Causality and Association: The Statistical and Legal Approaches

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This paper discusses different needs and approaches to establishing ``causation'' that are relevant in legal cases involving statistical input based on epidemiological (or more generally observational or population-based) information. We distinguish between three versions of ``cause'': the first involves negligence in providing or allowing exposure, the second involves ``cause'' as it is shown through a scientifically proved increased risk of an outcome from the exposure in a population, and the third considers ``cause'' as it might apply to an individual plaintiff based on the first two. The population-oriented ``cause'' is that commonly addressed by statisticians, and we propose a variation on the Bradford Hill approach to testing such causality in an observational framework, and discuss how such a systematic series of tests might be considered in a legal context. We review some current legal approaches to using probabilistic statements, and link these with the scientific methodology as developed here. In particular, we provide an approach both to the idea of individual outcomes being caused on a balance of probabilities, and to the idea of material contribution to such outcomes. Statistical terminology and legal usage of terms such as ``proof on the balance of probabilities'' or ``causation'' can easily become confused, largely due to similar language describing dissimilar concepts; we conclude, however, that a careful analysis can identify and separate those areas in which a legal decision alone is required and those areas in which scientific approaches are useful.

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