last even after the incentives disappear.

A study among 15 elementary schools in the US found that children increase their consumption of healthy foods when they are offered incentives, and that this increase is largest when the incentive is greater, when it is immediate (as opposed to delayed).²⁶ A field experiment among 40 elementary schools the US incentivised children to eat fruits or vegetables during lunch.²⁷ For each lunch during which a child ate a serving of fruit or vegetables, it received a token worth \$0.25 which could be spent at the school shop. Encouraging children to eat more healthily temporarily (the incentives were in place for either three or five weeks) led to more children continuing to fruit and vegetable at lunch two months after the end of the intervention. Consumption after the five-week intervention resulted an increase twice as high as after the three-week intervention.²⁸

Even if a school does not have significant resources to provide an incentive, something other than money might suffice. Another experiment testing the impact of incentives tried to evaluate the effects of incentivising the choice (rather than consumption) of fruit and vegetables among elementary school children in England.²⁹ The study compared schools in a control group to schools in two different incentive scheme groups – one in which children could choose a prize for each week they brought or chose a fruit or vegetable item for lunch at least four times, and one in which the children were assigned to groups and only those who had brought in or chosen such an option the most could choose a prize (building in an element of competition).

Figure 1: Stickers and prizes used by Belot et al.³⁰



In the immediate term, students increased their consumption of healthy items by roughly 12%, although the effect quickly dissipated for those in the individual incentive scheme.³¹ The effect persisted for the duration of the competition scheme. For a period after the incentives ended, the likelihood that a child would choose a healthy item reduced (although it remained higher than the baseline). This suggests that there was some habit formation. This effect had disappeared when the authors followed up six months after the end of the schemes, so unless incentives are sustainable then they may not lead to longer term behaviour change. However, with cheap incentives such as stickers (which can be effective among younger primary school children) it may be possible to sustain the intervention.

School-based interventions to increase fruit and vegetable consumption are only moderately effective – a meta-analysis on the topic found an improvement of 0.25 portions of fruit per day (or, in other words, one portion of fruit every four days).³² Increasing consumption of vegetables was more difficult, with an effect of only 0.07 portions daily (or one portion every two weeks).³³

Summary:

- **Change the choice architecture around food**
- **Remove unhealthy items from schools**
- **Provide and encourage drinking of tap water**
- **Test incentive schemes for healthy eating**

Educating students

The primary activity of schools is to educate their pupils, and many researchers have investigated the impact of education about nutrition and lifestyles on eating habits and obesity.

Nutritional education

Obesity is the result of a continued imbalance between calorie consumption and calorie use, and programmes focused on educating pupils about the physiological processes through which this happens, as well as about the nutritional impact of certain dietary choices, could influence behaviour. Overall, we find mixed evidence that educational programmes have a meaningful impact on childhood obesity. We think teaching children about nutrition is a necessary but not sufficient approach to countering obesity.

A year-long programme in six primary schools (n=644) in the south west of England tested the effect of an educational intervention stressing wellbeing and dental health benefits of reducing sugar intake on children's consumption of sweetened carbonated beverages.³⁴ Each class in the treatment group was assigned four 1-hour sessions; one focused on the balance of good health and promoting water consumption (by showing children a tooth in a glass of soda), two focused on a music composition including health messaging, and one involved art presentations and a classroom quiz. The authors report a modest decrease in self-reported consumption of carbonated drinks. In addition, the proportion of children in who were overweight or obese at the end of the year-long programme increased in the control group (by 7.5%) while it remained basically the same in the treatment group (it decreased by 0.2%).³⁵

Delivery of educational programmes should be interactive and tailored to individuals.^{36 37} Systematic reviews have found that educational activities on computers that allow for **personalisation and tailoring** of the information shows better results than generic classroom information provision.^{38 39} A web-based computer-tailored intervention in twenty secondary schools in the Netherlands found that the programme had positive effects on fruit and vegetable consumption, sugary drinks consumption, and snack intake.⁴⁰ However, the programme was associated with a reduction in physical activity (almost 11,000 fewer steps per week), and there was no effect on BMI or waistline measurements. Effect sizes for nutritional education delivered through tailored computer-based programmes tend to be small and temporary.⁴¹ Interventions that are **dynamically tailored** (as opposed to based on a one-off assessment) are slightly more effective, and their effects seem to last longer.⁴²

It is not clear how many sessions educational programmes should consist of, although it is highly likely that **more is better**. Higher-intensity or longer-duration programmes are more likely to reach all students and to strengthen the understanding (as well as to help children develop useful rules-of-thumb about healthy eating).^{43 44}

Lifestyle programmes

While nutritional education aims to teach children about the theoretical underpinnings of nutrition and physical activity, lifestyle programmes often aim to provide more practical tips that would lead to healthier choices.

In addition to purely educational programmes (such as lessons on physiology and the biological impact of calorie consumption), much research has focused on programmes focused on teaching students and parents about healthy lifestyles. There is no strong evidence in support of such programmes, and they do not seem to be effective when not combined with other approaches. Multi-component programmes addressing various parts of lifestyle (e.g. diet and sedentary behaviour) may be somewhat more effective.

A recent study tested the impact of an intensive, year-long Healthy Lifestyles Programme (HELP) which was delivered in 16 primary schools in Devon and Plymouth.⁴⁵ Throughout the year, students partook in activities including physical activity workshops, education sessions, homework tasks, drama sessions, and goal-setting with parental support. However, despite the duration and intensity of the intervention the researchers did not find a significant effect on the students' BMI scores. This study shows how difficult it is to have a sustained impact on the lifestyle of children. The authors concluded that while schools are an important part of their environment (and they allow for the easy and targeted delivery of population-based intervention), "school-based interventions might not be sufficiently intense to affect both the school and the family environment, and hence the weight status of children."⁴⁶

Similar results came out of a cluster-randomised controlled trial in 60 schools in the south west of England tested the effect of a programme aimed at increasing physical activity, reducing sedentary behaviour, and increasing fruit and vegetable consumption in children in year 5 (ages 8-10).⁴⁷ The programme was called Active for Life Year 5 (AFLY5), and consisted of a full day of teacher training, provision of 16 lesson plans and 10 homework plans aimed at engaging children as well as parents, and written materials distributed to children and parents. The researchers found no significant effect on physical activity or sedentary behaviour (as measured by accelerometer), nor on fruit and vegetable consumption.

Educational interventions and lifestyle programmes on their own are unlikely to have large effect sizes, in large part because changes in intentions may not translated into actually changing our eating habits.^{48 49} Even when people know what the healthy option is, and when they know they should eat healthily, our consumption is influenced by environmental factors. One way of bridging the gap between intentions and actions is by encouraging individuals to set specific '**implementation intentions**' – detailed plans about what they will do in specific situations.⁵⁰ Implementation intentions can be effective at encouraging people to eat more healthy foods, although they are less effective in relation to reducing unhealthy consumption.⁵¹ For example, such plans helped undergraduate students eat more healthily after choosing one of the next five days to make a 'healthy eating day'.⁵²

Given the impact of lifestyle factors such as sedentary behaviour, physical activity, and diet, programmes could combine various lifestyle factors instead of only focusing on, for example, healthy eating. A review of reviews that sought to identify behavioural factors that improve health and lifestyle education across various domains (substance abuse, sexual behaviour, and nutrition) concluded that various characteristics seem to contribute to the success of interventions.⁵³ These characteristics are the use of theory, addressing social

influences (especially social norms), addressing cognitive-behavioural skills, training facilitators or administrators well, and including multiple components.⁵⁴

Summary:

- **Overall mixed evidence** that education or lifestyle interventions have meaningful impacts on childhood weight.
- However successful programmes have some common characteristics:
 - o Tailoring
 - o Trained facilitators
 - o Multiple components
 - o Social influences (such as social norms)
 - o Addressing cognitive-behavioural skills
- Increase nutritional education offering; (dynamically) tailored if possible.
- Encourage pupils to set **implementation intentions** to reduce unhealthy eating.

Physical activity

Obesity is the result of an extended imbalance between calorie consumption and caloric expenditure. Addressing consumption, as described above, is one side of this coin – physical activity is the other. Physical activity has been shown to play a smaller role in the rise of childhood obesity (and in effective strategies to tackle it), but it is still important.⁵⁵ Below, we address ways of improving physical activity (and reducing sedentary activity) in schools, as well as between the home and the school.

In schools

The impact of school-based physical activity interventions tends to be minimal. A meta-analysis found that such interventions on average contribute to about 4 more minutes of walking or running per day (or between 15-25 kcal for a 14 year old boy of average size).⁵⁶ School-based physical activity interventions generally have a small but positive impact on the duration of physical activity, lung capacity, and blood cholesterol.⁵⁷ However, they have no meaningful effect on physical activity rates when children are out of school, on blood pressure, on pulse rate, or on BMI.^{58 59}

School-based physical activity programmes are slightly more effective when their frequency is increased (e.g. having five sessions of at least 45 minutes each week),⁶⁰ the quality of physical education classes is improved, incidental physical activity during breaks and at other times throughout the day increases, the school builds physical education capacity, and there is school-level commitment as exemplified by changes to curricula and the purchase of equipment for physical education.⁶¹ Effective school-based physical activity interventions often benefit from the school's ability to engage with the least active children (who are otherwise hard to reach).⁶²

A systematic review of 57 studies aimed at increasing physical activity among children found that the effective interventions brought about gains ranging from 2.6 minutes of additional physical education related physical activity, to 283 minutes of overall physical activity.⁶³ The more effective interventions were often multi-component school-based ones that included involvement of the family. Two meta-analyses of the effect of school-based physical activity interventions did not find an improvement in BMI on aggregate, nor in other measures of body composition.^{64 65} However, a more recent meta-analysis finds a small positive effect (-0.16kg/m²).⁶⁶ After-school programmes aimed at increasing physical activity have also been shown to be effective at improving physical fitness (although not BMI).⁶⁷ A review of interventions related to children's recess activities found no conclusive evidence.⁶⁸

School-based physical activity programmes are popular because they provide a relatively centralised platform for authorities to increase physical activity. The level of control over behaviour in schools makes interventions more feasible, and the compliance that comes with it helps ensure significant effects. In schools in China, where control over the activity levels of students is likely to be much higher than in the UK, the impact of physical activity interventions on BMI is therefore much higher than it is in the UK (-0.91kg/m² for physical activity interventions only, and -1.80kg/m² for programmes combining physical activity and health education).⁶⁹ These significant effect sizes can be attributed to the mandatory,

intensive, and targeted nature of the interventions – such as an hour-long physical activity class that overweight and obese students were required to take part in two to five days per week. It is unlikely that there is appetite for an intervention with this approach and intensity in the UK, however.

Active travel to school

Walking (or cycling) to school is associated with higher levels of physical activity than taking motorised transport (such as a car or bus).^{70 71} A small accelerometer study found that boys who walked to elementary school were more physically active after school and during the evening as well, suggesting that the association was caused by a greater tendency to be physically active overall.⁷² It is possible that active travel to school helps reduce overweight (as the travel does constitute physical activity), or that skinnier children are simply more likely to travel to school by foot or bicycle. The association between active modes of transport and increased activity and reduced overweight is stronger in boys than in girls.^{73 74}

A study in Australia found that active commuting to school was less likely when parents thought few other children did so, there were no traffic lights or crossings to help the children, and there was a busy road they had to cross to get to school.⁷⁵ Interventions to ensure that the built environment around schools makes it easy and safe to travel actively (and makes it less convenient to travel by motorised transport) are likely to have small positive impacts on physical activity levels. BIT's "Streets" evidence note has further details on what makes a more walkable environment.

Summary:

- **Lack of positive evidence** that physical activity classes have a meaningful impact on weight. Bringing about meaningful impacts here likely requires significant investment in intensity and quality of the classes.
- **However**, physical activity and education should be promoted in schools for wider health and educational benefits
- Increase physical education offering in schools, including the quality of the courses as well as the frequency and duration.
- Physical activity programmes seem more effective for overweight and obese children. However, targeting activity at these students may have stigma attached.

3 Who these work best for

It is important to know whether an intervention works best for one group or another since interventions have the potential to exacerbate health inequalities. Despite this importance, there is a lack of evidence on who interventions work best for.

Children entering secondary school tend to consume more sugar-sweetened beverages and unhealthy fried foods, and while school lunches influence their consumption in school most of the unhealthy eating seems to happen outside of school.⁷⁶ Some evidence suggests that incentivising the consumption of healthy foods is more effective in schools with a larger fraction of low-income children – a group likely to benefit most.⁷⁷ However, the out-of-school food environment for these children tends to be healthier as well.

For healthy eating interventions, one paper reviews all the studies which report outcomes for different SES groups.⁷⁸ Interventions that are “upstream,” for example changes to prices/levies or at the point of purchase, were found to generally decrease health inequalities by being more effective among lower income groups. Interventions that were “downstream,” such as dietary advice and counselling, were likely to widen health inequalities however.

A review of healthy eating interventions did not find that these were generally more or less effective for children.⁷⁹ However, it did find that interventions were more effective in reducing unhealthy choices rather than increasing healthy choices.⁸⁰ In an incentive scheme that rewarded choosing healthy options, younger children (year 2) slightly decreased their consumption of healthy options (by 8%) while older children (year 5) increased their consumption (by 16%) under the same scheme.⁸¹ Such a scheme, therefore, should be implemented for pupils in Year 5, but not for younger pupils (e.g. Year 2).

There is some evidence from other areas to suggest that boys respond more to competition than girls.^{82 83 84} This suggests that interventions including a performance based (or other competitive) mechanism may be more effective for boys.

School-based physical activity interventions seem to be more effective when targeted at overweight and obese children.^{85 86} Physical activity interventions aimed at children of lower socioeconomic backgrounds do not seem particularly effective.⁸⁷

The most effective interventions focus on multiple components (such as physical activity, diet, *and* education), and involve parents as well.^{88 89 90 91} More intensive interventions such as multi-component interventions aimed at increasing physical activity, which include school and family or community engagement, are more effective than single-component interventions for groups that are otherwise difficult to influence (such as adolescents).⁹² This is likely because it is more difficult to change behaviour (and outcomes) for adolescents, who have more autonomy and may have more strongly-formed habit. The interventions more likely to succeed for them therefore need to be more intensive. A meta-analysis of studies including almost 28,000 children found that intervention effects gets smaller as children get older.⁹³ The intervention effect for children aged 0-5 was -0.26kg/m^2 , for those aged 6-12 it was -0.15kg/m^2 , and for those aged 13-18 it was -0.09kg/m^2 . This

finding, which is supported by other meta-analyses,⁹⁴ shows the importance of intervening early and preventatively.

With a limited number of studies focussing specifically on who interventions work best for, making robust conclusions is difficult. This evidence is consistent with our view that minimising the effort required to take up interventions and the burden associated with participation will both maximise impact while reducing (or at least not widening) health inequalities.

4 Why these interventions work (and others don't)

When it comes to interventions aimed at preventing or reducing overweight and obesity, more is generally better.⁹⁵ There is no conclusive evidence for any one type of intervention, as contexts and the way interventions are implemented matter.⁹⁶ School-based interventions contribute to a healthy diet, as they influence the availability and consumption of things like sweets and sugary drinks among pupils.⁹⁷ This is made possible, in large part, by the school's right to change the environment and offering that children face, as well as generally broad acceptance of changes in schools that benefit children.

However, interventions should not be limited to the school environment only, and should include multiple components aimed at improving diet, increasing physical activity, and education.

There is no conclusive evidence about the length required for interventions to be effective.⁹⁸ However, given the additive nature of calorie consumption (as well as of physical activity) interventions that make permanent and lasting changes to calorie intake and calorie expenditure are likely to be more successful. One meta-analysis found that while school-based interventions had no impact on BMI overall (likely because much consumption happens outside schools), interventions lasting one year or longer helped reduce the prevalence of overweight and obesity.⁹⁹

Interventions that prompt self-monitoring of behaviour tend to be more effective than others. Self-monitoring often takes the form of asking people to keep a diary about certain behaviours (such as unhealthy eating), to help them spot patterns in their own actions and to encourage them to break these patterns. A meta-analysis found that healthy eating and physical activity interventions combining self-monitoring with one or more of four other self-regulation techniques (such as goal-setting, specifying goals in relation to contextualised actions, providing feedback on performance, and reviewing previously-set goals) were significantly more effective than interventions not including self-monitoring and one other self-regulatory technique.¹⁰⁰

5 Evidence-based ideas

Here, we summarise some innovative ideas based on behavioural science applications in different areas that may have an impact on childhood obesity as well.

Pre-ordering and pre-commitment

When it gets to lunchtime our willpower to choose a healthy option can be weakened by hunger or the look or smell of a less healthy option. A number of studies have found that pre-ordering of food leads to more healthy purchases. This has been seen in both adults¹⁰¹ and children.¹⁰² When pupils decide on a screen or form what they want to eat hours or even days before the actual meal, their choices are less likely to be influenced by feelings of hunger or by present-bias. Other benefits of this approach are that they would allow for the involvement of parents (e.g. by asking parents to pre-order their children's meals), and that pre-ordering would help caterers reduce food waste and costs (as they'll know what will be ordered, and can prep exactly the right amount of food).

What might this intervention look like?

We appreciate that a formal meal-ordering system likely will not be possible in schools in Lambeth and Southwark. However, we think that the idea behind pre-ordering can be captured by having children make a mini-commitment. For example, in the morning children are shown some of the choices they will have at lunch. They then commit to making healthier choices such as not having custard on their desert or taking an extra portion of veg. The children record this commitment on a simple "order" sheet. At lunchtime the children then bring their "order" with them and are prompted to make the choices they earlier committed to.

Encourage Self-Monitoring through Feedback

Keeping track of what you eat can help disrupt unhealthy habits by bringing them to our attention.¹⁰³ This has been done by asking people to complete food diaries, but is much more easily done in environments where purchases can be tracked, such as in school canteens. A record of someone's previous food purchases could be used to feed back to them how healthily they have been eating, and allow for recommendations for relatively small changes that might be easy to make but have a significant impact over time (e.g. small portion of something rather than the large, or drinking water instead of soda). An intervention using this type of feedback found that it increased fruit and vegetable consumption among adolescents who engaged with the feedback (but not among those who didn't).¹⁰⁴

What might this intervention look like?

In secondary schools where pupils use prepaid cards to buy lunch (or even to buy snacks from vending machines), these cards could be used to track what pupils eat. The pupils could then be presented with that feedback, as well as (for example) comparisons to standards for daily recommended intake or comparisons to peers. **This information should**

be presented privately, as this intervention could lead to stigmatisation. Careful consideration is necessary about how to present the information about unhealthy eating patterns.

Suggestions for Implementation

It seems easier to reduce unhealthy eating than it is to increase healthy eating or to reduce the total amount we eat.¹⁰⁵ This would suggest that where possible, interventions are tailored to reducing unhealthy eating. For example, instead of feeding back or incentivising to increase the consumption of healthy items such as fruit and vegetables, it might be more effective to use these techniques to reduce unhealthy consumption.

A focus on reducing unhealthy eating should also, where possible, include interventions higher 'up' the supply chain. If all pupils in a school eat the same meal in a canteen, making sure that meal is prepared healthily (e.g. with less fat, sugar, or salt) can have a large and almost automatic impact. Working with school catering companies to ensure they do everything in their power to make the food as healthy as possible is therefore a useful approach. This may not necessarily be easy for schools, as evidence from the Netherlands suggests that schools whose canteens are externally managed are less likely to switch to healthier offerings.¹⁰⁶ A study on the correlation between obesity levels and schools having healthy lunch vendors in the US found no significant effect.¹⁰⁷ However, a review of randomised controlled trials in schools in the US concluded that schools' food service needs to be involved in obesity prevention.¹⁰⁸ We therefore recommend that schools engage with their catering services about the best ways to make consumption in the schools healthier.

6 Prioritising Interventions

Diet: Interventions in the food environment in schools			
Intervention	Impact	Scalability	Evidence
Change the choice architecture around food in canteens	Medium	Medium	High
Remove unhealthy items from schools	High	Low	Medium
Provide and encourage drinking of tap water ¹⁰⁹	Low	High	Low
Incentivise pupils to eat healthier	Medium	Low	Medium

Education: Interventions to improve knowledge of dietary impact			
Intervention	Impact	Scalability	Evidence
Increase nutritional education offering	Low	Medium	Medium
Offer intensive combined lifestyle programmes	Low	Medium	High
Encourage pupils to set implementation intentions	low	Medium	Medium

Physical activity			
Intervention	Impact	Scalability	Evidence
Increase quality and offering of physical education classes	Low	Medium	High
Encourage active travel to school	Low	Low	Medium

Innovative evidence-based ideas (Section 5)			
Intervention	Impact	Scalability	Evidence
Implement a pre-commitment or pre-ordering option for children	Medium	High	Low
Encourage self-monitoring through feedback	Medium	Medium	Medium

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