Covid-19: What is the R number?

Elisabeth Mahase

It’s been driving policy decisions since covid-19 emerged in late 2019, but what is the R number, and does it matter, asks Elisabeth Mahase

What is the R number?

The R number could refer to either the basic reproduction number, known as the R nought or zero (R₀), or the effective reproduction number (Rₑ).

R₀ describes how many people each infected person will infect on average, assuming that there is no pre-existing immunity in the community. It is often estimated using three factors: the duration of contagiousness after a person becomes infected, the likelihood of infection in each contact between a susceptible person and an infectious person or vector, and the frequency of contact.

Rₑ is the number of people that can be infected by an individual at any specific time, and it changes as the population becomes increasingly immunised, either through individuals gaining immunity after being infected or through vaccination, and also as people die. Re can also be affected by people’s behaviour, such as by social distancing. Rₑ and R₀ are often confused or just referred to as the R number.

What are the R₀ and Re for SARS-CoV-2?

SARS-CoV-2, the coronavirus that has caused the covid-19 pandemic, has an estimated R₀ of around 2.63, says the SARS-CoV-2, the coronavirus that has caused the covid-19 pandemic and what can happen next. German chancellor Angela Merkel appeared on television to explain the reasoning behind her government’s strategy, referring to the reproduction number. Meanwhile Boris Johnson told the public on 10 May that easing lockdown in England would depend on whether the reproduction number could be kept down.

It is often presented in simple terms: if the Rₑ is above 1 then the outbreak is expected to continue, but if it can be reduced to less than 1 the outbreak will end. This is because if each person who is infected in turn infects less than one person, the outbreak will reduce; an Rₑ of 0.5 would mean that 10 infected people would infect five others, who would then infect another 2.5. In contrast an Rₑ above 1 would mean that the outbreak would increase exponentially.

However, experts have warned that without up-to-date and comprehensive data the reproduction number is a “blunt monitoring tool.”

Azra Ghan, professor in infectious disease epidemiology at Imperial College London, said, “At present we are estimating both R and the infection rate from data on hospitalisations. These form only a small fraction of all infections and represent an estimate of transmission that occurred 1-2 weeks earlier—and are therefore a blunt monitoring tool.”

“Models or model based estimates (such as Rₑ) can be helpful in interpreting data trends but should never be viewed as a surrogate for good data. Only with extensive surveillance and rapid testing of suspect cases in the wider community, in hospitals, and in care homes, and other places at high risk, can we be truly confident that the epidemic is in decline and that it is safe to relax measures.”

Is the Rₑ important?

Many politicians have pointed to the Rₑ as an important measure to determine how well their country is responding to the pandemic and what can happen next. German chancellor Angela Merkel appeared on television to explain the reasoning behind her government’s strategy, referring to the reproduction number.

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1 Centre for Evidence-Based Medicine. “When will it be over?”: an introduction to viral reproduction numbers, R₀ and Re. Apr 2020. https://www.cebm.net/covid-19/when-will-it-be-over-an-introduction-to-viral-reproduction-numbers-r0-and-ra.
