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CHANGE

Back in September: A Test for Our Schools

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Overview

Schools must reopen fully in September. This critically important objective faces two barriers:

1. Fear among pupils, parents and teachers, rooted in perceived health risks of the school setting
2. Insufficient testing capacity for mass, regular testing that allows asymptomatic individuals to know their Covid-19 status, allowing outbreaks to be contained

This paper sets out a way to restore confidence by utilising a testing regime that accounts for current capacity and builds on the latest surveillance data from Public Health England. If adopted, this approach would offer a route back to school for all pupils by September despite small increases in the number of outbreaks. The paper evolves the concept of a “super-spreader setting”, which is the major risk posed through reopening, as evidenced by setting-specific outbreaks across Europe, and proposes that this status should be confirmed or disproved in schools through an initial three-week, twice-weekly testing sample. This sample will cover all school types and every staff member and pupil within a school environment. This would require 700,000 to 800,000 tests to be done per week, which is attainable through existing lab-based testing and also makes use of innovative, onsite tests and child-friendly saliva-based tests.

Given what we understand about Covid-19 and younger people, and from the most recent data about schools, the working hypothesis is that schools will not be super-spreader settings but staff and some older students returning may lead to a small number of outbreaks. Therefore, it remains important to conduct the initial three-week sampling period to restore confidence amongst pupils, teachers and parents to return to the school environment and to inform any additional protective measures that would need to be in place.

If the status as a super-spreading setting is confirmed among certain school types in certain geographies and/or among different groups of people within a school population, a set of measures including ongoing testing would be introduced to curtail outbreaks and mitigate risk. This would still enable students and staff to return to these school types.

The overall objective of this exercise is to restore confidence to return to school. It should be seen as complementary to a test, trace and isolate programme and the government’s recent school-specific measures, including pupil bubbles and changes to social distancing requirements. Its

outcome may also increase public support for these measures and any further relaxing of them, which has been strained owed to a recent spate of new cases.

The approach recommended in this paper takes account of the current confines of testing capacity. Ultimately, the government should build to a level of testing capacity that enables regular, ongoing testing of all children and adults. This mass testing regime is the 'gold standard' and, short of a vaccine, the most effective way of managing the spread of Covid-19, identifying asymptomatic carriers and preventing outbreaks.

Outbreaks: The Biggest Threat to Health and to Education

“There will be outbreaks.”

The words of the prime minister were short and to the point. Spoken on 23 June as the easing of lockdown was announced, they presented an implicit acknowledgement that – short of a vaccine or a wonder drug – there is no end in sight to Covid-19.

Risk will always be present. Protective measures are introduced to reduce the risk to a tolerable level; they must always be grounded in an understanding of the science of this pandemic, including the health outcomes of the disease and how, where and by whom the virus is transmitted.

Key to all this is the concept of super-spreader settings. Evidence is building around the idea that a high number of transmissions originate in a small number of people. In Israel, 80 per cent of secondary cases were caused by 5 per cent of the population¹ and analysis by the London School of Hygiene and Tropical Medicine suggested that 80 per cent of secondary transmissions came from 10 per cent of the population². This is an important characteristic of the pandemic, which has been masked by popular focus on the “R” rate of reproduction, leading to the introduction of generalised measures when specific, focused interventions would be more effective and easier to implement.

As it stands, there is no evidence that a biological factor causes one individual to transmit the disease more than another. Instead, it’s better to view the super-spreader phenomenon as an individual in a particular setting that makes them more likely to spread the disease. From other countries – such as Germany, South Korea and Austria – we have seen outbreaks occur in environments with common characteristics and where large numbers of people convene. This enables us to identify the characteristics of a potential super-spreader setting. Through testing, we can confirm or disprove their status, implement measures specific to these settings, monitor outbreaks and direct health-care resources quickly and effectively. It gives us the ultimate option of locking down super-spreader settings, if necessary.

Key to this is regular, twice-weekly testing that is focused on the setting itself. By embracing pooled testing and adopting innovative rapid antigen tests, we can reach the testing capacity required to meet this challenge. Initially, testing would take place for a three-week period. The outcomes of this would then determine the designation of a setting.

- If the three-week testing period reveals a low number of new cases: The status of a super-spreader setting is disproved. This would have the effect of restoring confidence for the public to return to these settings. The most pressing example of this is schools.
- If the three-week testing period reveals a significant number of new cases: The status of a super-spreader setting is confirmed, and regular testing and isolating is maintained.

(Any positive case of Covid-19 identified through this testing would be subject to the concurrently running test, trace and isolate regime.)

This approach of focusing on super-spreading settings will catch outbreaks in their nascent stages and ultimately help to prevent a second wave. Crucially, this approach will restore the public's confidence in returning to essential settings that are currently deemed too risky. Schools are a particularly pressing example. Given the educational, social and economic benefits of pupils being at school, as articulated by the prime minister in his commitment to having all pupils return by September, and fresh evidence on the number of outbreaks in school settings, we argue that the government should urgently introduce time-limited, focused testing in a representative sample of schools – including pupils, parents and teachers. The evidence from this programme will work to restore people's confidence, allowing teachers and students to return.

1 <https://www.medrxiv.org/content/10.1101/2020.05.21.20104521v1>

2 Endo A, Centre for the Mathematical Modelling of Infectious Diseases COVID-19 Working Group, Abbott S et al. Estimating the overdispersion in COVID-19 transmission using outbreak sizes outside China [version 1; peer review: 1 approved, 1 approved with reservations]. Wellcome Open Res 2020, 5:67 (<https://doi.org/10.12688/wellcomeopenres.15842.1>)

Outbreaks in Schools Are Rising as More Pupils Return

We have been monitoring the weekly surveillance report from Public Health England.³ It covers outbreaks in community settings in England (outbreaks are defined as two or more cases in the same setting). Below is a table looking back at outbreaks in schools since the report was first released and how this links to school reopening measures. There is a very small increase in outbreaks as younger children return, but this almost doubles as older students come back. This could impact the confidence of pupils and their parents returning to school, as well as the safety of those they go home to. These data will be watched closely over the coming weeks as more children return.

Table 1 – Number of acute respiratory outbreaks and Covid-19 cases in English schools by week

Week	Acute respiratory outbreaks ⁴ in schools (England) and number identified as Covid-19 positive ⁵	Schools open to:
15 – 21 June	44 outbreaks, 23 positives	Year 10 Year 12 16-19 learners in first year of their course Nursery Reception Year 1 Year 6 Priority groups
8 – 14 June	24 outbreaks, 12 positives	Nursery Reception Year 1 Year 6 Priority groups
1 – 7 June	14 outbreaks, 9 positives	Nursery Reception Year 1 Year 6 Priority groups
25 – 31 May	15 outbreaks, 9 positives	More children going back Priority groups

³ <https://www.gov.uk/government/publications/national-covid-19-surveillance-reports>

Week	Acute respiratory outbreaks in schools (England) and number identified as Covid-19 positive	Schools open to:
18 – 24 May	3 outbreaks, 3 positives	Priority groups
11 – 17 May	4 outbreaks, 2 positives	Priority groups
4 – 10 May	1 outbreak, 0 positives	Priority groups
27 April – 3 May	3 outbreaks, 2 positives	Priority groups
20 – 26 April	2 outbreaks, 2 positives	Priority groups

4 An outbreak is defined as two or more people experiencing a similar illness, which appears to be linked to a particular setting
5 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/895356/Weekly_COVID19_Surveillance_Report_w26.pdf

How Many Tests Are Needed for the Sample Stage to Determine If Schools Are Super-Spreader Settings?

The initial three-week testing period would see:

- 395,432 pupils across the UK tested twice a week, a total of 790,864 tests
- Testing conducted at 1,054 nurseries, 679 primary schools and 136 secondary schools across the UK
- Testing at 130 specialist and independent schools, including pupil referral units
- 30,000 teachers and other adults in school workforce tested twice a week

This is a total of 716,140 tests a week for a period of three weeks. This is achievable within the government's current testing capacity of 1,400,000 tests per week. As testing capacity continues to increase and when the methods advocated above are adopted, including pooled testing and the adoption of new innovative tests, the sample size could be increased or additional sampling groups could be initiated.

This approach has been informed by established sampling practices in the world of polling and has opted for double the number of sample schools than would be required for 95%+ accuracy in results. This allows more detailed data and specific areas to be tested. The sample size and number of tests could be halved if capacity was an issue. See Appendix for a deeper insight from Martin Boon, director of London-based polling agency Deltapoll.

Determining the Number of Pupils

There are an estimated 32,095 schools and 32,400 nurseries in the UK⁶. The average primary school has 282 pupils and the average secondary school has 965 pupils. Within these settings, there are approximately 10,425,800 pupils⁷ and approximately 503,200 teachers⁸.

Based on current and medium-term testing capacity, it would be near impossible to test every single pupil, teacher and adult associated with every school. This is why we recommend adopting the principles of statistics to draw a representative sample of schools to test in the initial three-week period, totalling 2,000 schools and nurseries. This sample is large enough to

account for the different types of schools and geographies, enabling us to disprove or confirm a school's status as a super-spreader setting. It's likely that, given what we know about the infection in children, the majority of types of schools would be discounted as super-spreader settings and this would allow us to focus any ongoing testing regime on school types that are designated as such following the three-week period.

Table 2 – Proposed number of pupils tested by school type in initial three-week sampling period

School type	Number in UK	As a % of total schools	Number of schools testing in three-week sample	Average number of pupils in school type⁹	Estimated number of pupils tested in sample
Nurseries	32,400 ¹⁰	53	1,054	45 ¹¹	47,449
Primary or Middle	20,851	34	679	282	191,356
Secondary	4,188	7	136	965	131,522
Independent	2,408	4	78	251	19,670
Specialist schools	1,257	2	41	120	4,909
Pupil referral units	352	1	11	46	527
Total	61,456 schools and nurseries		2,000 schools in sample		395,432 pupils in sample

6 This figure combines total number of schools with pre-schools and day nurseries. Source: Department for Education; Welsh Government; Scottish Government; Northern Ireland Department of Education 2019 - <https://www.gov.uk/government/statistics/education-and-training-statistics-for-the-uk-2019>

7 Source: Department for Education; Welsh Government; Scottish Government; Northern Ireland Department of Education 2019 - <https://www.gov.uk/government/statistics/education-and-training-statistics-for-the-uk-2019>

8 Source: Department for Education; Welsh Government; Scottish Government; Northern Ireland Department of Education 2019 - <https://www.gov.uk/government/statistics/education-and-training-statistics-for-the-uk-2019>

School type	Number in UK	As a % of total schools	Number of schools testing in three-week sample	Average number of pupils in school type	Estimated number of pupils tested in sample
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in UK

Determining the Number of Teachers and Other Adults in the School Workforce

There are 503,200 teachers working across all schools in the UK ¹². Taking schools as potential super-spreader settings, it's important to account for the entire workforce – including admin staff, facilities managers and teaching assistants. This takes the number of adults in the teaching workforce closer to 1 million ¹³ (adjusted to account for UK nations). For those who are able to, working from home would continue, but for the purposes of establishing a conservative estimate to understand feasibility we have worked off the basis that all 1 million members of the school workforce would be present and onsite. Therefore, for an initial three-week sample of 1,000 schools (3 per cent of all schools), approximately 30,000 teacher and other adult staff would be tested.

Types of School

By conducting a sample made up of different types of schools, we can better segment and identify schools that may be super-spreader settings. This will enable a focused deployment of measures and testing capacity. The data could also identify types of schools in specific areas. For example, secondary schools in inner-city areas could be confirmed as super-spreader settings while primary schools in rural environments may not.

9 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812539/Schools_Pupils_and_their_Characteristics_2019_Main_Text.pdf

10 This figure combines the number of pre-schools and day nurseries (state and private). Source: Understanding the childcare provider market: implications for educational suppliers Jill Rutter, Family and Childcare Trust

11 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/845080/SCÉYP_2019_Main_Report_Nov19.pdf

12 <https://www.besa.org.uk/key-uk-education-statistics/#:~:text=216%2C500%20work%20in%20primary%20schools,teachers%20working%20in%20Northern%20Ireland>

13 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/811622/SWFC_MainText.pdf

What Happens If the Status of Schools as Super-Spreader Settings Is Disproved or Confirmed in This Sampling Period?

The approach of sampling i) by school type and ii) all the pupils within that school type will identify the types of schools, if any, that are super-spreader settings and the age range of pupils that are potential *individuals in a particular setting that makes them more likely to spread the disease*; this will allow us to focus regular, ongoing testing. For example, the initial three-week period might distinguish the status of super-spreader settings between primary and secondary schools, or even identify years 10 to 13 as the most likely carriers. Knowing this information will initiate one of two courses of action depending on the status of schools.

1) If a school type or age-group is confirmed as a super-spreader setting then all schools of this type would qualify for ongoing, twice weekly testing for all persons within this setting. Clearly, the feasibility of this regular testing depends on the capacity of testing available, but the number of tests needed would be much reduced owed to the focus granted by the initial sampling exercise. If two or more infections are confirmed, constituting an outbreak, then these individuals would be removed from the school environment for a two-week period that accounts for the incubation period of a virus. Where an unacceptable number of infections are identified, then immediate suppression measures would be introduced. These may include closing down an entire school for a two-week period and, if one third of schools in a given area are closed due to infections, then all others in that area may be closed for a time limited period.

This testing of schools confirmed as super-spreader settings would be done alongside the following measures:

- Teachers and other adults in the learning environment should be protected through the use of face shields, as recommended in our previous papers.
- All adults in the learning environment would be entitled to a regular test.
- Schools would be subject to Covid-19 spot checks and inspections, including the testing of all people within that setting regardless of age at regular intervals.

- If a teacher or student shows symptoms, they must self-isolate for the next 14 days.
- Prevention of schools becoming convening places for the community by reducing the number of people travelling to them, this would include measures such as an American-style school bus system.

2) If, as is likely, a school type or age-group is disproved as a super-spreader setting, then this outcome in and of itself would serve as a confidence boost and reassurance for parents, pupils and teachers to return back to school. Importantly, it does not mean that schools no longer adopt measures to mitigate the risks of Covid-19. The following would still be put in place:

- Protecting teachers and other adults in the learning environment through the use of face shields as recommended in our previous papers.
- Further time-limited, bi-weekly testing programmes and spot checks that would be conducted on a regular basis across all types of school to reaffirm their non-superspreader status still not occurring.
- If a teacher or student shows symptoms, they are not allowed to attend school for the next 14 days.
- The continuing expansion of test, trace and isolate. Over time, this should evolve into mass testing, which would involve the regular testing of all citizens regardless of symptoms.

How Do We Accommodate This Testing?

- Pooled testing

Inspired by the Covid-19 Testing Network ¹⁴, the approach involves collecting samples from patients, pooling a tenth of each sample in the lab, and then testing this compilation sample. If the results come back negative, we can conclude there were ten negative samples, if the sample comes back positive then the ten original samples are retested to determine which is positive. It works particularly effectively in mass testing where the number of positives is likely to be low (currently this is 1 in 1,700) and most tests are confirming a patient's negative status.

By pooling samples we can increase, overnight, testing by three- to five-fold. Over time, with automation and more effective sample collection (onsite and using saliva), this method could increase current lab-based capacity by 10 times.

- Innovative testing

We have identified rapid antigen tests in a previous paper and set out recommendations on how these can be brought online effectively, including through FDA-style emergency validation. These tests would boost capacity and reduce the turnaround time of samples, as many can be incorporated into the school environment.

- Less invasive sample collection including saliva testing

Saliva-based testing is quicker, easier and comparable to deep-nasal swabs making their use easier for patients and particularly schoolchildren. Meta-analysis ¹⁵ of studies on saliva-based testing found 91 percent sensitivity for saliva tests and 98 per cent sensitivity for nasopharyngeal swab (NPS) tests in previously confirmed Covid-19 infected patients across multiple datasets.

- A point of contact to collect samples in schools, following the Premier League.

The Premier League provides an excellent example of efficient coordination and collection of samples. There, tests are done at each club's training ground. As testing is administered in schools, the following lessons from the Premier League testing are relevant:

- Have a place to go in the school e.g. qualified nurses based in the school grounds
- Consider having this place outdoors (akin to a club training ground)

- Beyond schools, there is also an argument for making this a model for testing stations for mass population testing. Testing is more effective when there's a point of collection for a swab, for instance within a club or a school. For this reason, a "super-spreader setting" also serves as an effective model for conducting population-wide testing.
- Maximising existing lab capacity
There is still latent lab capacity in the UK, and this should be put to use in a coordinated way through engagement with regional and local facilities. From ongoing conversations with experts, we understand this latent lab space could boost testing capacity by a further 350,000 per week.

14 <https://www.covid19-testing.org/>

15 <https://www.medrxiv.org/content/10.1101/2020.05.26.20112565v1>

Evidence of Transmission in Children Suggests Schools Are Unlikely to be Super-Spreader Settings

It's understandable that many parents would not want to expose their children to any form of risk given the choice, but a recent study of seven countries¹⁶ put the risk in context: Out of nearly 43,000 confirmed cases of Covid-19 among 137 million children, there have been 44 deaths (0.03 per 100,000). Over the same period, there have been more than 100 deaths due to influenza (0.08 per 100,000) and more than 1,000 deaths due to unintentional injury (0.83 per 100,000).

In the UK, over the three-month period from February to May, unintentional injury caused 60 deaths (0.39 per 100,000) among those aged 0-19. Influenza was then the cause for six deaths (0.04 per 100,000), while Covid-19 related to 11 (0.07 per 100,000).

Clearly, children are less likely than adults to have symptoms; evidence suggests that those with fewer symptoms are less likely to spread the virus. Our testing sample will help to identify whether asymptomatic children are a silent conduit between different households. The last few weeks have seen a small but manageable increase in the number of outbreaks in schools as they reopen to more pupils. It's important we understand where and how these outbreaks are occurring, as it could be that these outbreaks are anomalies or are occurring amongst adults in the school environment – such as teachers, support staff and parents. Our testing sample will identify whether this is the case and confirm if asymptomatic children are a silent conduit between different households. Any measures to protect and restore confidence must reflect the true nature of transmission in school, such as face shields for teachers and other adult staff.

¹⁶ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7260492/pdf/main.pdf>

International Comparisons of School Outbreaks

UNESCO monitors school reopenings and the number of children in education across the world.¹ As of 19 June, 123 countries still had country-wide school closures, with most of those reopening on a localised basis or only for certain year groups.

Early evidence from the EU in mid-May, where 17 countries had returned early years, primary years and final years in secondary suggested no significant increase in infections. This trend has continued as many others successfully reopened schools without noticing a surge in cases. A meeting of the EU education ministers was told that reopening schools in 22 countries had not caused a large spike in cases.

Table 3 – Impact of school reopening on number of Covid-19 outbreaks by country

Country	Began reopening	Effect
Sweden	Open throughout	One notable outbreak in a primary school
Denmark	15 April	No impact on infection rate
Austria	18 May	No impact on infection rate
Norway	20 April	No impact on infection rates; schools will remain open even if wider rates spike
France	11 May	Seven schools linked to outbreaks in the first phase of reopening
Germany	20 April, stratified by state	No impact on infection rate
Finland	14 May	No impact on infection rate
Singapore	1 June	No impact on infection rate
Australia	11 May, stratified by state	No impact on infection rate

Country	Began reopening	Effect
New Zealand	18 May	No impact on infection rate
China	1 March, stratified by province	No impact on infection rate, but schools forced to close with recent spike
Taiwan	Never officially closed although held an extended winter break in February	No impact on infection rate
Japan	2 May, stratified by province	No impact on infection rate
Israel	14 May	Significant outbreaks in several secondary schools but unknown if staff or students
South Korea	27 May	Significant outbreaks; 251 schools forced to close, although infections linked to non-school locations
Vietnam	11 May	No impact on infection rate

Case Study: Schools in Israel

Israel shows the importance of risk management in potential super-spreader settings and how specific measures can keep an education system open. The country has not undertaken an initial testing period to identify the types of schools that may be designated as super-spreader settings, but evidence suggests that its outbreaks in educational settings are linked to teachers and older pupils.

- 3 May: Grades 1-3 and 11-12 return to school with social distancing with classes divided into two capsules¹⁷. Masks are obligatory in public spaces but not classrooms. Parents must attest to a lack of symptoms of their children and are not allowed onto school grounds themselves.
- 10 May: Kindergartens also reopen following a similar model.
- 15 May: First reported case in a school.
- 17 May: Grades 4-10 return. The capsule system is abandoned due to a

lack of space, although timings are still staggered. Masks are made obligatory, including in the classroom – but is suspended for a week during a heatwave. Parents continue to sign declaration of health of their children. Kindergartens also abandon capsules, with children not obliged to wear masks.

- From 17 May – 22 June: Cases multiply by 55, reaching 493.

Since then, 28 per cent of Covid-19 cases in Israel are from the education system; of these 493 total cases in the education system, 118 are teachers. Israel has moved to a model of closing schools only where infections are present, allowing other areas at lower risk to remain open. At the time of writing, 177 schools were closed, with 26,000 students and staff in quarantine. Other countries, such as Singapore and South Korea also saw an uptick when schools reopened, but not significant enough to warrant their closure.

Case Study: Schools in Germany

There has been much debate recently in Germany on the role of schools in the spread of the virus.

Studies by virologists in Berlin (for instance Christian Drosten from Berlin Charité hospital) show children can have as high a viral load in their throat and be as contagious as adults.

The regional Heinsberg study based on infections in the German city of Gangelt examined how the coronavirus spreads in families¹⁸. It found that if at least one adult in a family of three is infected, the risk of other family members being infected increases from 15 per cent to 35 per cent. If at least one child in a family of three is infected, the risk of the others being infected increases to almost 70 per cent.¹⁹

Germany has seen a recent spike in cases and has had to reimplement localised lockdown measures, with 500,000 citizens now back under restrictions. Schools and nurseries in two districts in North Rhine-Westphalia have closed until August.

Case Study: Schools in France

French schools began opening on 11 May, and as of 22 May, all French schoolchildren were mandated to return to school.

At the end of that month, there were reports that 50 schools had to close due to outbreaks, with 70 infections reported.

¹⁷ These are similar to ‘bubbles’ in the UK. Children don’t interact with children outside their capsule

¹⁸ <https://www.bmj.com/content/369/bmj.m1862>

Education Minister Jean-Michel Blanquer responded to this news by noting that the 70 cases were across 40,000 schools. He argued that the infections could have been caused prior to the reopening of those schools.²⁰

In the week commencing 22 June, two schools in Paris were closed as a precautionary step after cases were discovered. As of yet, they have not been identified as cluster outbreaks.²¹

19 https://www.deutschlandfunk.de/uebertragung-von-covid-19-welche-rolle-spielen-schulen-als.676.de.html?dram:article_id=476105

20 <https://fullfact.org/health/france-school-coronavirus/>

21 <https://www.nouvelobs.com/coronavirus-de-wuhan/20200624.OBS30470/deux-ecoles-ferment-a-paris-apres-des-cas-de-covid-19.html>

Recommendations

- Introduce twice-weekly, saliva-based testing in schools to determine what types of schools, in what geographies, are “super-spreader settings”.
- If types of schools are shown, after three weeks, not to have any increase in infections, then these schools would be deemed safe and testing would cease but containment measures would continue. This would help restore confidence in pupils, parents and teachers to return to school.
- Confirmation of super-spreader settings should inform containment measures. These would include i) regular, weekly testing to identify, curtail and prevent outbreaks; ii) measures to protect people in these environments; and iii) measures to prevent these settings becoming a convening place (for example by introducing an American style school bus system to reduce the number of separate journeys to the school).
- The same approach should also be adopted for other super-spreader settings such as factories.

Appendix – Determining the Shape and Size of the Sample

by Martin Boon, Director of London-based polling agency Deltapoll

When it comes to selecting the schools to test, there are a number of statistical considerations, all of which are consistent with any high-quality population survey sampling exercise. The primary consideration is one of basic integrity: The sample of schools selected must be a fully representative sample of the school universe. Data on the universe of schools, including by sector, type and pupil numbers, are fully available, which allows us to sample effectively and rigorously.

There are two separate approaches that could be adopted, depending on project objectives, both of which deliver said representative sample. One is to sample proportionally, the other, using stratification criteria. The former would be a more orthodox approach, assuming that if say, there are 3,714 nursery schools in England representing 11.3 per cent of all schools in England, then 11.3 per cent of schools selected for testing would be nurseries. The same logic would apply for each type of school, and indeed, for other criteria such as region or pupil numbers. Essentially, every school would be stratified within its type or other criteria; then using a random start, fixed interval technique, every *n*th school would be selected for testing.

The latter method of full stratification equalises the number of schools selected if any one variable is considered so important, that the integrity of the survey is dependent on robust numbers of tests controlling for it. For example, if regional spikes in virus infections are prevalent, it might be considered useful to ensure that equal numbers of schools are selected in each region to cover off local considerations. Obviously, this would imply that smaller regions such as the NE are significantly over-sampled, and those with large populations (and by corollary, schools) are under-sampled, with variation dealt with at analysis stage using standard weighting techniques to force the sample back to fully representative status.

Whichever methodology is chosen, the sample produced must have rigour and robustness. Either sampling method would satisfy the former demand, but the latter can only be met by generating test numbers that allow statistically viable conclusions to be drawn. Statistical viability is, of course, derived from standard sampling theory, which assumes that sample outcomes are accurate to within known statistical tolerances, or margins of error. For example, polling observers are familiar with the phrase that 1,000

interviews is correct to within $\pm 3.2\%$ at the 95 per cent interval. The extent to which this exercise needs tighter or looser margins of error is a factor linked to budget availability and professional judgment, just like any other survey exercise. The general point to make, of course, is that the bigger the sample, the more robust the survey, so long as fully random sampling techniques are adhered to.

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