

Revealed: Variant has made vaccinations ‘mathematically

Leading statistician and other experts fear eradicating Covid-19 through herd immunity is unachievable unless all children over 12 are also vaccinated

Exclusive

By Helen McArdle

FROM the beginning of the pandemic, herd immunity has been touted as a sort of finish line or Holy Grail at which point the virus runs out steam and true normality returns.

Fringe scientists and lockdown sceptics pushed for natural infections to be allowed to sweep through the healthy, younger population while the vulnerable and elderly were shielded.

The mainstream view was that the threshold could be reached much more safely and reliably with vaccines, but – while they remain our strongest weapon – the explosive rise of the Delta variant has changed the arithmetic.

Reaching herd immunity with vaccines alone now looks mathematically impossible and, even accounting for natural infections, is likely to remain out of reach unless the immunisation programme is extended to under-18s.

“Maths for herd immunity is deceptively simple,” says Professor Adam Kleczkowski, a statistician and expert in mathematical biology at Strathclyde University.

The equation relies on a calculation combining the R number, the percentage protection a vaccine provides against infection, and various divisions, deductions and multiplications.

The Wuhan strain had an R of three, meaning each infected person would pass the virus on to three others on average in the absence of any lockdown restrictions or mitigation measures.

Effectiveness

FROM this, the basic maths says that if two in every three people were immunised – 67 per cent of the population – the epidemic would stall. But that would only be the case if vaccines were 100% per cent effective, and none are. Taking the 89% estimate for the Pfizer vaccine’s effectiveness against the Wuhan strain, the formula tells us we would actually have to fully vaccinate 75% of the population to achieve herd immunity.

This would have been hard enough, but Delta has torn up the equation.

Its high transmissibility has pushed the R up to six (even seven or eight in worst-case scenarios) meaning that 83% of the total population would have to be fully vaccinated to stop the epidemic growing even if vaccines were 100% effective.

In reality, recent estimates from Public Health Scotland indicate that two doses of Pfizer are 83% effective at preventing symptomatic infections caused by the Delta variant – falling to 61% for AstraZeneca.

Run these figures through the formula and it tells you herd immunity through vaccination is only possible if 100% of the population are fully vaccinated with Pfizer, or – bizarrely – 137% with AstraZeneca.

Since the UK is using a combination of both, vaccinating our way to herd immunity against Delta is – in short – mathematically impossible.

The best hope

UNLESS vaccine efficacy against Delta turns out to be much better than current data suggests (Public Health England estimates 88% for Pfizer which lowers the threshold needed to 95% coverage if that were the only vaccine being used), our best hope for normality is to get as close as possible by maximising uptake.

Prof Kleczkowski believes that vaccinating children aged 12 and over will be essential since adults make up just 83% of Scotland’s population, with natural infections making up the difference.

He said: “Reading between the lines of Government policies, they seem to have accepted that full herd immunity cannot be achieved quickly (if at all) and so the objective is even more clearly to ‘manage’ rather than ‘eliminate’.

“This accepts that young people will need to gain immunity via ‘natural’ infection. I would strongly argue for vaccinating 12-year-olds and older, if we want to stop the disease from spreading. The risk is small, but not negligible, and we know children are at a significant risk of long Covid.”

Israel and the US are already vaccinating 12 to 15-year-olds and the UK’s regulator, the Medicines and Healthcare products Regulatory Agency (MHRA), concluded that the Pfizer vaccine was “safe and effective” for use



Prof Adam Kleczkowski



in the age group. The Joint Committee on Vaccination and Immunisation has yet to give the go-ahead, however.

Professor Danny Altmann, an immunologist at Imperial College London, said there are no “black and white answers” although he too believes herd immunity will be impossible unless vaccines are extended to under-18s.

He said: “We’ve left the world of pedagogic certainties into things that any scientist could debate: should we be using vaccines in secondary schools? Is it ethical if children are unlikely to become seriously ill or die?”

“Is it ethical if those doses could be used more effectively by exporting them to other countries that have none at all? After all, if you let the virus run rampant around the rest of the planet, that just means new variants coming in and we perpetuate this forever.”

He added that immunity gained through vaccination is “a million miles” superior to that gained from natural infection “in quality, quantity, and durability”, but said the current situation with Delta means governments may accept defeat.

“We’re at a branch in the road where we could decide ... to become a country that tolerates percolating variants in young people more or less in perpetuity and therefore become a country that is a carrier of this virus in perpetuity with all that that entails for generating new variants, and NHS burden, and excess deaths.”

‘Less optimistic’

DR ANTONIA Ho, clinical senior lecturer/consultant in infectious diseases at the Centre for Virus Research at the University of Glasgow, said that while the outlook on herd immunity was “less optimistic”, it was important to remember that routine interventions including social distancing, ventilation, facemasks, and meeting outdoors will continue to pull the R down from six – it is currently 1.1-1.3 in Scotland – while



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herd immunity through impossible' in Scotland



People take advantage of the relaxation of lockdown restrictions in Glasgow

Photograph: Colin Mearns

could help incentivise uptake in younger people who might not have bothered otherwise. Professor Neil Mabbott, personal chair of immunopathology at Edinburgh's Roslin Institute, said Delta had "changed the goalposts" but the objective remains fundamentally the same.

"We need to get as many people as possible fully vaccinated," he said, including potentially children, although he said he believes cases in children are "canaries" reflecting what is going on in the community outside rather than in the school environment.

School infections

IF MOST children are contracting the infection from adults, rather than one another, and are less able to pass the virus on to adults, the case for vaccinating them is also weaker. "In my opinion they're not necessarily picking the virus up at school and transmitting it between themselves at school, although for the Delta variant I guess we'll know in a few weeks' time if that is the case," said Prof Mabbott. "But there is always the possibility that a child who does become infected might propagate a new variant which can then start to spread around."

It is also important to remember that even if infections cannot be eradicated, vaccines continue to play a crucial role in making them less virulent and minimising the number of cases that result in a hospital admission or death.

So, how will we know if, despite all the obstacles, herd immunity is near?

Notably, governments across the UK have been reluctant to reinstate restrictions despite a rapid rise in cases that has seen Scotland propelled from around 2,000 cases a week to 2,000 cases a day in little over a month

But that means any slowdown and decline in infections will signal the point where immunity levels are gradually outweighing the virus – even if it can never be wiped out. "We saw cases go massively down last summer and we certainly didn't have herd immunity then, that was down to other interventions," said Prof Mabbott.

"They're still increasing so we're not there yet. If we had reached this magic number we would start to see cases declining because the virus is unable to spread. That's the idea of it, that you get sufficient individuals that have protection in the community such that if the virus does enter a population of say 10 people there are enough [immune] people around that person to stop it spreading."

Eriksen sparks defibrillator app surge

AN ambulance defibrillator app has seen a 13-fold spike in downloads after the shocking collapse of Christian Eriksen on the pitch during a Euro 2020 game.

The resuscitation app, which gives CPR advice and helps people find their nearest defibrillator in an emergency, saw a 1,300 per cent rise in downloads following the Danish football star's cardiac arrest during their group clash with Finland earlier this month.

After his collapse 13 minutes into their opening game of the tournament, the 29-year-old midfielder was fitted with an implantable cardioverter defibrillator (ICD) to regulate his heart rhythm.

Doctors and medics performed life-saving cardiopulmonary resuscitation (CPR) on the turf as horrified teammates and spectators watched on. The Inter Milan and ex-Tottenham ace left Rigshospitalet in Copenhagen a week ago after a successful operation.

Now the Save a Life app, developed by South Central Ambulance Service (SCAS), has seen a 13-fold increase in downloads. It uses GPS to locate the nearest automated external defibrillator (AED) as well as a list of others in the area. It also features videos, instructions and a question-and-answer section on how to use the device.

CPR and defibrillators – devices which deliver an electric current to shock the heart muscle – enable anyone to give immediate help to patients before the emergency services arrive at the scene.

Revamped museum to reopen

A BIBLE which saved the life of a soldier is among the artefacts preserved through a £4 million revamp of a museum at Stirling Castle.

The Argyll and Sutherland Highlanders Museum closed in September 2018 for the renovation, and will open on Wednesday.

Among the objects on show is a bible which saved the life of Private Robert Wren, with the damage still clearly visible.

Elsewhere in the museum, the wallet, notebook and photographs which stopped a bullet and saved the life of Private James Beveridge are on display.

Stirling Castle was the Argyll's depot from 1875 to 1964 and remains thought of as the regiment's home.

There are more than 5,000 objects in the museum's collection and the renovation involved creating a new floor to expand the items on show.



Dr Antonia Ho from the University of Glasgow

there is a lag and if case numbers continue to climb a small proportion of a very large number is still a lot."

Scottish data

THE most recent data for Scotland indicates that 3.4% of cases are leading to a hospital admission seven days later, meaning the 13,546 infections detected in the past week should translate into between 400 and 540 Covid patients.

How many feed through into ICU and deaths is less clear, but current worst-case projections forecast 100 Covid patients in ICU by mid-July compared to 16 now unless transmission declines.

While vaccinating children could be considered, said Dr Ho, the primary goal should be maximising uptake among adults – especially among ethnic minorities and age groups where apathy or hesitation is highest. Data also indicates a gender split, with 49% of females aged 18 to 29 having had a first dose compared to 39% of males.

Although scientific opinion on "vaccine passports" is mixed, some expect that initiatives such as quarantine-free travel for fully-vaccinated people

vaccines are rolled out. But scrapping these measures too quickly could backfire, she added.

"I'm uncomfortable with potential plans in England from July 19 to stop physical distancing and wearing masks – those are important messages to continue to pursue, especially indoors.

"Quite a lot of scientists have pushed for delaying that. I do understand it's really difficult for hospitality industries and I've got a lot of sympathy for that, but the fact is two months ago we had case numbers of under 2,000 and now we have over 16,000 cases per day in the UK, and albeit hospitalisation and death rates remain low, we have to bear in mind