

## POINT–COUNTERPOINT

# Causation in Epidemiology: a Socratic dialogue: Plato

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### Socrates Epimenides

*So* My dear Epidemides what were you doing here?

*Ep* My name is Epimenides.

*So* Sorry, Epimenides, my memory is failing!

*Ep* In fact, Socrates you are just the right person to hear the problem that occupied us, since, in a roundabout way, it was about causality.

*So* Well, surely, my dear fellow. By the way, do you remember what my friend and colleague Bertrand Russell said about it?

*Ep* No I don't!

*So* Well, he pointed out that the *law of causality ... like much that passes muster among philosophers, is a relic from a bygone age, surviving, like the monarchy, only because it is erroneously supposed to do no harm.*<sup>1</sup>

*Ep* this is a very surprising statement! Didn't Shakespeare write that *There is occasions and causes why and wherefore in all things?*

As a matter of fact, we epidemiologists could not dispense with some notion of causality.

*So* What exactly are you referring to?

*Ep* I mean this: a cause is a sufficient—i.e. a necessitating—condition for its effect: if the cause is present, the disease will always occur. Kenneth J Rothman believes that it is part of some sufficient cause.<sup>2</sup>

*So* What you say seems very likely but, dear Epimenides, do you know a single sufficient cause in medicine or epidemiology? Could you give me an example of such an object?

*Ep* It certainly isn't easy so far as I can see.

*So* Then don't you think that it should be relegated to the sphere of outdated ideas?

*Ep* You are probably right. But we want to be careful. Should we reject it altogether? In Rothman's component causes model which is now popular among epidemiologists, causes are elements of a sufficient hypothetical 'full' cause. It has great heuristic value, don't you agree?

*So* Yes I do, although, I must say, it remains very hypothetical for it lacks empirical content: there is not a single disease to which it might be applied; sufficiency is as unattainable as the philosophical stone. Actually, Doll and Hill's cohort studies evaluated the *tendency towards sufficiency* of tobacco smoking. And similarly, case-control studies estimate the *tendency towards necessity* of the causal factor.<sup>3,4</sup> Hence we may as well dispense with non-existing objects such as sufficiency and necessity: these are mere limiting concepts.

*Ep* Everyone should agree with you on this present point. Sufficiency, as it seems, is the mere unattainable top of the scale.

*So* Let us agree with a few further points. Sufficiency, in other words the speculative notion of necessitating causes, implies determinism, i.e. the view that every occurrence has previous causes: given its causes, each occurrence must have existed in the form it does. Do you believe like your friend Rothman who mistakenly attributes this view to Karl Popper,<sup>5,6</sup> that every event has a sufficient determinant cause? Do you believe that we live in a world in which medical events come and go according to immutable causal regularities?

*Ep* Yes I do.<sup>7,8</sup>

*So* Come on, Epimenides, aren't you using statistical instruments? Your analytic studies merely indicate that under certain conditions, something happens *most of the time* and show that certain events are more probable, given certain others. What is caused needs not be necessitated. The problem with determinism is that each of us believes it is true; it is a psychological habit, a kind of metaphysical dogma and to me it sounds like a mental blindspot. Events are not sufficiently predictable or preventable to justify an inference of inviolable regular succession. Every event has a cause but this does not imply that every event is determined by its cause<sup>9</sup> except if we interpret it as 'probabilistically' determined.

*Ep* What do you mean?

*So* I am suggesting that a cause makes its effects probable. Causality is a transmission of probability distributions, granted that appropriate restrictions rule out spurious causes; actually most of what epidemiology tells us is expressed in stochastic form.

*Ep* That's a promising start. Carry on.

*So* Bertrand Russell justified suspicion of causes applies to theoretical sciences such as physics in which a cause is allegedly a natural event which produces or prevents another natural event, not something produced or prevented by human agency. But if causes, as you claim, are legitimate in epidemiology, this springs from the *practical* nature of this discipline. Natural sciences such as physics, chemistry, biology or psychology are *theoretical* and disinterested since their general purpose is to know and understand for its own sake.

*Ep* That's undeniable. But so are the fundamental medical disciplines of physiology, biochemistry or biophysics.

*So* I hope you will forgive me if I disagree. Physiology, pathology, epidemiology and medical sciences in general rest on the implicit assumption that human biological occurrences are split into two counterparts, i.e. normal and abnormal ones; medical sciences concentrate on the latter, whereas natural sciences include both of them but usually ignore the latter. Biologically, diseases are descriptive concepts like 'herbs', but for medical men they are value-laden like 'weeds'; miscarriages

are no less natural than births but medicine takes spontaneous abortions as abnormal and endeavours to reduce their incidence.

*Ep* Don't talk nonsense, Socrates, aren't diseases part of nature?  
*So* True enough. Diseases are indeed part of nature, but the boundary we countenance between normal and abnormal processes, between physiology and pathology, between health and disease is not part of the basic inventory of the world. It depends on our way of describing the world for purposes which are not merely scientific, but also normative: diseases, handicaps and suffering are *bad* and their aversive nature calls forth preventive or therapeutic care.

*Ep* That seems right, Socrates. Suffering and diseases call for medical intervention.

*So* Quite right. Epidemiology—and more generally medicine—is a practical science of nature; this means a science 'whose essence *qua* science is not practical utility but theoretical truth, but one which, in addition to being true, is useful as providing the solution to practical problems by being "applied" to them.'<sup>10</sup> Like smelting, animal rearing or gardening, medicine is a practical discipline with explanatory, predictive and manipulative features: it attempts to prevent or attend to actual or potential physical or mental suffering, body injury and death.

*Ep* Certainly.

*So* Now I wonder whether you have noticed that we often pose our questions in comparative form; when we raise a question, we often have a *contrast* in mind which hides some implicit subordinate clause: 'Why do cigarette smokers (*compared to non-smokers*) develop lung cancer?' What we attempt to explain is not simply: 'Why this?' but rather 'Why this rather than that?' We compare a fact with a foil and a fact may have several foils, depending on our interests. If so I am asking you, how do we pick the correct comparison class? Choosing one class rather than another could give rise to distinct questions and consequently distinct answers.

*Ep* That's a good point which illustrates our need for controls and often for several sets of controls in clinical and epidemiological studies.

*So* Consider next that what we call *the cause* is the condition or the conditions which provoke a departure from normal functioning, i.e. from the contrast case. We talk about the causes of arrhythmia not of those of sinus rhythm.

*Ep* I agree with you entirely.

*So* As I say, a cause in medicine or epidemiology, contrary to alleged causes in natural sciences, consists always in some natural fact or occurrence, but *it is always potentially liable of being produced or prevented by human agency*.

*Ep* How so?

*So* I'll tell you. The practical question whether AIDS can be caused (or prevented) by HIV transmission (or its prevention) is not a further question arising when the theoretical statement that AIDS is due to HIV has been established; by that time, the question has already been agreed upon by the acceptance of that statement; the truth of the statement is constitutive of its applicability.

*Ep* Of course! It would be nonsensical to accept the theoretical claim and reject the practical question!

*So* You see, causes in medicine and epidemiology are like recipes or manipulative techniques to produce (in the case of sufficiency) or prevent (in the case of necessity) pathological processes;<sup>11</sup> they

are intrusions in what, somewhat arbitrarily, we consider the normal or physiological course of events. They may be facts, events, states or deeds which are abnormal when compared with the normal contrastive background and which account for the difference in the outcome e.g. the occurrence or elimination of a disease.

*Ep* Verily, the Greek word αἰτία,<sup>12</sup> from which 'aetiology' is derived, means *cause* but also *guilt* i.e. liability for harm. But Socrates, tell me, how do you picture the role of causes in epidemiology?

*So* First let me raise a question. What differentiates a cause from certain underlying characteristics such as age, sex or ethnic group that may affect the outcome?

*Ep* Tell us what it is.

*So* We intend by the cause of a disease the alterable condition, selected among several contributing causal factors, which we are able to produce or prevent of our own accord, just like an electrical switch which can be turned on and off.<sup>13</sup>

*Ep* That's splendid and quite true. We epidemiologists do not look at things from the mere standpoint of pure thinkers, eager to discover natural truths, but from the standpoint of a practical agent, eager to find out how we can manipulate nature to achieve our own ends.

*So* Well that's what I mean insofar as causes involve identifying salient factors, contrasting explanation and need to intervene. Causality is intrinsically connected with goals and effective strategies: this is why, contrary to physics, epidemiology needs this special notion. If you still think now as you did before our dialogue, Epimenides, please say so; but if at all differently, please explain how.

*Ep* For my part, Socrates, it seems to me you have given us a good account of causes in epidemiology. We are now all agreed on the truth of your position: the cause of a disease 'is the handle, so to speak, by which human beings can manipulate it'.<sup>14</sup>

*So* All right. Before you let me go, Epidemides, ...

*Ep* Epimenides ...

*So* Sorry, Epimenides, I would like to add a brief point: don't quote my friend Karl Popper.

*Ep* I never did, Socrates, but why do you say so?

*So* Because he was the object of a tragic case of *ignoratio elenchi* on the part of the Popperian epidemiologists: alluding to the principle of causality, my friend Karl resolved 'to exclude it, as "metaphysical", from the sphere of science'.<sup>15</sup>

## References

- <sup>1</sup> Russell B. *Mysticism and Logic*. London: Allen & Unwin 1959;180.
- <sup>2</sup> Rothman K, Greenland, S. *Modern Epidemiology*. 2nd edn. Philadelphia: Lippincott-Raven 1998;8–11.
- <sup>3</sup> Karhausen LK. The logic of causation in epidemiology *Scand. J Soc Med* 1996;**24**:8–13.
- <sup>4</sup> Karhausen LR. Causation: the elusive grail of epidemiology. *Medicine, Health Care and Philosophy* 2000;**3**:59–67.
- <sup>5</sup> Rothman K. op. citat., p.8.
- <sup>6</sup> Rothman K. *Modern Epidemiology*. Boston: Little Brown and Company 1986; pp.9–10; p.16.
- <sup>7</sup> Popper KR. *The Open Universe. An Argument for Indeterminism*. London: Hutchinson 1982; passim.
- <sup>8</sup> Poole R. Induction does not exist in epidemiology either, pp.153–61, In: Rothman KJ, ed. *Causal Inferences*. Chestnut Hill, MS: Epidemiologic Resources, 1988.
- <sup>9</sup> Renton A. Epidemiology and causation: a realist view. *J Epidemiol Community Health* 1994;**48**:79–85.

- <sup>10</sup> Popper KR. op. citat., pp.10–11.
- <sup>11</sup> Collingwood RG. Causation in practical natural science. In: RG. Collingwood, *An Essay on Metaphysics. Revised Edition*. R Martin, ed., pp.286–312, Oxford: Clarendon Press, 1998; p.298.
- <sup>12</sup> Hart HLA, Honoré T. *Causation in the Law. 2nd edn*. Oxford: Clarendon Press, 1985, p.31.
- <sup>13</sup> *aitia* from which stems ‘etiology’.
- <sup>14</sup> MacMahon B, Trichopoulos D. *Epidemiology. Principles and Methods. 2nd edn*. Boston: Little, Brown and Company, 1996;22.
- <sup>15</sup> Collingwood op. citat., 296.
- <sup>16</sup> Popper K. *The Logic of Scientific Discovery*. New York: Science Editions, Inc., 1961, p.61.