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.

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The precautionary principle: in action for public health

Marco Martuzzi

Better health, better environment, better science: better use the precautionary principle

Article 174 of the Amsterdam Treaty of the European Union says "Community policy on the environment [...] shall be based on the precautionary principle". European law, at its highest level, is explicit and uncompromising. As promotion and protection of human health is one of the key motivations of environmental preservation, the provision of the Treaty is good news for public health too. In fact the importance and relevance of the precautionary principle in the health domain has been attracting growing interest.[1] Ministers of health, together with ministers of environment of the Member States in the World Health Organization (WHO) European Region (52 of them in 2004) declared: "We reaffirm the importance of the precautionary principle as a risk management tool, and we therefore recommend that it should be applied [...]".[2] These are only two of many acts or laws where the precautionary principle is referred to. So what is this principle and why is it important for public health as well as the environment?

Born in the environmental domain in the 1970s, the precautionary principle gained political profile in the 1980s and 1990s, and has attracted the attention of many involved in matters of environmental protection.[3] Despite its resonance, there is no unanimously agreed definition of the principle. Quite simply, it is usually taken to state that lack of scientific certainty must not be used as a reason to ignore or postpone preventive or remedial action when there are other good reasons to do so, as has happened many times in the past.[4] The prescription to err on the side of caution, the "better safe than sorry" approach, may seem little more than common sense. Indeed it is implied by the principles of clinical medicine, in particular by the principle of non-maleficence, more familiar to the public health profession. The concept of precaution is deeply rooted in the history of public health, and environmental health is no exception. Several established risk factors, such as air, water and soil contaminants, are known for their adverse effects on human health. The best strategy for dealing with these is prevention, and some prudence in, for example, setting protection standards, as when safe levels are divided by factors of 10 or more to allow for possible inaccuracy in risk estimates. But this is not the crucial area of application of the precautionary principle. Prevention applies to known causes; precaution, strictly speaking, is more relevant for uncertain determinants, complex scenarios, suspected risk factors, unpredictable circumstances.

Caution may be common sense, but such common sense seems to be badly needed, and in big supply, at times when we are faced with increasing complexity and uncertainty, when potential health threats can be far-reaching and irreversible; when technological development and societal organisation evolve fast enough to outpace, in numerous cases, the accumulation of data, knowledge and evidence; when the adverse consequences of policies may be felt at great distances, or by future generations. In areas such as climate change, chemical safety, genetically modified organisms and nanotechnologies, to mention just a few, the potential for health damage is great. The deterioration or loss of life support systems, the persistence of ubiquitous endocrine-disrupting chemicals, the cross-breeding of genetically modified species, the introduction of nanoparticles in human tissues, for example, may be harmful to health through direct but also indirect effects; some of these effects can be difficult to detect and measure, but with serious consequences, perhaps borne by the most vulnerable, or elsewhere, or tomorrow. Pointing out that many of us live longer and better than never before is of limited relevance: we are highly uncertain of what scenarios we might be facing, and we do not know how likely different outcomes are; furthermore, we do not know what these outcomes might be at all. Often, we do not know what we do not know.

The precautionary principle, however, is not only about uncertainty, ignorance and caution, but also about policy and action. Applying precaution does not result in systematically rejecting new technologies or in a "zero tolerance" attitude. On the contrary, despite the lack of a universally accepted definition, several implications on how to exercise precaution while dealing with uncertainty emerge in several formulations of the precautionary principle and can be seen as its distinctive elements: (1) the principle suggests to adjust the balance of burden of proof from the need to prove that agents or technologies are harmful before they are removed or controlled (an onus usually borne by recipients) to the duty (for the proponents or beneficiaries) to demonstrate that they can be used safely; (2) it stresses the fundamental importance of participation, openness and transparency in decision making under uncertainty, recognising that participatory models of decision-making are an almost inevitable response to high uncertainty and complexity; (3) it recommends that, when faced with a possible threat, alternative courses of action should be considered and explored, preferably before arriving at the awkward evaluation of acceptable levels of risks, where one might have, for example, to assign monetary values to life and death. After all, the precautionary principle was born as the German *Vorsorgeprinzip*—that is, the "foresight" principle, a more positive concept than precaution, which emphasises a proactive, anticipatory, imaginative attitude according to which preventing or bypassing exposures and possible adverse effects is preferable to mitigating them or analysing whether they are worth the benefits.

What about scientific evidence? Science has a central role to play to achieve these goals, especially when used critically. Invoking the use of sound science to support decisions is ambiguous: "evidence-based" policy, meant to imply "evidence-determined" decisions, is not a realistic option in modern governance.[5] The direct translation of evidence into wise decisions is, in fact, fraught with difficulties. First, defining and framing the policy question is a social process, not an expert task. Second, the same evidence can have different implications depending on the underlying ethical viewpoint, especially when a utilitarian framework clashes with a deontological one.[6] Third, evidence on the problem may be solid and abundant, while evidence on the solutions (costs and acceptability of policies, for example) may be scant. Fourth, the expert-driven process of identifying optimal decisions in the light of available knowledge is vulnerable to manipulation by vested interests. And so on.

Rather than determining univocally the preferable course of action, available evi-

dence and scientific reasoning must be part of the deliberative process, perhaps on par with the other interests and values at play. The literature on the precautionary principle has paid considerable attention to these questions.[7] For a start, the assumptions and limitations of science must be realised and made explicit. For example, epidemiological enquiry following the Popperian scheme of hypothesis generation and testing typically has high specificity and low sensitivity—that is, false positives are penalised more heavily than false negatives.[8] As taught in textbooks, the recurrent snags of epidemiological studies, such as measurement error, exposure misclassification and many forms of bias, push risk estimates towards the null more often that the other way around; complex questions on broad health determinants are broken down into workable operational research goals—an often necessary reductionist strategy that makes it difficult to recompose the full picture. These intrinsic characteristics, per se, are not a good reason for rejecting the current scientific paradigm (in the Kuhnian sense), if only because a new paradigm has yet to be articulated. Nonetheless, enhanced methods are needed for knowing, describing and dealing with uncertainty. Innovative tools are desirable for more comprehensive risk assessment and comparison of alternatives, for studying upstream health determinants, multi-causality, complex systems. Thus, precaution requires more and better science. As precaution can also stimulate technological innovation and create new markets through the development and production of cleaner alternatives, the precautionary principle is best seen as an overarching concept,[9 10] which "has relevance to the whole risk assessment, management and communication process", as declared by European Ministers in the 4th Ministerial Conference on Environment and Health.[2]

The debate on these themes is instructive, sometime controversial, but fascinating, and has been instrumental for reflecting critically about public health, its environmental determinants, the relevance of scientific evidence and its use in decision-making—generally speaking, about science and society. We hope that the debate continues and involves more people engaged in public health.[11]

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