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## PERSONAL VIEW

# Managing uncertainty in the covid-19 era

## Uncertainty is inevitable in pandemics, but some simple rules help decision making

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The covid-19 pandemic is maturing, but uncertainties continue to multiply for individuals and for policy makers. Should I return to work? Should I visit relatives? Which businesses should reopen? What about schools and universities?

This article is not about the answers to those questions. It is about uncertainty and how we handle it at personal and policy levels when urgent action is essential.

Science is sometimes depicted as the methodical and painstaking search for truth and good policy making as the translation of those evidence based truths into action. Before the pandemic such assumptions sometimes (though not always) held. But covid-19 has brought the complexity of science and policy making in the context of uncertainty into sharp focus.<sup>1</sup> Some recent research findings can probably be given the status of facts, but overall the evidence base on effectiveness of interventions (preventive and therapeutic) remains patchy. The extent to which research findings from other diseases (and even other coronaviruses) can be extrapolated to covid-19 is contested.

As each country's covid-19 experience shifts from an acute national disaster to a chronic policy crisis, we all—clinicians, scientists, policy makers, and citizens—need to move on from imagining that the uncertainties can be resolved. They may never be.

This is because covid-19 is a complex problem in a complex system.<sup>2</sup> Complex systems are, by definition, made up of multiple interacting components. Such systems are open (their boundaries are fluid and hard to define), dynamically evolving (elements in the system affect, positively or negatively, other elements), unpredictable (a fixed input to the system doesn't have a fixed output) and self-organising (the system responds adaptively to interventions). Complex systems can be properly understood only in their entirety; isolating a part of the system to “solve” that does not produce a solution that works across the system for all time. Uncertainty, tension, and paradox are inherent and must be accommodated rather than resolved.<sup>3</sup>

In circumstances like this, uncontested facts—things that are ascertainable, reproducible, transferable, and predictable—tend to be elusive. Most decisions must be based on information that is flawed (imperfectly measured, with missing data), uncertain (contested, perhaps with low sensitivity or specificity), proximate (relating to something one stage removed from the real phenomenon of interest),

or sparse (available only for some aspects of the problem).<sup>4</sup>

Data that are trustworthy, certain, definitive, and plentiful can be presented as facts, and evidence based decisions can follow from them. These are the data we hope for and search for, the science that will inform the ultimate exit strategy from this pandemic.<sup>5</sup> But the stage of the current pandemic requires us to work with the kinds of imperfect data described above, so different approaches are needed.<sup>4</sup>

All of us making use of such data should be aware of our own confirmatory biases, avoiding groupthink and applying the same standards of scrutiny to findings that appear to support our prior beliefs or personal biases as to those that challenge them. In such circumstances we all may need to make decisions on the basis of “balance of probabilities” rather than “evidence beyond reasonable doubt.”<sup>6</sup>

Instead of seeking (or feigning) certainty we should be open about uncertainty and transparent in the ways in which we acknowledge the limitations of the imperfect data we have no choice but to use. Teams should be encouraged to admit ignorance, explore paradoxes, and reflect collectively (box 1).<sup>7</sup> This will improve the quality of decision making by supporting constructive scrutiny and make us more open to revising our decisions as new data and evidence emerge.

Even when an evidence base seems settled, different people will reach different conclusions with the same evidence. When the evidence base is at best inchoate, divergences will be greater. Unacknowledged or suppressed conflicts over knowledge can be destructive. But, if surfaced and debated, competing interpretations can help us productively to accept all options as flawed and requiring negotiation between a range of actors in the complex system.<sup>8</sup> If there is mutual respect and space for negotiation, such conflicts can be channelled into multifaceted solutions and adaptive actions.<sup>9</sup>

Rather than demonising others for their alternative interpretations we should celebrate the different perspectives that those who engage rigorously with the science can bring to bear on the unavoidably flawed data we have to work with. The purist pursuit of an illusory, one dimensional truth is doomed to failure. Instead we must collaborate to achieve “viable clumsy solutions.” By carefully evaluating how these imperfect responses unfold in messy real world settings we can help to build the multifaceted evidence base the world urgently needs.<sup>10</sup>

**Box 1: Five simple rules for managing uncertainty in a pandemic**

- Most data will be flawed or incomplete. Be honest and transparent about this.
- For some questions, certainty may never be reached. Consider carefully whether to wait for definitive evidence or act on the evidence you have.
- Make sense of complex situations by acknowledging the complexity, admitting ignorance, exploring paradoxes, and reflecting collectively.
- Different people (and different stakeholder groups) interpret data differently. Deliberation among stakeholders may generate multifaceted solutions.
- Pragmatic interventions—carefully observed and compared in real world settings—can generate useful data to complement the findings of controlled trials and other forms of evidence.

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- 1 Lancaster K, Rhodes T, Rosengarten M. Making evidence and policy in public health emergencies: lessons from COVID-19 for adaptive evidence-making and intervention. *Evidence & Policy: A Journal of Research, Debate and Practice* 2020;16:477-90. doi: 10.1332/174426420X15913559981103.
- 2 Hawe P, Shiell A, Riley T. Theorising interventions as events in systems. *Am J Community Psychol* 2009;43:267-76. doi: 10.1007/s10464-009-9229-9 pmid: 19390961
- 3 Greenhalgh T, Papoutsi C. Studying complexity in health services research: desperately seeking an overdue paradigm shift. *BioMed Central*, 2018:95.
- 4 Wolpert M, Rutter H. Using flawed, uncertain, proximate and sparse (FUPS) data in the context of complexity: learning from the case of child mental health. *BMC Med* 2018;16:82. doi: 10.1186/s12916-018-1079-6. pmid: 29895295
- 5 Farrar J. This virus isn't going away. The only way to beat it is to work together. Wellcome Trust. 30 Jun 2020. <https://wellcome.ac.uk/news/virus-isnt-going-away-only-way-beat-it-work-together>.
- 6 Fischer AJ, Threlfall A, Meah S, Cookson R, Rutter H, Kelly MP. The appraisal of public health interventions: an overview. *J Public Health (Oxf)* 2013;35:488-94. doi: 10.1093/pubmed/fdt076 pmid: 23995712
- 7 Lanham HJ, Leykum LK, Taylor BS, McCannon CJ, Lindberg C, Lester RT. How complexity science can inform scale-up and spread in health care: understanding the role of self-organization in variation across local contexts. *Soc Sci Med* 2013;93:194-202. doi: 10.1016/j.socscimed.2012.05.040 pmid: 22819737
- 8 Tsoukas H. Don't simplify, complexify: From disjunctive to conjunctive theorizing in organization and management studies. *J Manage Stud* 2017;54:132-53doi: 10.1111/joms.12219.
- 9 Mouffe C. *Agonistics: Thinking the world politically*. Verso Books, 2013.
- 10 Ulijaszek SJ. *Models of obesity: from ecology to complexity in science and policy*. Vol 78. Cambridge University Press, 2017doi: 10.1017/9781316338650.

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