The precautionary principle

The reactionary principle: inaction for public health

David Kriebel

Commentary on the editorial by Martuzzi (see page 569)

Martuzzi's commentary on the precautionary principle is welcome and timely.[1] I will make a few largely supportive comments while perhaps anticipating and addressing some concerns that readers may have.

The 1998 Wingspread consensus statement characterised the precautionary principle this way: ''when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically''.[2] The statement went on to list four central components of the precautionary principle:

1. taking preventive action in the face of uncertainty;
2. shifting the burden of proof to the proponents of an activity;
3. exploring a wide range of alternatives to possibly harmful actions; and
4. increasing public participation in decision-making.

A skeptical reader may ask: isn't this just a fancy new name for what any responsible public health scientist has always done?

On the contrary, precaution brings important new insights into occupational and environmental health policy and the science which informs it. To illustrate this, it may be useful to give a name to the policy framework in which occupational and environmental health research *currently* operates: it is the reactionary principle.[3] Under this system, anyone is free to introduce a new hazard into the environment, and governments must wait until an overwhelming body of evidence is accumulated before intervening. Each new regulatory action is challenged with the objective of slowing down or stopping public oversight of production and distribution of chemicals and technologies. We can see reactionary principle *inaction* in the unconscionable delays in regulating a long list of hazards whose risks were clear long before effective actions were taken to control them: asbestos, benzene, dioxins and PCBs.[4] While these are ''old'' hazards, a reactionary approach is evident as well in many current controversies in our field, including the potential health risks from: hexavalent chromium,[5] artificial butter flavouring,[6] and the antimicrobial agent triclosan.[7]

The reactionary principle operates through these key components (referring back to the list for precaution may be useful):

1. requiring incontrovertible evidence of harm for each hazard before taking preventive action;
2. placing the burden on the public (or government agencies) to show that each chemical, material or technology is harmful;
3. not considering potential health and environmental impacts when designing new materials and technologies; and
4. discouraging public participation in decision-making about control of hazards and introduction of new technologies.

Perhaps framing the status quo this way helps the reader to see the kinds of changes in the science/policy interface which Martuzzi and others are advocating.

What can be done to shift from reaction to precaution? One important step would be to reduce the corrupting influence of economic interests on the evidentiary base of environmental health regulation.[8] Recent evidence documents how some corporations seek to impede regulation through the intentional manufacturing of uncertainty about the hazardousness of their products.[9] Clearly, removing conflicts of interest and intentional manipulation of data would make it easier to act in a more precautionary way. But there is more that we can do as responsible public health scientists.[10] I will mention two examples.

Causal inference is a critical step in the recognition and control of hazards, and epidemiologists play an important role. We are taught to distinguish causation from correlation using guidelines like those of Bradford Hill.[11] A precautionary approach would emphasise that this judgement is not purely scientific; our public health responsibility requires that we ask ''when do we know enough to act *as if* something is causal?'' This will depend not only on the strength of evidence but also on the availability of alternative ways of achieving the same social good (how essential are artificial butter flavour and antimicrobial socks?), and on the consequences of inaction or acting in error.

When we continue to study the same known hazards while thousands of widely dispersed chemicals remain without basic toxicology, we may inadvertently be promoting inaction by implying that more must be learned before action can be taken. To avoid this, environmental and occupational health scientists can learn from colleagues in climate science. There is now a (nearly) global consensus that human impact on climate is likely to have serious negative consequences.[12] Climate scientists have managed to communicate an important yet complex message: much more needs to be learned about climate AND we know enough that we cannot remain silent about the need for action. These scientists have stepped out of their roles as data gatherers and analysts, and spoken publicly about the need for action.

While striving to do the best science possible, we should be aware of the potential impact of our research and of our social responsibility to do science that protects human health and the environment. The precautionary principle is useful in focusing attention on the need for this balance.

ACKNOWLEDGEMENT

I am grateful to Margaret Quinn and Joel Tickner for comments and suggestions.

Occup Environ Med 2007;**64**:573–574.
doi: 10.1136/oem.2006.031864

Correspondence to: Dr D Kriebel, School of Health and Environment, University of Massachusetts, 1 University Avenue, Lowell, MA 01854, USA; david_kriebel@uml.edu

Competing interests: None.

REFERENCES

1 **Martuzzi M**. The precautionary principle: in action for public health. *Occup Environ Med* 2007;**64**:569–70.
2 Raffensperger C, Tickner J, eds. *Protecting public health and the environment: implementing the precautionary principle*. Washington, DC: Island Press, 1999.
3 **Kriebel D**, Tickner J. Reenergizing public health through precaution. *Am J Public Health* 2001;**91**:1351–5.
4 **European Environment Agency**. *Late lessons from early warnings: the precautionary principle 1896–2000*. Copenhagen: European Environment Agency, 2001. Available at http://reports.eea.europa.eu/environmental_issue_report_2001_22/en (accessed January 2007).
5 **Michaels D**, Monforton C, Lurie P. Selected science: an industry campaign to undermine an OSHA hexavalent chromium standard. *Environ Health* 2006;**5**:5.
6 **Kreiss K**, Gomaa A, Kullman G, *et al*. Clinical bronchiolitis obliterans in workers at a microwave-popcorn plant. *N Engl J Med* 2002;**347**:330–8.
7 **Adolfsson-Erici M**, Pettersson M, Parkkonen J, *et al*. Triclosan, a commonly used bactericide found in human milk and in the aquatic environment in Sweden. *Chemosphere* 2002;**46**:1485–9.
8 **Clapp R**, Hoppin P, Kriebel D. Erosion of the integrity of public health science in the USA. *Occup Environ Med* 2006;**63**:367–68.
9 **Michaels D**. Doubt is their product, industry groups are fighting government regulation by fomenting scientific uncertainty. *Sci Am* 2005;**29**:96–101.
10 **Kriebel D**, Tickner J, Epstein P, *et al*. The precautionary principle in environmental science. *Environ Health Perspect* 2001;**109**:871–6.

11 **Bradford Hill A**. The environment and disease: association or causation? *Proc R Soc Med* 1965;**58**:295–300.

12 **Houghton JT**, Ding Y, Griggs DJ, *et al*, eds. *Climate change 2001: The scientific basis*. Published for the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press, 2001. Avaiable at http://www.ipcc.ch/index.html (accessed January 2007).

The precautionary principle

The precautionary principle in the context of multiple risks

L Rushton

Commentary on the editorial by Martuzzi (see page 569)

The precautionary principle plays a central role in the world of risk assessment and risk management. Two common but seemingly opposing approaches are: proactively regulate risks and endorse the precautionary principle, that is, better safe than sorry;[1] wait for evidence of actual harm before regulation. The latter view would not be shared by those who favour risk avoidance.[2] In this issue, Martuzzi makes a plea for the use of both caution and common sense and highlights the changing definitions of the precautionary principle.[3]

Wiener[4] defines three basic interpretations of the precautionary principle:

1. uncertainty does not justify inaction;
2. uncertain risk justifies action;
3. shifting the burden of proof.

The UK Interdepartmental Liaison Group on Risk Assessment (ILGRA) addresses the first by defining the purpose of the precautionary principle as creation of an impetus to take decisions, notwithstanding scientific uncertainty about the nature and extent of the risk—that is, to avoid ''paralysis by analysis''.[2] The second interpretation goes further and calls for proactive precautionary measures while the third is stricter still by implying a shift of the burden of proof away from the regulator to the hazard creator.

In practice the approach chosen may vary depending on the context and the circumstances. Common sense requires acknowledgement that all activities invoke some risk. We accept the need to walk across a road even though there is an uncertain chance of injury. How seriously an outcome is taken, whether it be to health or the environment, depends on how it is valued in the context of other risks. A fatality caused by a familiar hazard such as driving may be viewed as more ''tolerable'' than a fatality caused by an unfamiliar hazard such hazardous waste.[5]

All the various definitions and interpretations of the precautionary principle demand an understanding of the need to balance false negatives and false positives and a decision as to which we should try hardest to avoid. Many precautionary regulations err on the side of preventing false negatives but run the risk of generating false positives. Hrudey and Leiss show that in the area of risk management this approach may encounter a dominance of false positives.[6] This can generate complacency. For example, we may expect to have a large proportion of false positives for any single practical screening procedure. Positive tests for microbial indicators may not signal the presence of an infective dose of viable pathogens making an outbreak imminent unless there is other evidence of contamination.[7] Knowledge of this may lead risk managers to ignore adverse monitoring results. Hrudey and Leiss warn against the ''overzealous search for absolute elimination of false-negative errors in a futile search for zero risk''. In the area of children's environmental health countries such as Sweden and Denmark have developed strategies and goals for the reduction of exposures to hazardous substances, particularly toxic chemicals, with the objective of achieving a ''non-toxic environment''. However, the potential economic consequences of these moves and the effort and time required to effect reduction have also been acknowledged.[8]

Banning or restriction of a substance or activity that later turns out to be benign or less hazardous than initially thought may itself be the cause of health or environmental damage. For example, banning genetic engineering may prevent the potential reduction of the use of chemicals, and the use of substitute substances may pose different risks, and exaggerated warnings may cause panic and later cynicism among the public.[9] Reducing a target risk can also increase another risk—for example, cleaning up hazardous waste protects the public but may put workers at risk.[10]

Wiener suggests that the main shortcoming of the precautionary principle is that it does not address the interconnectedness of multiple risks and neglects the trade-offs between them.[4] In so doing it ignores the adverse health and environmental effects of the precautionary measures themselves.[1 9] This does not mean that we should abandon regulatory intervention but we need to acknowledge that this can lead to a range of consequences. The overall goal of risk assessment and management should thus be to confront the trade-offs between target risks and countervailing risks and focus on developing the scientific methodology to minimise overall risk. This requires acceptance of a blurring of the line between risk assessment, the primary aim of expert scientific committees in countries such as the UK, and risk management. Martuzzi calls for more and better science. In addition as Wiener suggests we need a principle of ''optimal precaution'' and we need to develop ways to make precautionary regulation itself ''safer''.

Occup Environ Med 2007;**64**:574.
doi: 10.1136/oem.2006.031856

Correspondence to: Dr L Rushton, Imperial College London, Department of Epidemiology and Public Health, Faculty of Medicine, Room UG40, St Mary's Campus, Norfolk Place, London W1 2PG, UK; l.rushton@imperial.ac.uk

Competing interests: None declared.

REFERENCES

1 **Margolis H**. Dealing with risk: why the public and the experts disagree on environmental issues. University of Chicago Press, Chicago, USA, 1996.
2 **Interdepartmental Liaison Group on Risk Assessment**. *The precautionary principle: policy and application*, Available at http://www.hse.gov.uk/aboutus/meetings/ilgra/pppa.htm (accessed 12 July 2007).
3 **Martuzzi M**. The precautionary principle: in action for public health. *Occup Environ Med* 2007;**64**:569–70.
4 **Wiener JD**. Precaution in a multirisk world. In: Paustenbach P, ed. *Human and ecological risk assessment: theory and practice*. New York: John Wiley and Sons, 2002.
5 **Slovic P**. Perceptions of risk. *Science* 1987;**236**:280.
6 **Hrudey SE**, Leiss W. Rusk management and precaution: insights on the cautious use of evidence. *Environ Health Perspect* 2003;**111**:1577–81.
7 **Nwachuku N**, Craun GF, Calderon RL. How effective is the TCR in assessing outbreak vulnerability? *J Am Water Works Assoc* 2002;**94**:88–96.
8 **Tickner JA**, Hoppin P. Children's environmental health: a case study in implementing the precautionary principle. *Int J Occup Environ Health* 2000;**6**:281–8.
9 **Wiener JB**. Managing the iatrogenic risks of risk management. *Risk Environ Health Safety* 1998;**9**:39–84.
10 Graham JD, Wiener JB, eds. *Risk vs risk:tradeoffs in protecting health and the environment*. Cambridge MA: Harvard University Press, 1995.