study groups. This yielded a 14% decrease in absenteeism at program sites and a 5.8% decrease at nonprogram sites. The pretest–posttest nonequivalent control group design cannot rule out other influences related to self-selection of program sites or regression to the mean.

These and other study limitations, some of which could lead to underestimates of the program impact, are already mentioned in the text or described in the discussion. Additional research is needed to replicate our results and to control for sources of bias that may not be controlled in our study. □

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Agent Orange: Exposure and Policy

In his editorial, "Agent Orange: Exposure and Policy," Michael Gough states that "compassion probably will win; science will lose, and society will pay the price in misplaced priorities and decisions"(1) with regard to compensation for diseases which may or may not have been caused by Agent Orange exposure. I do not agree that science must lose, but rather that science should lose when it is incapable of providing a firm basis for a policy decision.

The science of epidemiology is observational and therefore lacks safeguards and controls common to experiments. Conclusion about cause and effect is usually difficult and should never be made in haste. Weak but real effects are difficult to identify and problems in measurement of exposure or disease can obscure true exposure–disease relationships. The publication of a study in the peer-reviewed literature (usually) acknowledges that the study was well done, not that its results are conclusive, provide proof, or are beyond refute. In fact, science must withstand the test of scrutinization if it is to be regarded as "good science." Good science is a consequence of its methods, not of its results or the potential application of these results. Of course, the scrutinization must itself be scrutinized for hollow arguments which distract rather than enlighten.

But even good science is not the end-all for policy-making. Epidemiologists do not always agree in their interpretations, but most would allow for reasonable interpretations differing from their own. In conclusive results do not diminish good science, but make a statement that our best estimate of the truth is that the exposure–disease association is minimal or absent. Valid studies whose conclusions point to a weak association open the door for emphasis of considerations other than epidemiology when a policy decision must be made.

When there are reasonable doubts about cause and effect—and often there are—factors such as compassion may supersede science. Policy should not be intertwined with epidemiology but should rely on it for direction. It is when this information is inconclusive that the direction policy should take is less clear. □

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Reference


Gough Responds

Dr. Waterbor argues that "science should lose when it is incapable of providing a firm basis for a policy decision." He then lists a number of reasons why epidemiologic studies can generate weak findings. But I think that the focus on epidemiology misses a fundamental difference between science and policy.

Science attempts to disprove the null hypothesis; in epidemiology that hypothesis holds that there is no association between an exposure and a health effect. In particular, in the Agent Orange controversy, it holds that exposure to that herbicide did not cause diseases in veterans or birth defects among their children. Related to the null hypothesis is the knowledge that we cannot prove a negative; it follows that we cannot prove that Agent Orange did not do some or all of the things that have been alleged. But if we are analytically about the "observational science" of epidemiology, we find that there is scant support for effects of Agent Orange. First of all, few veterans were exposed. Second, studies of much more heavily exposed worker populations do not support the plethora of effects that are claimed by some veterans. Although no one can say definitely that nothing happened, the weight of the evidence supports the null hypothesis.

Policy is different. It does not test the null hypothesis but follows other routes to decisions. In matters of disease, it often begins with the assumption that no disease is without a knowable cause and from there reaches a conclusion about causation. Many members of the public and some policymakers concluded long ago that Agent Orange caused some diseases in veterans—diseases no different from those found in nonveterans and no more common than in nonveterans. That conclusion, reached in the absence of scientific support, will not be dislodged by science, either. That is an unpleasing outcome to some scientists, but it is understandable, and I do not think that science loses if that is the course of events. It loses when the policymakers, perhaps seeking to bolster their own decisions, discredit the disagreeing science and scientists.

Dr. Waterbor and I agree that good science is not all that's needed for policy making. We also seem to agree that we don't know what else is needed. □

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Survey Strategies Discussed: Using More Than One Questionnaire

The article by Beland and colleagues concludes, "when similarly worded items are used to test for both attitudes and behaviors, two questionnaires are required."(1) The authors attribute the higher correlations between attitudes and behaviors observed when a single questionnaire is used to a "retrieval" effect, whereby "a response to a question is likely to be retrieved as a basis for a subsequent response." It seems that an alternative conclusion needs to be evaluated before survey researchers double their budgets and the burdens they place on surveyed populations. Although not stated in the paper, at least several days (and possibly several weeks) passed between the dates respondents completed the two questionnaires. Even if respondents had been asked the identical questions both times, the correlations to the same items answered at different times would have been less than 1.0. Hence, it should not be surprising that the correlations between related questions answered at different times would be lower than correlations between related questions asked at a single sitting even if respondents did not consult.