The story of the R number

How an obscure epidemiological figure took over our lives

Part 3: Media

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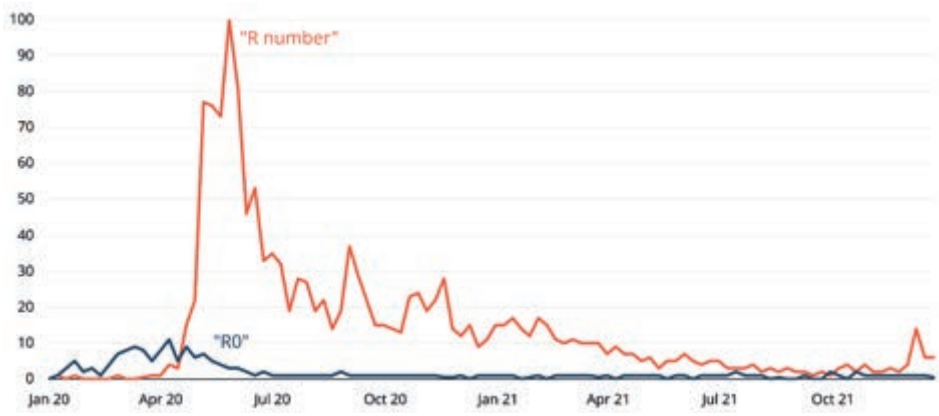

Figure 1: Popularity on Google of search terms "R number" and "R0", January 2020 to December 2021. Chart by Gavin Freeguard, using data from trends.google.com, UK only.

Chicago. We hear her cough. We see the sweat on her forehead. Our gaze lingers on the surfaces she touches – a bowl of nuts on the bar, her credit card.

Hong Kong. A coughing man clings to handrails on boat and train, our gaze on the button he presses to summon a lift.

London. An unwell model leaves a shoot, our gaze on the folder she leaves behind.

On a flight, another man coughs.

Within a few minutes of Steven Soderbergh's 2011 film, *Contagion*, it is clear that the fictional disease, MEV-1, has gone global. The film itself went viral in early 2020. *Contagion* may have been many people's first exposure to the R number. It is not long before the epidemic intelligence service officer played by Kate Winslet scribbles "FLU 1, SMALLPOX 3, POLIO 4/6" on a whiteboard and explains the need to determine, "For every person who gets sick, how many other people are they likely to infect? … We call that number the R-nought". The film's MEV-1 mutates to an R_0 of not less than 4, and with a high fatality rate.

In the real world, initial reports from Wuhan suggested Covid-19 had an R_0 of 2.5 (and a lower fatality rate than the fictional MEV-1); the World Health Organization put it at 1.4 to 2.4; other estimates ranged from 0.4 to 4.6.

The emergence of R in the media

The first significant media mention of R was probably in January 2020, when *The Atlantic* described it as "the deceptively simple number" that health organisations turn to "when a new disease emerges" (tinyurl.com/3csxz32f). The article criticised a tweet (later deleted), describing an R of 3.8 as "thermonuclear pandemic level bad", for its dubious interpretation, which suggests R was already going viral in some corners of social media. In the British media, it was mid-March before R started to spread. On 15 March, "R_0, or basic reproduction number" featured in a *Guardian* coronavirus glossary. Four days later, *Times* columnist Robert Colvile compared our expertise in economic jargon during the 2008 financial crisis to us now being "fluent in terms such as R_0 (reproduction number), social distancing or self-isolation". This too suggests R may have been circulating before coming to national media attention. A handful of other mentions follow, including the *Financial Times,* with "reproduction number" very much in quotation marks.

The first super-spreader event for the concept of R was the 30 March Downing Street press conference (tinyurl.com/ndnyfz5m), catalysing a cluster of explainer articles in early April. Asked by the BBC's then political editor, Laura Kuenssberg, whether restrictions were working and the NHS might avoid being overwhelmed, Patrick Vallance replied that the measures were "having a very big effect on contacts. That is predicted to have a very significant effect on the so-called R. The R value is the number of people on average infected by one infected person. And the idea is to get that number below 1, at which point the epidemic stops and starts to go down." He expected it was "coming down or below 1", though there would be a lag before seeing that reflected in fewer hospitalisations and deaths.

Mentions of R grew steadily in the British media through April. On 19 April, it featured in a classic *Sunday Times* "inside Number 10" story. With R below 1, the debate in Downing Street was "'between people who think we should suppress the virus completely and

those who think we should run things quite hot, use the spare capacity in the NHS and aim to keep the R number just below one,'" one official said. Another senior insider added: "You have to be clear. Running hot means more people are likely to die. That's the decision the prime minister will have to take."

Reflections on the reporting

How well did the media report R, overall? By September 2020, the head of the Office for Statistics Regulation, Ed Humpherson, could tell Parliament's Public Administration and Constitutional Affairs Committee that "in general", the media was "doing a good job", "increasingly expressing" R as a range and regionally rather than nationally, but he would encourage referring to the prevalence of Covid alongside R. Fact-checking charity Full Fact detected similar improvement in their evidence to the same inquiry, but noted that preprint research papers (those not going through an academic peer review process) were suddenly making headlines; "trying to unpick complex materials can and did lead to significant errors in some newspapers", including an *Express* article that misinterpreted one study as saying Covid had been "genetically engineered for the 'efficient spreading in the human population'".

Others were less sanguine. The Royal Society wondered if the "rapid increase" in familiarity with R was a sign of increasing scientific literacy, or just familiarity. SAGE participant Rob Challen remembers some quick, provisional analysis that ended up in a national newspaper: it "went from having 'this is what I've done in an afternoon, which shows a worrying trend that needs further investigation' to 'SAGE scientist says it's x% more deadly'… Whatever makes the best headline is how it will get reported." In late May, the Cambridge/PHE modelling group published an R of 1.01 for the North-West of England. "It felt like in the media the headline was 'R is greater than 1', and this was subsequently used to justify a delay in reopening schools in the North West when they were being reopened elsewhere', says fellow SAGE scientist Paul Birrell of

Figure 2: Documents published on the UK government website featuring the R number, January 2020 to December 2021. Chart by Gavin Freeguard, using data from gov.uk.

Glossary

- **NHS – National Health Service, the UK's publicly funded health-care system**
- **PHE – Public Health England, executive government agency created in April 2013 to protect and improve the nation's health**
- **UKHSA – UK Health Security Agency, which replaced PHE in April 2021**
- **SAGE – Scientific Advisory Group for Emergencies, convened whenever the UK Cabinet needs help handling national emergencies**
- **SPI-M – Scientific Pandemic Influenza Group on Modelling, a subgroup of SAGE**
- **SPI-M-O – Scientific Pandemic Influenza Group on Modelling, Operational, a subgroup of SPI-M**

Cambridge/PHE. "Nobody should make a decision based on a single estimate of R of 1.01 with uncertainty stretched either side."

The emergence of R in government communications

Vallance's 30 March press conference mention is not R's first appearance on gov.uk. (That actually doesn't show up in searches, given the lack of a transcript.) That distinction belongs to a 2006 study on the spread of HPAI H5N1 influenza on Vietnamese poultry farms (tinyurl.com/ydrp6nxx). Other international mentions follow, including Ebola in 2015, before we get to Covid-19. "Precautionary SAGE 1" minutes, circulated on 22 January, find it "highly probable" that R is above 1 in Wuhan. These were not published until May – SAGE published minutes more quickly as the pandemic wore on – so the earliest published mention is a SPI-M-O "consensus statement" (dated 2 March, published 20 March). This suggests the lockdown of those already infected ("herd immunity") in Wuhan reduced R from 2.4 to around 1, grapples with the implications for the UK, and finds it "highly likely that there is sustained transmission" of the disease in the UK.

Early SAGE documents reflect the fact that R is uncertain – by early April, it is given as an estimate (0.6), as part of a range (0.3 to 0.9), arrived at by consensus. It features as the basis for a "reasonable worst case scenario" for a UK outbreak, as a possible justification for ending contact tracing if that fails to bring R down (contact tracing would end on 12 March, only to be restarted in April), and much else besides. But it is one number among many, such as doubling time (the time taken for an epidemic to double in size), various fatality ratios (the infection fatality ratio, the percentage of anyone with the disease dying from it; the case fatality rate, anyone with symptoms dying; or the hospitalised case fatality ratio, anyone in hospital dying from it), hospitalisations, and the incubation period.

It is unclear exactly how R came to be "the key parameter" by the end of April. *The Times* reported in January 2021 that "SPI-M members are just as baffled as the rest of us about why the government set such store by this number". The government's coronavirus action plan of early March 2020, setting out a contain–delay–research–mitigate strategy, does not even mention R (tinyurl.com/yc3n86jt). Paul Birrell recalls that it was originally the doubling time, not R, that was of most interest. But since the doubling time is hard to estimate when the epidemic is no longer growing exponentially and its uncertainties are difficult to define, it was "fairly rapidly chosen that the R number would be the headline number that we could communicate, primarily to decision makers. At that stage, the public was probably secondary in our thoughts." Andrew Engeli, formerly of the UKHSA, wonders if "it may have been that the hand of government was forced – it popped up in popular imagination, every armchair epidemiologist started basing their discourse on R".

A SPI-M-O consensus statement on 27 April cemented R's position as the key metric. That same day, the Prime Minister made his first Downing Street statement after recovering from Covid-19 – and his first mention of R caused the next spike in media and popular consciousness. In it, he "recognise[s] the risk of a second spike, the risk of losing control of that virus and letting the reproduction rate go back over one" which would mean death, disease, and, through "slam[ming] on the brakes", "economic disaster" and "lasting damage". There is no attempt to explain what this "reproduction rate" is. He also references "our five tests", set out by the then Foreign Secretary Dominic Raab 11 days earlier, the first mention of R by a government minister (https://tinyurl.com/y6hd2d6h). Raab had noted R ("the rate of infection") was likely below 1, and set the R decreasing to "manageable levels across the board" as one of five tests for adjusting lockdown measures (alongside protecting the NHS's ability to cope, a "sustained and consistent fall" in daily death rates, having operational challenges – like testing and PPE – in hand, and not risking a second peak that could overwhelm the NHS).

The Prime Minister reiterates these five tests on 30 April. Now that the country had come through the peak – "or rather we've come under what could have been a vast peak, as though we've been going through some huge alpine tunnel, and we can now see the sunlight and pasture ahead of us" – it is vital not to "lose control and run slap into a second and even bigger mountain". Nothing should be done that would allow R back over 1 – "keeping the R down is going to be absolutely vital to our recovery". The PM stood aside for a short video explaining R and emphasising how "it's vital R stays below 1 … It will be a key factor in how social distancing measures are used in the future." BBC political editor Laura Kuenssberg asked at what level R should be before the government would be "comfortable easing restrictions" – Chief Medical Officer Chris Whitty replied, "we are absolutely confident that the wrong answer is anything over 1".

After the press conference, Politico's *London Playbook*, an indispensable email newsletter for politicians and policy wonks, mentioned R for the first time – "now it's all about the R". ■

Next issue

In part four, we explore the arrival of R in the UK Parliament. Thanks to Understanding Patient Data (understandingpatientdata.org.uk) who first commissioned this text.