



Letters to the Editor

Re: Causality and causal inference in epidemiology: the need for a pluralistic approach

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Vandenbroucke *et al.*¹'s critique of the potential outcomes framework does in fact set up a 'straw man': the 'Restricted Potential Outcomes Approach' ' , a term not used by anyone but themselves. A central thesis of their paper is that the potential outcomes approach 'equates causal claims with precise predictions about contrary-to-fact statements'. This contention confuses a reasonable statement, 'predictions of contrary-to-fact interventions is a form of causal claim', (which is our own view) with an extreme position, 'predictions of contrary-to-fact intervention is equivalent to, and the only form of, causal claim' (which they attribute to us). This misattribution constitutes an error in logic. 'A implies B' is not equivalent to 'A = B'. The same error is also made repeatedly by one of the paper's authors elsewhere.² The remainder of the confusion in their paper follows from this one.

An accurate statement would be that the potential outcomes approach 'identifies predictions about contrary-to-fact interventions as among claims that are causal, and focuses on this set of causal claims', and this is what a careful reading of the quotations they provide states. In a recent book,³ seemingly cited by Vandenbroucke *et al.* as representing the 'restricted potential outcomes approach,' one of us clearly articulates (Section 16.2) that potential outcomes claims, requiring hypothetical interventions, are a subset of counterfactual claims, which are themselves a subset of questions concerning causality. Again, Vandenbroucke *et al.* attribute views to us that we do not hold, and we moreover thus also disagree with their depiction of causal theories in Figure 1.

The potential outcomes framework does not delimit the bounds of causality; it is concerned with a subset of causal questions that can be defined as a contrast of hypothetical interventions. By focusing on this subset, effect estimates have a relatively well-defined causal interpretation, which is especially important when they are used to guide decisions in the real world. However, even after restriction to this form of causal questions, some ambiguity regarding interpretation remains because some ambiguity is inherent in the interventions themselves. Though Vandenbroucke *et al.* neglect to acknowledge it, the position of the authors they cite is that all counterfactuals are vague to a certain extent, but that they are made more precise by specifying further the relevant intervention.^{3–6} The point is not 'infinite' regress, as per Vandenbroucke *et al.*¹, but rather trying to reduce ambiguity instead of ignoring it. Again, it is difficult to take Vandenbroucke *et al.*'s extreme 'restricted potential outcomes approach' seriously.

The problems resulting from Vandenbroucke *et al.*'s mis-construal of the potential outcomes framework reverberate throughout their paper. They state that the potential outcomes framework 'makes no provision for' other forms of evidence for causation. This is again a misunderstanding. First, some of the other forms of evidence mentioned by Vandenbroucke *et al.*, such as negative controls or ruling out alternatives, do fall squarely within the potential outcomes framework.⁷ Second, and perhaps more importantly, the potential outcomes framework is agnostic about other forms of evidence in scientific reasoning. Saying it 'makes

no provision' for it would be like saying 'microarrays make no provision' or 'logistic regression makes no provision'. Like microarrays or logistic regression, potential outcomes are a tool for scientific reasoning—not the only tool, but an extremely important one for causal thinking. Potential outcomes do not provide the only form of evidence and they do not preclude the use of other forms of evidence.

Whereas we would agree with the suggestion of a 'pragmatic pluralism' about concepts of causality and reasoning about causality, it is also important to remember that not all causal claims are equally ambiguous or clear, and not all concern effect estimates that are used to assist decision making. The potential outcomes framework has not only brought clarity, but also important methodological advances. In some areas, as with the effects of time-varying exposures,^{5,8} key insights arose from the potential outcomes framework. A pragmatic pluralism may be reasonable in thinking about the meaning of causality and causal reasoning. However, when it comes to analysing data and thinking more precisely about the interpretation of effect estimates, it is not clear that there are at present many alternatives from which to choose.

References

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