Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

COVID-19 vaccines: effectiveness and number needed to treat

Authors' reply

We thank Luis C L Correia and Denise Matias[1] for the opportunity to clarify why both relative and absolute vaccine effects should be reported when projecting individual and population-wide benefits from clinical trials[2] and why this reporting is necessary for well informed public health decision making. Beyond statistical disputes, it is about how health research data are generated, presented, understood, and used for policies.

It is customary yet inappropriate to compare vaccine efficacies and make policy decisions solely on relative risk reduction (RRR) from clinical trials with different protocols in populations with different background risks for COVID-19—unless vaccines were tested within a common trial as advocated by WHO.[3]

RRR focusses on those who benefit from the vaccine and, although more stable across event rates (levels of risk for COVID-19), its interpretation requires knowing the actual background risk and its variability. Absolute risk reduction (ARR) considers all individuals and translates conveniently into number needed to vaccinate within a population with a given risk,[3] but its public health significance varies with the risk. For any given RRR, ARR is higher when event rates are higher—eg, earlier into a vaccination programme, or in high-risk groups—and decreases as risks decline.

Both ARR and RRR are helpful to assess trade-offs between benefits and harm, because evidence is still limited on whether or how they change across the range of individual responses and risks related to age, comorbidities, behaviours, and level of exposure, as well as over time—with risk of COVID-19 decreasing with vaccination scale-up or altering due to virus variants.

Real-world implementation studies, reporting both relative and absolute benefits, are needed,[4] including subgroups with different background risk, to inform tailored public health decisions.

RRR and ARR are a source of endless statistical debate yet poorly understood outside specialists' circles. Neither are perfect, both are required to contextualise the expected individual and population-level effect of reducing the risk of COVID-19 through vaccination.

We should move on: to educate policy makers, health professionals, and the public on how each of these measures contribute to understanding real-world vaccine effects; to elevate the discussion to the crucial elements for informed policies accounting for benefits and risks; and to advocate for head-to-head comparative trials, transparent communication of results, and fuller access to data for independent analyses.[5]

The comment by Correia and Matias is genuine, but scientists should combine perspectives to identify the most appropriate interventions to overcome the biggest health crisis in generations.

We declare no competing interests.

*Piero Olliaro, Els Torreele, Michel Vaillant
piero.olliaro@ndm.ox.ac.uk

Centre for Tropical Medicine and Global Health, Nuffield Department of Medicine, University of Oxford, Oxford OX3 7FZ, UK (PO); Institute for Innovation and Public Purpose, University College London, London, UK (ET); Competence Center for Methodology and Statistics, Luxembourg Institute of Health, Strassen, Luxemburg (MV)

1 Correia LCL, Matias D. COVID-19 vaccines: effectiveness and number needed to treat. *Lancet Microbe* 2021; published online May 14. https://doi.org/10.1016/S2666-5247(21)00119-1.
2 Suchmacher M, Geller M. Individual and collective benefit and risk indexes inferable from intervention studies. In: Suchmacher M, Geller M, eds. Biostatistics. Cambridge, MA: Academic Press, 2012: 139–51.
3 WHO. Accelerating a safe and effective COVID-19 vaccine. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov/accelerating-a-safe-and-effective-covid-19-vaccine (accessed April 23, 2021).
4 Dagan N, Barda N, Kepten E, et al. BNT162b2 mRNA Covid-19 vaccine in a nationwide mass vaccination setting. *N Engl J Med* 2021; **384:** 1412–23.
5 Doshi P. Pfizer and Moderna's "95% effective" vaccines—let's be cautious and first see the full data. 2020. https://blogs.bmj.com/bmj/2020/11/26/peter-doshi-pfizer-and-modernas-95-effective-vaccines-lets-be-cautious-and-first-see-the-full-data (accessed April 23, 2021).

Published **Online** May 14, 2021 https://doi.org/10.1016/S2666-5247(21)00120-8