


Disagreement among experts about public health decision making: is it polarisation and does it matter?

Jane H Williams,^{1,2} Claire Hooker,² Gwendolyn L Gilbert ,³ Suyin Hor,⁴ Chris Degeling¹

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¹Australian Centre for Health Engagement, Evidence and Values (ACHEEV), School of Health and Society, University of Wollongong, Wollongong, New South Wales, Australia

²School of Public Health, The University of Sydney, Sydney, New South Wales, Australia

³Sydney Institute for Infectious Diseases, The University of Sydney, Sydney, New South Wales, Australia

⁴School of Public Health, University of Technology Sydney, Sydney, New South Wales, Australia

Correspondence to

Dr Jane H Williams;
williamsj@uow.edu.au

ABSTRACT

It is common for aspects of the COVID-19 response—and other public health initiatives before it—to be described as polarised. Public health decisions emerge from an interplay of facts, norms and preferred courses of action. What counts as ‘evidence’ is diverse and contestable, and disagreements over how it should be interpreted are often the product of differing choices between competing values. We propose a definition of polarisation for the context of public health expertise that acknowledges and accounts for epistemic and social values as part of evidence generation and its application to public health practice. The ‘polarised’ label should be used judiciously because the descriptor risks generating or exacerbating the problem by oversimplifying complex issues and positions and creating groups that seem dichotomous. ‘Independence’ as a one-size-fits-all answer to expert polarisation is insufficient; this solution is premised on a scientific account of the role of evidence in decision making and does not make room for the value difference that is at the heart of both polarisation and evidence-based decision making.

INTRODUCTION

Polarisation seems to capture the current zeitgeist.^{1 2} In a time of populist politics, environmental emergencies and a global pandemic, the term is regularly used to describe either a cause of, or response to, current crises. Polarisation can be damaging by promoting social unrest, confusion and distrust, and spreading false information.^{3 4} Our group studies societal preparedness for, and responses to, infectious disease emergencies. Polarisation arises often in our reading and deliberations, but what it constitutes and who or what it affects is not always clear. Polarisation is a term of art but is also used colloquially. Terms of art often differ between disciplines but, as a multidisciplinary research team, we recognise the importance of precise definitions to avoid misunderstanding, promote clarity and question hidden assumptions.

Public health measures have long been contentious. Abortion, vaccination, water

SUMMARY BOX

- ⇒ ‘Polarisation’ is increasingly used to describe variation in expert opinion on COVID-19 mitigation measures.
- ⇒ There are often appeals to ‘independent’ evidence review as a way of managing polarisation among experts. This cannot solve the problem; in the context of COVID-19 it may have exacerbated it.
- ⇒ We propose that polarisation among public health experts describes a situation where: identifiable positions on an issue are distributed in a manner that is clustered towards opposing positions; where those positions are defined predominantly by values; where the actors involved perceive incommensurability or little common ground, and/or express their positions primarily in terms of in and outgroup commitments. This accounts for the role of epistemic and social values.
- ⇒ We find that most expert difference in public health not polarised; different interpretations of evidence and disagreement over resulting policies have long been a feature of the scientific method.
- ⇒ Referring to disagreement as polarised may oversimplify complex positions and worsen disagreement with pejorative labelling.

fluoridation, circumcision, bicycle helmets, drug-injecting centres, among others, have been the subject of controversy for different reasons. These are often studied as examples of issues-based political polarisation or ‘culture wars’^{5 6} rather than as sites of expert dissent. COVID-19 (and smallpox, cholera, pandemic influenza and Ebola before it) has reminded us that infection control measures are controversial. Mask use, quarantine, border closures and vaccine mandates have been the subject of expert disagreement, public anger, protest and—according to headlines and public discourse—polarisation. There is no question that these public health debates have been, for centuries, ideological, political, either/or arguments. But are they examples of polarisation?

In this paper, we question the applicability of existing definitions of polarisation to public health expertise. We argue that this term not only misdescribes much expert disagreement, but that its (mis)use can create this damaging phenomenon. We suggest a new definition for expert polarisation, and argue that the suggested solutions—namely improved data appraisal and scientific ‘independence’—are non-viable. We re-examine so-called COVID-19 polarisation in the context of this definition.

DEFINING POLARISATION

The term ‘polarisation’ draws from the Latin *polus*, the end of an axis. Metaphorically, sociopolitical polarisation suggests an identifiable shift towards directly opposing and, perhaps, simplified positions (real or perceived). However, a metaphor leaves much to interpretation. We reviewed definitional uses of polarisation in political science, social psychology, economics, human and economic geography, computational sciences and informatics, in an attempt to arrive at an overarching definition to explain its use in public health literature and discussions about experts and COVID-19. As expected, polarisation was conceptualised differently according to discipline, but retained the elements of a shift in position towards increased opposition.

In the interests of brevity, and acknowledging both conceptual variation among scholars and the impossibility of doing justice to well-developed and extensively theorised fields of inquiry in a few lines, we will mention only those first two disciplinary definitions here. For decades, political scientists have used polarisation to mean not merely disagreement, but separation over time on a measurable scale. Political polarisation was initially understood to be based on issues, such as abortion or social welfare, over which there has been protracted public debate, especially in the USA. More recently, Iyengar *et al* have posited an increase in ‘affective’ polarisation; rather than simply disagreeing on issues, groups increasingly distrust and feel animosity towards each other based on belonging and social identity.⁷ Social psychologists examine mechanisms of group polarisation, a process by which social groups harden their views on a topic according to group identification and norms.⁸ One explanation for group polarisation—like affective polarisation—is the desire to establish and police perceived in-group norms, consistent with social identity theory.⁸

While our reading did not identify consistent use of polarisation in relation to public health, the various disciplinary definitions shared some important relevant commonalities. First, irrespective of discipline, the literature on polarisation is overwhelmingly focused on the USA. This is perhaps because early political science concepts aligned closely with relatively polarised US systems. One outcome is a tendency to use US Republican/Democrat, liberal/conservative groupings and labels to generalise about group positions more broadly,

as if their sociodemographic, ideological or other characteristics are consistently understood by, and applicable, to non-US audiences. It may be that expectations and ideas have been unintentionally shaped by a predominantly US-centric set of observations. A second common feature is the existence of in-group/out-group sentiment and behaviour. The constitution of in/out groups varies across disciplines, however. For example, groups may be based on geographic and spatial sorting, income patterns, religious beliefs or sociopolitical allegiances. Some groupings may be issue-specific (eg, people opposed to vaccination come from across the sociopolitical spectrum⁹) or reflect and reinforce broad social norms.⁷ Finally, dichotomous group labels are popularly used as shorthand for both social and issues-based polarisation. In addition to the US-based categories, groups are sorted into Left/Right, pro-vax/anti-vax, pro-life/pro-choice, Leavers/Remainers. Out-groups are labelled pejoratively by in-groups as, for example, ‘climate change deniers’, ‘covidiot’, ‘covid minimisers’ and other types of social outlier or extremist, and labels are then extrapolated to individuals.

Reviewing definitions of polarisation raised questions: is ‘polarisation’ an accurate term when applied to public health expertise, especially outside the USA? Could using the term create or worsen the very problem it describes? Our concern is that (1) the use of the term may reflect, and potentially reify, a shorthand that falsely represents complex expert positions on apparently dichotomous issues and (2) worsen (perceived) disagreement through pejorative labelling. Given these problems, how might polarisation best be defined for the context of public health expertise? Does it describe simplified shifts in position, opposing knowledge or policy positions, or merely rancour, pejorative labelling and reduced capacity to perceive complexity?

In the only clear definition of polarisation we found in the public health literature, Ploug and Holm described polarised experts in scientific communities as those who (1) self-identify as proponents of a particular position that needs to be strongly defended *beyond what is supported by the data* and (2) *discount arguments and data that would normally be taken as important* in a scientific debate¹⁰ (emphasis ours). This definition does not reflect a US-centric position; its focus on data implies the ideals of objectivity that resist pejorative labelling. But is this definition sufficient—and can polarised debates be resolved, as suggested by this definition, through normal scientific methods?

Disagreement between experts is a normal part of science and can involve differences in the interpretation of data and, particularly in medicine and public health, which courses of action are best supported by the evidence. Acknowledging that evidence is sometimes sparse or contradictory and always filtered by values and experience, it is not surprising that experts interpret and value it differently. Expert polarisation, however, suggests intransigence anchored to deeply held values that dictate

that a particular position holds, irrespective of circumstances. It is these values that are missing from Ploug and Holm's definition.

Early exemplars of what is labelled as polarisation in public health are situated in ideological differences about what matters. Writing in the wake of The Ottawa Charter for Health Promotion, Green and Raeburn warned of ideological polarisation as experts took positions that they characterise as 'the individual vs the system debate'. A system model encompasses the environments that shape health behaviours; an individual model focuses on individual lifestyle choices.¹¹ The basis of this debate is a divergence of expert opinion on the nature of the public health paradigm itself. Another example of paradigmatic disagreement in public health, also described as polarised, is the precautionary principle versus pragmatism debate. Experts favouring the precautionary principle advocate for pre-emption of harm, as far as practical, for example, by criminalising behaviour with the goal of keeping people safe. Pragmatists allow for risk and accept that some harm is inevitable, broadly speaking and instead seek to minimise harm, for example, by providing public health services such as pill testing or medically supervised injecting rooms. Public health approaches to practices with the potential to harm, such as drug use, sex work or, currently, vaping, are characterised by moral and values-based arguments and selective use of evidence.¹² Here, again, it is different conceptions about the goal of the public health project that underpin expert difference.

In the public health literature, expert polarisation is also used to characterise issues-based struggles, such as those concerning mammography screening for early breast cancer detection, the use of statins to lower cholesterol and water fluoridation for the prevention of tooth decay. There has been considerable debate about the relative benefits and harms of these interventions, with experts taking positions that are fixed and characterised by rancour, with expert consensus deemed impossible.^{13–15} Each topic has seen fundamental disagreement about how to weigh incommensurate outcomes—or what should matter most—during the generation and evaluation of evidence, and how to translate contested evidence into policy.¹⁶ Some of this reflects the different epistemic values that accompany the interdisciplinarity of public health. What is considered important in study question, design, analysis and implementation is likely to reflect a researcher's primary discipline. For example, in cancer screening disputes, clinical experts considered individual interests paramount while epidemiologists based decisions on population level outcomes¹⁷; in the water fluoridation controversy, dentists were more supportive than toxicologists.¹⁸

We suggest a definition of polarisation in public health expertise that incorporates epistemic and social values, as identified in the examples above. We propose that polarisation among public health experts describes a situation where: *identifiable positions on an issue are distributed in a manner that is clustered towards opposing positions;*

where those positions are defined predominantly by values and where the actors involved perceive incommensurability or little common ground and/or express their positions primarily in terms of in-group and out-group commitments.

This definition draws on conclusions from our ongoing and previous empirical work on scientific disagreement and public health interventions that have been sites of vigorous debate.^{17,19} Not all expert difference is polarised. Our definition distinguishes between disagreement that is normal and that which is obstructive. It excludes noisy outliers—the existence of fringe or minority perspectives is different to polarisation. It captures the connection between epistemic and (damaging) social features of polarisation. Most importantly, it captures the fundamental causal driver of polarisation: opposing values. The contested legitimacy, of opposing positions and of the experts who hold them, expresses contests between epistemic and social values.

Our definition usefully extends that of Ploug and Holm, who define polarisation as positions held beyond what is supported by data or that are selective about and discount data. But given that 'data' are never objectively understood and instead embody epistemic and social values,²⁰ this definition expresses only the manifestation of polarisation and not its values-based origins. Our definition also suggests that the processes of 'normal science' are unlikely to resolve polarisation among expertise. We discuss this in the next section.

INDEPENDENCE AS THE ANTIDOTE TO POLARISATION

To solve problems of polarisation among experts in mammography screening and statin use, independent reviews were proposed. The concept of independence is not fixed; it depends on the problem at hand. In the case of breast screening, it meant excluding breast screening experts because their positions were assumed to be already fixed and their appraisal of evidence therefore biased.¹⁰ The *British Medical Journal's* call for an independent review of the evidence on statins refers to the need for a 'third party' to take on the role, with a request for it to be funded by England's chief medical officer.²¹ Government action, in both cases, was fundamental to providing the sort of independence required to settle bitter disputes. Because the ideal of independence implies a commitment to impartiality and objectivity by those making scientific assessments, it continues to be suggested as a solution to polarisation. But it is well established that scientific evidence alone cannot solve public health policy problems,²² because evidence itself is contested, and different values are held by those producing and interpreting it, whether or not they are subject experts.

DISAGREEMENT AMONG 'EXPERTS' ABOUT COVID-19

During the COVID-19 pandemic, experts from different disciplines (including some who had not previously claimed expertise in infectious diseases or infection

control) were asked—or sometimes took it on themselves—to interpret scant evidence quickly, to advise policy makers in a context of great uncertainty and/or to provide opinion on evidence and policy in the media. COVID-19 has provoked significant disagreement, domestically and internationally, over issues that changed over time as evidence emerged and circumstances changed. These issues often concerned non-pharmaceutical interventions (NPIs), and included *inter alia*, mask effectiveness, school closures, modes of transmission, vaccine mandates and stay-at-home orders.^{23–27} Disagreements were aired publicly, with regular media commentary from experts in different disciplines on how policy makers should respond to evidence.

Although many experts have modified their original positions, 3 years after the pandemic was declared, disagreement among experts is still often described as polarised. Experts continue to bicker on Twitter. One high profile commentator maintains that ‘some ‘experts’ doggedly cling to claims they made 2 years ago’, with persistence of ‘COVID-camps’ or ‘people or groups with particular pandemic positions taken early on that they then continually reinforce by selectively sourcing information, eventually building a base of followers that organise around that position and defend it viciously’.²⁸

We argue that COVID-19 controversies represent examples of values-informed differences about what matters driving practice. To see them as exceptional is to erroneously promote the idea of science as being value-free, and thereby operating outside of the social and ideological contexts in which it is generated. It also overlooks the fact that expert disagreement in public health (and science and medicine more broadly) is of course not a new phenomenon but rather part of the method by which consensus is reached.

It is important to acknowledge that pandemics are always initially characterised by fear and uncertainty and decisions are made in an emotionally charged climate. We contend that this fact means that expert disagreement was amplified by COVID-19 in two respects: in the breadth of what is considered expertise and in how differences are aired.

WHO IS AN ‘EXPERT’?

The plethora of different voices commenting on COVID-19 is both a problem and an opportunity. Some dissenting opinions were patently incorrect or politically/ideologically biased. Others provided an alternate perspective on conventional and often conservative public health and infection prevention and control opinion.

Expertise—what is it, who has it, who should have it, how it is performed—is the subject of vigorous scholarly debate, particularly in the context of the (US-centric?) ‘war on expertise’ that preceded the pandemic.^{29 30} COVID-19 created an environment where ‘experts’ were numerous and claims of expertise went well beyond the

disciplinary norms that might ordinarily be expected in contestations of evidence. Given the public airing of disagreement, assessing expertise has largely fallen to the public. Expert gate-keeping is neither desirable in times of crisis nor possible given how rapidly information is disseminated. It is important that publics can assess the veracity or applicability of expert claims, however assessing claims of expertise in a specialist subject can be difficult. Steps have been taken to address the dissemination of misinformation,³¹ but selective claims by people claiming expertise are less easy to counter. Detailed frameworks for identifying expertise exist to help policy makers³² but tend to assume cues and social judgments that may not be accessible to publics. Guides for publics are general (eg, does the person have a degree? An academic affiliation?); these may filter out some inappropriate claims of expertise but not all.

DISAGREEING IN PUBLIC

An important difference between COVID-19 and other public health issues described as polarised is public visibility. Previously, the airing of differences among experts in the biomedical sciences was more limited in its reach (as were the numbers and types of experts involved), playing out in medical journals and at academic conferences. Disagreement over COVID-19 mitigation measures has been highly visible, via traditional and social media, reaching an audience unfamiliar with the ways that evidence is contested before it is settled.³³ Communication of conflicting information to the public, in the interests of transparency, has been a goal of independent groups, but there is increasing concern that trust in the scientific community has been eroded as disagreements played out in public.^{34 35} Expert COVID-19 commentators may not have the credentials that were traditionally assumed of experts. Disagreement among them in the context of COVID-19 has a whole of society impact, beyond clinical outcomes and decision making. The nature of COVID-19 as a global concern, and the ease with which information can now be shared, mean that public engagement with expert disagreement is not surprising, but it complicates the discussion. It is possible that the levels and types of disagreement vary among different countries and subpopulations within countries. While people’s attitudes to COVID-19 policy are consistently influenced by political considerations,³⁶ they are also driven by personal priorities and experience. These features—augmented breadth of expertise, and public debate—have impacted how the concept of independence has been used.

INDEPENDENCE

As with previous examples of public health disagreement characterised as polarised, the suggestion, that ‘independence’ (which implicitly lays claim to other epistemic and moral characteristics such as integrity, transparency and responsibility) could provide a solution

to COVID-19-related disagreements, gained currency during the pandemic. In the UK, this led to establishment of ‘Independent Strategic Advisory Group of Experts (SAGE)’, a group of (out-group labelled) ‘rebel scientists’³⁷ offering advice that ‘follows the science’³⁸ as an alternative to that proffered by the government-appointed SAGE—noting that the latter group’s recommendations were initially not made public. The construction of independence as a key in-group characteristic defines experts working inside policy processes as being improperly influenced by politics and external interests. This situation is complicated by government-imposed secrecy or confidentiality requirements. Crucially, a goal of Independent SAGE is to engage with the public rather than with decision-makers to make the former prompt the latter to change course.³⁹ Similar groups have been established elsewhere, for example, Independent OzSAGE in Australia releases regular public advice which often differs from official government advice.⁴⁰

Independence in these contexts has been characterised to mean independent of government; the label has effectively been co-opted to create a grouping for those experts who disagree with government policy (and by extension, their advisors) on the basis of what outcomes matter most. Public trust in government decisions is important in times of unprecedented uncertainty, in part because public health outcomes are determined by adherence (or not) to collective action. But what type of government decisions are threatened by expert disagreement? This dilemma is worse in situations where social challenges, political positions and technical knowledge are intertwined. One example of this was polarisation over stay-at-home orders. Some experts supported this measure on the basis of transmission risks⁴¹; others rejected it on the basis of the potential for social harms⁴² or because they perceived unacceptable political limits on liberty.⁴³

DOES IT MATTER WHAT WE CALL IT?

There needs to be language that differentiates the regular contestations that are part of the process of settling evidence, from the shouting matches that have been a feature of some COVID-19 disagreements. Despite this, we contend that labelling such expert disagreements as polarised, if they do not fit our definition (above), is likely unhelpful. This contention is triggered and exacerbated by our argument that the ‘independence’ antidote to polarisation has, in fact, heightened the problem, and that expert incivility in the public forum (but not expert disagreement as such) may be more likely to destabilise than reassure or educate.

Our definition echoes extensive research showing that polarisation and progress are mutually incompatible. The process of ongoing disagreement places some dissenters in an outgroup, which creates an unhelpful response and creates or exacerbates polarisation. This process may be actively encouraged and exploited by actors who gain

from the impression that evidence is uncertain.^{44 45} But we contend that the polarisation label, with its suggestion of impasse, itself creates harms. It can contribute to and amplify divisive social forces and harden social identities such that it becomes more difficult for people to change their minds. A focus on and labelling of difference as polarised can lead to its becoming a created categorisation. This is because, as newly defined categories or groups of people are created, individuals are potentially influenced to adopt characteristics in order to fit into the new category. When expert disagreements and debates are presented as polarised, individuals are more likely to feel compelled to choose and defend a side. The classification shapes the reality.⁴⁶

CONCLUSIONS: WHERE TO FROM HERE?

Policy decisions emerge from an interplay of evidence, norms and preferred courses of action. What counts as ‘evidence’ is diverse and contestable and disagreements over how it should be interpreted are often the product of differing choices between competing values. It is beyond the scope of this paper to offer solutions. Nevertheless, we believe that acknowledging and managing expert disagreement in a way that promotes social cohesion is essential for an effective public health response to emergencies. We suggest that clarity and transparency about the role of values in interpretation of evidence, and policy-making⁴⁷; and scrutiny into the roles and contributions of ‘independent’ responses could be useful strategies to start with.

It is time to prepare for the next pandemic, rather than prolonging debates about COVID-19. Preparedness should include an acknowledgement of the unhelpfulness of polarised disagreement and facilitate mutually respectful and open-minded conversations among experts outside of the highly charged context of an emerging infectious disease emergency.

Twitter Jane H Williams @janewilliams141

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ORCID iD

Gwendolyn L Gilbert <http://orcid.org/0000-0001-7490-6727>

REFERENCES

- Pew Research Center. Partisanship colors views of COVID-19 handling across advanced Economies [Internet]. Pew Research. 2022. Available: www.pewresearch.org/global/wp-content/uploads/sites/2/2022/08/PG_2022.08.11_COVID_FINAL.pdf
- Arnold-Forster A. Polarisation, incivility, and scientific debate during covid-19-an essay by agnes arnold-forster. *BMJ* 2021;374:1888.
- Jung J, Grim P, Singer DJ, et al. A multidisciplinary understanding of polarization. *American Psychologist* 2019;74:301–14.
- Finkel EJ, Bail CA, Cikara M, et al. Political sectarianism in america. *Science* 2020;370 (6516).
- McCarty NM. *Polarization: what everyone needs to know*. New York, NY: Oxford University Press, 5 December 2019.
- Mouw T, Sobel ME. Culture wars and opinion polarization: the case of abortion. *American Journal of Sociology* 2001;106:913–43.
- Iyengar S, Lelkes Y, Levendusky M, et al. The origins and consequences of affective polarization in the united states. *Annual Review of Political Science* 2019;22:129–46.
- Jost JT, Baldassarri DS, Druckman JN. Cognitive-motivational mechanisms of political polarization in social-communicative contexts. *Nature Reviews Psychology* 2022;1:560–76.
- Dubé É, Ward JK, Verger P, et al. Vaccine hesitancy, acceptance, and anti-vaccination: trends and future prospects for public health. *Annual Review Public Health* 2021;42:175–91.
- Ploug T, Holm S. Conflict of interest disclosure and the polarisation of scientific communities. *Journal of Medical Ethics* 2015;41:356–8.
- Green L, Raeburn J. What is it? what will it become? *Health Promotion* 1988;3:151–9.
- Zampini GF. Evidence and morality in harm-reduction debates: can we use value-neutral arguments to achieve value-driven goals? *Palgrave Communications* 2018;4:1–10.
- Bewley S. The NHS breast screening programme needs independent review. *BMJ* 2011;343:d6894.
- Godlee F. Lessons from the controversy over statins. *Lancet* 2017;389:1100–1.
- Mazur A. Li disputes between experts. *Minerva* 1973;11:243–62.
- Parker L. Including values in evidence-based policy making for breast screening: an empirically grounded tool to assist expert decision makers. *Health Policy* 2017;121:793–9.
- Williams J, Carter SM, Rychetnik L. Contested guideline development in australia's cervical screening program: values drive different views of the purpose and implementation of organized screening: table 1. *Public Health Ethics* 2016;10:phw030.
- Gravitz L. The fluoride wars RAGE on. *Nature* 27, 2021.
- Carter SM, Williams J, Parker L, et al. Screening for cervical, prostate, and breast cancer: interpreting the evidence. *American Journal of Preventive Medicine* 2015;49:274–85.
- Worrall J. Evidence and ethics in medicine. *Perspectives in Biology and Medicine* 2008;51:418–31.
- Godlee F. Statins: we need an independent review. *BMJ* 2016;i4992.
- Humphreys K, Piot P. Scientific evidence alone is not sufficient basis for health policy. *BMJ* 2012;344:e1316.
- Escandón K, Rasmussen AL, Bogoch II, et al. COVID-19 false dichotomies and a comprehensive review of the evidence regarding public health, COVID-19 symptomatology, SARS-cov-2 transmission, mask wearing, and reinfection. *BMC Infectious Diseases* 2021;21:710.
- Brosseau LM, Sietsema M. COMMENTARY: masks-for-all for COVID-19 not based on sound data [internet]. CIDRAP: center for infectious disease research and policy. 2020. Available: www.cidrap.umn.edu/news-perspective/2020/04/commentary-masks-all-covid-19-not-based-sound-data
- Ludvigsson JF. Children are unlikely to be the main drivers of the COVID-19 pandemic-a systematic review. *Acta Paediatrica* 2020;109:1525–30.
- Morawska L, Milton DK. It is time to address airborne transmission of coronavirus disease 2019 (COVID-19). *Clinical Infectious Diseases* 2020;71:2311–3.
- Bendavid E, Oh C, Bhattacharya J, et al. Assessing mandatory stay-at-home and business closure effects on the spread of COVID-19. *European Journal of Clinical Investigation* 2021;51:e13484.
- Sridhar D. Why can't some scientists just admit they were wrong about covid? the guardian [internet]. 2022. Available: www.theguardian.com/commentisfree/2022/mar/24/scientists-wrong-covid-virus-experts
- Rutledge PE. Trump, COVID-19, and the war on expertise. *The American Review of Public Administration* 2020;50:505–11.
- Eyal G. *The crisis of expertise*. Cambridge, UK: Polity Press, 2019.
- World Health Organisation. Infodemic [internet]. 2022. Available: www.who.int/health-topics/infodemic
- Thomas M, Buckmaster L. Expertise and public policy: a conceptual guide [Internet]. Canberra, Australia: Social Policy Section, Department of Parliamentary Services. 2013. Available: www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1314/PublicPolicy
- Boyle P. Widespread distrust in science: Is the way we communicate to blame? [Internet]. AAMC. 2022. Available: www.aamc.org/news-insights/widespread-distrust-science-way-we-communicate-blame
- Horton R. Offline: science and the breakdown of trust. *Lancet* 2020;396.
- Schultz É, Ward JK. Public perceptions of scientific advice: toward a science savvy public culture? *Public Health* 2021;194:86–8.
- Flores A, Cole JC, Dickert S, et al. Politicians polarize and experts depolarize public support for COVID-19 management policies across countries. *Proceedings of the National Academy of Sciences USA* 2022;119.
- Clarke L. Covid-19's rebel scientists: has isage been a success? *BMJ* 2021:2504.
- Independent SAGE | Following the Science [Internet]. 2022. Available: www.independentsage.org/
- Pillay D. Independent SAGE replies to the BMJ. *BMJ* 2021:n2850.
- Independent OzSAGE [Internet]. OzSAGE. 2023. Available: <https://ozsage.org/>
- The Doherty Institute. COVID-19 modelling papers and press conference [Internet]. 2020. Available: www.doherty.edu.au/news-events/news/covid-19-modelling-papers/
- Great Barrington Declaration and Petition [Internet]. Great Barrington Declaration. 2023. Available: <https://gbdeclaration.org/>
- About Brownstone Institute * Brownstone Institute [Internet]. Brownstone Institute. 2023. Available: <https://brownstone.org/about/>
- Lewandowsky S. Liberty and the pursuit of science denial. *Current Opinion in Behavioral Sciences* 2021;42:65–9.
- Senger M. Who Pushed for Lockdowns? 101 Leading Voices [Internet]. Brownstone Institute. 2022. Available: <https://brownstone.org/articles/who-pushed-for-lockdowns-101-leading-voices/>
- Hacking I. Making up people. London review of Books [Internet]. 2006. Available: www.lrb.co.uk/the-paper/v28/n16/ian-hacking/making-up-people
- Hooker C, Leask J. Risk communication should be explicit about values. A perspective on early communication during COVID-19. *Journal of Bioethical Inquiry* 2020;17:581–9.