
Article:
Lee, A. orcid.org/0000-0002-9795-3793, Thornley, S., Morris, A.J. et al. (1 more author) (2020) Should countries aim for elimination in the covid-19 pandemic? British Medical Journal (BMJ), 370 (8259). m3410. ISSN 1759-2151

https://doi.org/10.1136/bmj.m3410

Item: BMJ-UK; Article ID: leethornley20200902;
Article Type: Standard article; TOC Heading: Head to Head; DOI: 10.1136/bmj.m3410

Head to Head

Should countries aim for elimination in the covid-19 pandemic?

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*Elimination is possible and is the only way to prevent the biggest loss of life and economic harm in the long run, says **Andrew Lee**. But **Simon Thornley**, **Arthur J Morris**, and **Gerhard Sundborn** argue that the cost to quality of life years is too big a risk when "possible" is not the same as "achievable"*

Yes—Andrew Lee

Independent SAGE, a group of scientists providing independent scientific advice on covid-19, has called on the UK government to work towards a "zero covid UK"[1]—in other words, the elimination of covid-19.

Elimination is usually pursued for diseases that cause serious illness or death such as smallpox, polio, measles, and Ebola. The alternative approach is suppression, which attempts to reduce disease incidence to acceptable levels. This normally applies to low consequence infections, such as diarrhoeal diseases[2]—the risk of death is low, and the disease continues to circulate in the population at low levels.

It could be argued that pursuing elimination with intensive control measures, including societal lockdowns, is too costly. Indeed, in some major economies, gross domestic product (GDP) could fall by 20-25% because of control measures implemented so far in the pandemic.[3] Against the backdrop of rising unemployment and economic recession, suppression may seem the most economical approach. However, this is a short term perspective. Societal costs in the longer term need to be considered.

Failure to eliminate

Take influenza, for example. The 1918 flu pandemic is estimated to have killed 40 million people worldwide and caused a 6% decline in GDP, similar in magnitude to the 2008-09 recession.[4] Each year a billion people are infected with flu, and as many as 650 000 die from it.[5] The costs of immunising, treating, and controlling flu are substantial.

The US alone spends over $8bn (£6.03bn; €6.77bn) a year in medical costs directly related to flu.[6] Lost productivity and national economic growth cost tens of billions more. Extrapolate this worldwide over decades, and the total costs are staggering. Seasonal flu epidemics also contribute to thousands of excess deaths each year. Failure to achieve elimination is a lose-lose solution, for both health and economic outcomes.

Furthermore, covid-19 is not a low consequence infection. It is more contagious than flu and has high fatality rates, especially among elderly people and those with comorbidities.[7] Treatment can be costly, especially if intensive care is needed, and survivors may have long term health consequences.[8] A suppression approach means tolerating thousands of excess deaths each year, especially in vulnerable populations.

Is elimination possible? “Zero covid” status has been achieved in New Zealand,[9] Vietnam, Brunei, and island states in the Caribbean.[10] We know what works: consistent adherence to physical distancing, hygiene practices, and ubiquitous use of face coverings, as well as the early detection, testing, tracing, and isolation of cases—plus timely, targeted lockdowns to deal with local outbreaks. If and when a vaccine becomes available, mass immunisation programmes could help to boost population immunity. All of these measures taken together can work,[11] but they come at a cost.

With large epidemics occurring worldwide, some people may consider elimination futile. In a globalised world, infections travel across continents within days. Travel restrictions and border control measures may stem the spread of infections.[12] Once the local disease incidence is low, health protection resources can be targeted at tackling imported cases. Indeed, over the years, health protection teams nationally have kept imported diseases such as typhoid fever, Ebola, and MERS-CoV at bay. Ultimately, global eradication is desirable—eliminating covid-19 everywhere, permanently. But this is challenging, and it will require global leadership and coordination.[13]

Driving infections down

Even if elimination is not achieved, the measures taken will drive infection numbers down to levels that make it more easily contained. The risk of community spread then becomes low, and normality can be restored for schools, businesses, and social life. Moreover, elimination measures are similar to suppression measures except that they are applied with greater force and rigour. These measures may also have the co-benefit of reducing other infections.[14]

This pandemic could still get worse. We do not know yet whether its spread will be enhanced by other winter infections[15] or whether mutations are increasing its infectiousness.[16] Unless elimination is achieved, covid-19 will become endemic[17]: recurrent outbreaks and seasonal epidemics will become the norm, with a grim toll in the human lives and wealth lost.

No—Simon Thornley, Arthur J Morris, Gerhard Sundborn

We would all like to eradicate covid-19 from the globe. However, closer scrutiny shows that the odds are heavily stacked against this as a sustainable, cost effective, long term strategy. New Zealand's apparent three month success has recently been broken by a cluster with no known link to overseas travel. Ongoing lockdowns have now occurred in Auckland, and the country is still focusing on elimination.

To consider the case of covid-19, and the notion of elimination itself, poses several questions. By prioritising elimination, do we believe that it is an important health issue, many times more deadly than other respiratory viruses? What is elimination, and how will we know that it's been achieved? Where does elimination lead? What are the long term consequences of pursuing it, and what are the costs versus the benefits?

First, how deadly is covid-19? Initially, the estimated infection fatality ratio was high when polymerase chain reaction tests were used to detect cases, and the denominator of this calculation was low. With the development of antibody assays it's now clear that infection spread is much wider, and fatality ratio estimates now range from 0.02% to 0.86%, with a median of 0.26%,[18] similar to that for seasonal flu.[19]

The ratio of deaths to the number of infections is also strongly age correlated: the age distribution of covid-19 deaths in New Zealand is similar to that from the same period in 2019[20] (Fisher test P=0.93). This indicates that SARS-CoV-2 is not dramatically shortening life when compared with background survival.

What is elimination?

For measles, the World Health Organization defines regional elimination as no community transmission for more than 36 months, in the presence of good surveillance.[21] Genotyping evidence is also recommended to assess the interruption of endemic spread. After elimination is thought to have been achieved, the molecular information from new cases should be compared to ensure that these are different genotypes. To date, the only globally eradicated human disease is smallpox, which took 30 years to achieve.

Such a definition sets a very high bar, borne out by previous programmes. It also means that what New Zealand had achieved with no locally acquired cases in three months, although impressive, is far from the generally accepted definition of elimination. Pursuing this goal means permanently restricted borders, with relaxation contingent on an effective vaccine coming in less than 3-4 years as a best case scenario.

How realistic are such time frames? Byram Bridle, a Canadian immunologist charged with developing such a vaccine, has said that the fastest historical development of a vaccine was four years (Merck: mumps),[22] while most take 10 years. However, vaccines for many viruses, such as HIV, may never arrive. And immuno-senescence in elderly people may blunt vaccine efficacy in this high risk age group.[23]

A heavy cost

With the virus now widespread globally and vaccines a distant possibility, a more sustainable strategy is for nations to learn to live with it. Heavily restricting borders indefinitely will severely damage economies and translate to unemployment, with strong relations to other illnesses and suicide.[24]

Seeking elimination comes with a heavy cost. The New Zealand government's estimates, translated to quality adjusted life years, indicate that the costs outweighed the benefits of extended lockdowns designed to eliminate the virus, by a factor of 96:1.[25] A similar comparison in the UK estimated the costs of lockdown outweighing the benefits by 10:1.[26]

Instead, we must protect our elderly people and should closely monitor—and increase if needed—the capacity of our hospitals and public health services. Chasing an unrealistic goal comes with an unacceptably high price to our country that will take decades to repay.

Competing interests: We have read and understood BMJ policy on declaration of interests and declare the following interests:

AL is a member of the UK Faculty of Public Health, the Royal College of General Practitioners, and the Royal Society for Public Health. He has previously received research grant funding from the National Institute for Health Research.

ST and AM are providing paid advice to Auckland International Airport related to health risks associated with covid-19.

Provenance and peer review: Commissioned; not externally peer reviewed.

1 Independent SAGE. On achieving a zero covid UK. 13 Jul 2020. https://www.independentsage.org/independent-sage-on-achieving-a-zero-covid-uk-i-e-the-elimination-of-the-virus-from-the-uk/.

2 Dowdle WR. The principles of disease elimination and eradication. *Bull World Health Organ* 1998;76(suppl 2):22.

3 OECD. Evaluating the initial impact of covid-19 containment measures on economic activity. 2020. http://www.oecd.org/coronavirus/policy-responses/evaluating-the-initial-impact-of-covid-19-containment-measures-on-economic-activity-b1f6b68b/.

4 Barro RJ, Ursúa JF, Weng J. The coronavirus and the great influenza pandemic: lessons from the "Spanish flu" for the coronavirus's potential effects on mortality and economic activity. *Natl Bur Econ Res* 2020.

5 Iuliano AD, Roguski KM, Chang HH, et al. Estimates of global seasonal influenza-associated respiratory mortality: a modelling study. *Lancet* 2018;391:1285-300.

6 Rothman T. The cost of influenza disease burden in US Population. *Int J Econ Manag Sci* 2017;6:443.

7 Docherty AB, Harrison EM, Green CA, et al. Features of 20 133 UK patients in hospital with covid-19 using the ISARIC WHO Clinical Characterisation Protocol: prospective observational cohort study. *BMJ* 2020;369:m1985.

8 Mahase E. Covid-19: What do we know about "long covid"? *BMJ* 2020;370:m2815.

9 Baker MG, Wilson N, Anglemyer A. Successful elimination of covid-19 transmission in New Zealand. *N Engl J Med* 2020:e56.

10 World Health Organization. Coronavirus disease (covid-19) situation report—184. 22 Jul 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200722-covid-19-sitrep-184.pdf?sfvrsn=7680210a_2.

11 Ferguson N, Laydon D, Nedjati Gilani G, et al. Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce covid19 mortality and healthcare demand. 16 Mar 2020. http://www.imperial.ac.uk/mrc-global-infectious-disease-analysis/covid-19/report-9-impact-of-npis-on-covid-19/.

12 Wells CR, Sah P, Moghadas SM, et al. Impact of international travel and border control measures on the global spread of the novel 2019 coronavirus outbreak. *Proc Natl Acad Sci USA*. 2020;117:7504-9.

13 Lee AC, Morling J. Coronavirus disease 2019: emerging lessons from the pandemic. *Publ Health* 2020

14 Iacobucci G. Covid lockdown: England sees fewer cases of colds, flu, and bronchitis. *BMJ* 2020;370:m3182.

15 Academy of Medical Sciences. Preparing for a challenging winter 2020/21. 14 Jul 2020. https://acmedsci.ac.uk/file-download/51353957.

16 Korber B, Fischer WM, Gnanakaran S, et al. Tracking changes in SARS-CoV-2 Spike: evidence that D614G increases infectivity of the covid-19 virus. *Cell* 2020.

17 Hunter P. The spread of the covid-19 coronavirus: health agencies worldwide prepare for the seemingly inevitability of the covid-19 coronavirus becoming endemic. *EMBO Rep* 2020;21:e50334.

18 Ioannidis J. The infection fatality rate of covid-19 inferred from seroprevalence data. *medRxiv* 2020. https://www.medrxiv.org/content/10.1101/2020.05.13.20101253v3.

19 Garske T, Legrand J, Donnelly CA, et al. Assessing the severity of the novel influenza A/H1N1 pandemic. *BMJ* 2009;339:b2840.

20 Thornley S. Is New Zealand's covid-19 story past its use-by date? 2020. https://www.covidplanb.co.nz/our-posts/is-new-zealands-covid-19-story-past-its-use-by-date/.

21 World Health Organization. Framework for verifying elimination of measles and rubella. *Wkly Epidemiol Rec* 2013;88:89-98.

22 Hargreaves B. Merck CEO: covid-19 vaccine manufacture and distribution “huge issue”. 2020. https://www.biopharma-reporter.com/Article/2020/07/15/Merck-CEO-on-covid-19-vaccine-challenges?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright.

23 Grubeck-Loebenstein B, Della Bella S, Iorio AM, Michel J-P, Pawelec G, Solana R. Immunosenescence and vaccine failure in the elderly. *Aging Clin Exp Res* 2009;21:201-9.

24 Blakely TA, Collings SC, Atkinson J. Unemployment and suicide. Evidence for a causal association? *J Epidemiol Commun H* 2003;57:594-600.

25 Heatley D. A cost benefit analysis of 5 extra days at covid-19 alert level 4. 2020. https://www.productivity.govt.nz/assets/Documents/cost-benefit-analysis-covid-alert-4/92193c37f4/A-cost-benefit-analysis-of-5-extra-days-at-COVID-19-at-alert-level-4.pdf.

26 Miles D, Stedman M, Heald A. Living with covid-19: balancing costs against benefits in the face of the virus. *Natl Inst Econ Rev* 2020;253:R60-76.