

Applying precaution to environmental health issues at the local level: A proposed guide based on the research and experiences of Toronto Public Health

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Abstract: While the Precautionary Principle (PP) is an important policy innovation relevant to public health, practitioners do not agree on how or when it should be applied. Action on environmental health issues at Toronto Public Health (TPH) has clearly been informed by the PP. We have recently developed a guide to applying precaution that can be used to assist local public health practitioners in decision making to address environmental health hazards in the community. We applied the Guide retrospectively to TPH case examples involving education, program, policy, legislative, and advocacy interventions to manage exposures to environmental hazards. This exercise served to refine the Guide and increase our understanding of how and when TPH has applied precaution in the past. Our Guide promises to be a useful decision making support tool that will help users (1) assess what degree of precaution is appropriate for a given context; (2) systematically document evidence about harms and exposures (including uncertainties) while making the assumptions about evidence more explicit and transparent; (3) highlight potential trade-offs (including consideration of both risks and benefits), explore alternatives, and assess feasibility of interventions; (4) plan adequate communication and stakeholder engagement; and (5) institute monitoring and evaluation so as to ensure interventions still meet users' needs. We see the Guide as a tool that deepens the process of learning and enquiry on issue management in environmental health practice. We urge others to share their applications of the PP using our Guide to promote mutual learning.

Key words: environmental policy, environmental exposure, environmental impacts, decision support systems, risk management, local government.

Introduction

Responding to emerging threats to the public's health is part of the core business of environmental health teams in Canada. For Ontario health units, health hazard prevention and management is guided by the Environmental Health Standard and the relevant Protocol (Ontario Minister of Health and Long-Term Care 2008). The protocol proposes application of risk assessment to identify and determine responses to health

hazards and is consistent with Health Canada's (2000) decision making framework for identifying, assessing, and managing health risks. Unlike the topics covered in other protocols, which fall under the Environmental Health Standard (i.e., beach management, drinking water, and food safety), the health hazard prevention approach is broad and leaves some discretion for decision making. Notably absent from the protocol is the mention of how to proceed when evidence is uncertain.

The Precautionary Principle (PP) is described as an ethical approach or philosophy for decision making and taking action on threats to health or to the environment when evidence is uncertain or incomplete (Fisher et al. 2006). The PP has been a

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source of guidance that some local authorities have drawn upon when needing to address emergent environmental hazards in the community. It is increasingly cited or invoked when public health policy decisions must be made in situations of uncertainty. Health Canada's (2000) decision making framework, noted above, explicitly identifies use of a "precautionary approach" as key to manage uncertain health risks. It identifies the concept as pervasive, i.e., influential throughout decision making in the context of scientific uncertainty. Ongoing debate about exactly when and specifically *how* to use the PP in the context of environmental health issues poses implementation challenges for local public health decision-makers.

Objective

In this paper, we describe the development of a guide for applying precaution at Toronto Public Health (TPH). Our objective is to share this guide with fellow Canadian practitioners and colleagues (i.e., local public health teams responsible for environmental health promotion, protection, and response) for use in their own settings. We also hope to elicit feedback and discussion on the practical challenges and lessons from applying precaution in practice.

The Precautionary Principle — definitions and challenges

There are many formal and legal definitions of the PP, each varying in its specific elements, emphasis, constraints, and intended audience (Beloin 2008). Commonly cited definitions of the PP include Principle 15 of the Declaration of the Rio Conference on Environment and Development (United Nations 1992) and the 1998 Wingspread Statement. Echoing the Rio Conference definition, the City of Toronto 2000 Environmental Plan notes that "where there are concerns about serious harm to human or environmental health, the lack of full scientific certainty shall not be used as a reason to postpone cost-effective, preventive measures" (City of Toronto 2000, p. 19) in its description of a precautionary approach.

Essentially, the PP urges acting despite uncertainty, when there are reasonable indications to do so (Beloin 2008). The focus of the PP is on avoiding risk or reducing hazards at the outset of a project or activity by assessing alternatives, along with stakeholders, evolving to complement and broaden traditional risk assessment techniques (Tickner and Raffensberger 1998). The PP effectively changes the way in which evidence is assessed and uncertainties are treated.

Experts acknowledge that precaution has long been at the heart of and consistent with traditional public health practice (Tickner 2002; Pearce 2004; Grandjean 2004). Calls for a greater role of the PP in public health action and decision making have come from official reviews reflecting on recent Canadian public health crises (e.g., see Krever 1997; Campbell 2006). The how and when of applying the PP has

since become the subject of discussion and attention by the public health community (alPHA 2007; Weir et al. 2010). Some are doubtful that precise formulations for the PP are possible, given how dependent on "cultural values and references" are many of its concepts or possible action thresholds (Beloin 2008, p. 11). For example, it is difficult to imagine agreement on how to define concepts such as "unacceptable damage" or "serious harm" (United Nations 1992; Weir et al. 2010), as these would understandably be influenced by local experience.

The Government of Canada Privy Council and others therefore have noted the need for flexibility in applying precaution (Government of Canada 2003; Goldstein 2007; Cameron 2006; Beloin 2008; Stirling and Tickner 2004) and have oriented their approaches around general principles, while at the same time providing guidelines to assist decision-makers (e.g., see Tickner and Raffensberger 1998; Stirling and Tickner 2004; Commission of the European Communities 2000). Most recently, a framework of guiding questions was suggested by public health practitioners (Weir et al. 2010). While each of these frameworks or guidelines highlights what are core criteria in precautionary decision making, none goes far enough in addressing the challenges faced by local public health when dealing with emergent, unfamiliar, challenging, or contentious environmental health hazards.

What is applying precaution at the local level?

In its 2003 Framework document, the Canadian government uses the terms PP, applying precaution, or precautionary approach interchangeably, making no distinctions among these concepts. We and others, however, see that the legal connotations of the PP, and its identity more as an environmental policy lever used in international and national arenas, present challenges to operationalizing the PP per se at a local level. The notion of "applying precaution" or taking "a precautionary approach" is seen by others to be a more flexible formulation, one that acknowledges the different capabilities of local authorities. Local environmental health practitioners in Canada often deal with site-specific concerns related to soil contamination, noise and other physical agents, and environmental releases and potential exposures. Although guidance on managing environmental health issues based on new or uncertain information may be forthcoming from national and (or) international or provincial authorities, in many cases it may lag behind the evidence or be missing altogether. There may be times when the approaches or standards of higher jurisdictions are not considered adequate to protect health, especially when community values or expectations require different solutions. Exploring the needs of the impacted community and the potential for health benefits associated with the behaviour or activity are also important considerations in understanding how to approach an issue.

Rationale and process for development of the TPH guide

TPH teams that deal with environmental health assessment and policy and environmental response have been informed by the PP to guide policy, programs, and practice in varying situations: when a need to investigate the health impacts associated with a major City undertaking arises or is mandated (e.g., by the Board of Health); when the Medical Officer of Health must respond to environmental health concerns, including site-specific issues that are raised by the public, colleagues, community partners, elected officials, or by other government agencies; when new health concerns arise from our own monitoring of information or from work with community partners or other levels of government.

Similar to other health units, TPH applies precaution as a matter of course in its decision making, rather than applying the PP explicitly as a guiding principle. We understand the notion of “applying precaution” to involve public decision making where there is potential environmentally related health harm and a need to take measures to prevent that harm in the face of the scientific uncertainty. The uncertainty can be related to either the nature of the causal relationship between environmental agent and harms or to the likelihood of human exposure to the agent. In reflecting on our practice, in 2009, we began to explore coherent, explicit, and transparent ways to ensure that we were being comprehensive and consistent. To begin, we reviewed existing literature to inform development of our Guide to Applying Precaution. From a review of relevant publications and existing guides, we outlined common criteria and developed a draft suite of questions that can appropriately guide a precautionary approach to our issues. (Details of the methodology and approach can be provided on request by contacting the authors.)

In refining the Guide, we reflected upon how precaution had already guided and influenced decisions on environmental health issues at TPH. We selected cases in which TPH had intuitively used a precautionary approach in the past to uncover the factors that influenced the assessment of risk and selection of the most appropriate response. We applied the draft Guide to eight case studies, which varied in terms of the issue, state of uncertainty, and type of action or intervention taken (see Table 1). We documented our responses to the Guide questions and also rated each question’s importance in applying precaution in each case study. This information helped to identify which questions consistently were most (or least) relevant in our experience and highlighted additional needed questions. In-depth analysis and discussion of five of the case studies and additional literature review informed the current version of the Guide.

The final Guide presents a set of questions organized into five domains: Context, Assessment of Harms and Exposure, Exploration of Alternative Interventions, Implementation, and Monitoring and Evaluation. Each domain explores aspects of applying precaution that are commonly found in existing frameworks or approaches (see Table 2). The questions provide a way to systematically document what is known about the

issue at hand, while making assumptions or judgements explicit and hence transparent to others.

Learnings from case study analyses

Our analyses of the case studies identified that context, and specifically how an issue came to our attention, was uniformly a very important factor influencing our precautionary decision making. Context played out differently, however, depending on the details of the issue. For example, public concern was an important driver in restricting lawn care pesticide use and location of cell phone towers in Toronto. Media attention played a large role in the CCA-wood play-structure issue, whereas concerns raised by City councillors prompted attention and action on EMFs in power corridors and RFs from cell phone towers. Proactive attention to an issue arising from research or community health needs was important context for TPH advocacy for a more protective national health-based air quality warning system (AQHI) and development of a guide to consume fish that considered fish benefits.

Under the Assessment domain, the greater uncertainty around chronic, low-dose exposures and vulnerability of specific subgroups (including children) was common in most of the case studies. The lack of high-quality evidence on either causation of harms or extent of exposure was also common in our case study examples, and not unexpected given that this is the situation when the PP is most typically applied. This explains why we feel it would be inappropriate to base precautionary guidance on strict application of Bradford-Hill criteria, as some authors have suggested (Weir et al. 2010). For familiar and well-understood toxicants (e.g., mercury in fish or arsenic in play structures), uncertainty was less around harms but more about exposure in these different contexts — i.e., high fish-consuming groups and young children touching play structure surfaces. Also common was the observation that our view of the inadequacy of existing policy measures from other levels of government had prompted precautionary actions by TPH to better protect health, while also considering the diverse and unique needs of people in our community (e.g., fish consumption advice, AQHI, pesticides bylaw, and WNV mosquito control approaches).

The Exploration of Alternative Interventions domain revealed that we had both formally and informally identified and explored a range of options available to address a given issue. In this section, consideration of proportionality was important in several of the case studies. For example, given the uncertainty in the harm assessment for EMFs and RFs, we put in place policies of “prudent avoidance”, a form of the PP that promotes “no or low cost” feasible actions being taken to minimize exposure when possible. Including consideration of the potential health benefits of the issue is also important in assessing alternatives, such as when we developed detailed advice on fish consumption.

The Implementation domain highlighted the importance of explicitly and carefully documenting the chosen action and what it entails. This section also helped us identify the

Table 1. Toronto Public Health Case Studies of Applying Precaution.

Issue	Description	Intervention type	What was precautionary about our actions?	Status/comments
Electromagnetic fields (EMFs) prudent avoidance policy (power lines)	City Council policy affecting new beneficial uses in power corridors. Also affects new development adjacent to power corridors. Requires proponents to assess EMF levels and submit an EMF management plan that ensures average annual EMF exposures to children are minimized.	Policy	TPH developed the policy in the absence of federal or provincial guidelines for addressing health concerns from EMFs. Requests precaution used in siting new facilities and structures.	Origins in former City of Toronto policy from 1993. Council approved new policy in 2008. Ongoing.
Radiofrequencies (RFs) prudent avoidance policy (cell towers)	City Council policy governing the siting of new cell phone towers (free standing antennas at ground level or large ones on top of buildings).	Policy	This City policy encourages RF levels to be < 1% of the federal standard (Safety Code 6). Uncertainty about health impacts of long-term, low-level exposure to RFs prompted proposal to reduce exposure by using an added factor of protection, an approach that is consistent with the standard setting practices for chemical substances.	Originally endorsed by Board of Health in 1999. New policy approved by Council in 2008. Ongoing.
Air quality health index (AQHI)	We advocated for a national health effects warning system that would accurately convey the health burden associated with air pollution. TPH cited research indicating that a major proportion of premature deaths and hospitalizations were occurring in Toronto when air quality was deemed to be "good" according to the Ontario Air Quality Index	Advocacy	Proposed intervention to provide accurate health-based air quality information so that people might minimize personal exposure by adjusting behaviour. AQHI provides users with a more realistic understanding of health risk as air pollution levels change.	Advocacy began in 2000 to 2001 (ongoing) Toronto AQHI pilot.
West Nile virus (WNV) mosquito control program	We applied a tiered mosquito control program to combat WNV that incorporated integrated pest management (IPM) approaches.	Program	Emphasis on preventive approaches with least negative impact on health and environment first (e.g., education, non-spray pesticide control, larviciding) and minimizing exposure to toxic pesticides like malathion recommended in Ministry of Health & Long-Term Care WNV protocol.	Protocol developed 2002–2003. Ongoing.
Chromated Copper arsenate (CCA) in wood playstructures	We assessed arsenic levels below and on all 217 wooden play structures in Toronto parks and at child care centres, using this information to develop a targeted mitigation strategy (e.g., accelerated removal of older priority structures, regular application of sealant and remediation of soil and sand under those with highest arsenic) and regular monitoring program.	Program	The mitigation strategy was developed in the absence of standards as to acceptable levels of arsenic on wood surfaces and no information regarding exposure levels for children.	Issue arose in 2001. Assessment and mitigation 2002–2006 (ongoing until older structures replaced).

Table 1 (continued).

Issue	Description	Intervention type	What was precautionary about our actions?	Status/comments
Pesticides bylaw	Development of a bylaw restricting pesticide applications on all public and private properties in the City of Toronto. Bylaw implementation focused on public education and phased in enforcement to motivate compliance, raise awareness, and support professionals and homeowners to adopt pesticide alternatives.	Legislation	Strong action taken to reduce unnecessary pesticide exposure despite federal and provincial authorities' assurances that existing legislation ensured adequate protection of health.	Bylaw approved in 2003; implemented 2004 to 2007. Superseded in 2009 by Ontario Pesticides Ban.
Fish consumption advice	In consultation with colleagues from other jurisdictions, we prepared advice and messages to women in childbearing years and for families eating fish to maximize benefits and minimize risks.	Education	Applied mercury and PCB toxicological reference points more health protective than that of Health Canada. Carefully considered risks in light of benefits and fish sustainability issues. Original precautionary messages of "no more than two fish meals per week" softened. Research and tailored outreach to address needs of high fish consumers.	Developed 2006–2008 (ongoing outreach and evaluation).
ChemTRAC program and bylaw	Environmental Reporting & Disclosure Bylaw and ChemTRAC program for City of Toronto address 23 priority substances of concern in Toronto's air. Mandated increased industry reporting and public disclosure will drive reductions in the use and release of toxic chemicals, improve public health, and support a green local economy.	Legislation	Assessment of priority substances of health concern in Toronto using health-based benchmarks from other jurisdictions. Took a community right to know perspective to air toxics management.	Approved in 2009. Enacted in 2010. Ongoing.

Table 2. Key domains and abbreviated questions from TPH's Guide to applying precaution.

<p>1. Understanding context</p> <p>Context How did the issue come to your attention?</p> <p>Drivers for decision making Is there public concern? Are there standards to be met? Who are known supporters and detractors? Financial gains or losses; for whom?</p> <p>2. Assessment</p> <p>Identifying harm What are the acute and chronic harms? What are the inter-generational impacts? How irreversible are the effects? Populations are most susceptible to harm?</p> <p>Uncertainty of harm Lines of evidence are available to assess harm? What assumptions are made about the evidence?</p> <p>Identifying exposure Exposure pathways? Populations are most exposed? Exposures voluntary, individually controlled?</p> <p>Uncertainty of exposure Lines of evidence available to assess exposure? What assumptions are made about the evidence?</p>	<p>3. Exploration of alternative interventions</p> <p>Alternatives for exposure and harm reduction How can exposure/harm be minimized or eliminated? Alternative public health interventions? Evidence of the effectiveness of alternatives?</p> <p>Feasibility of alternatives Political, technical, economic feasibility?</p> <p>Trade-offs What risks (if any) do these alternatives produce? Unintended consequences of these alternatives?</p> <p>Consistency Interventions consistent with existing measures for similar exposures?</p> <p>Proportionality Interventions proportionate to potential harms?</p> <p>Stakeholder views Efforts made to consult or involve stakeholders? Extent to which stakeholder views considered? Do alternatives empower affected populations?</p> <p>Equity Opportunities to reduce or prevent inequities?</p> <p>4. Implementation What interventions (if any) will be implemented? Plans communicated to the public and stakeholders?</p> <p>5. Monitoring and evaluation Frequency and intensity of monitoring? Who is accountable? How often will new evidence be assessed? Evaluating effectiveness of interventions? Feedback on monitoring given to stakeholders?</p>
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Note: Last updated September 2011; full Guide can be found at: http://www.toronto.ca/health/hphe/environmental_health/environmental.htm.

communication needs internally and with stakeholders and the public. We observed that in most cases, presenting this information at a Board of Health meeting was the typical route of engagement and communication with the public and others. However for bigger, more progressive initiatives, deliberate and specific communication strategies were deemed more important to support their success (e.g., pesticides bylaw and the ChemTRAC program).

Finally, documenting our activities under Monitoring and Evaluation revealed that there was a need to be more consistent in planning in these areas. Formal monitoring and evaluation was most often reserved for more contentious or complex issues (e.g., CCA-wood play structures, WNV mosquito control program) or for those where we took a more progressive policy intervention (e.g., pesticides bylaw and ChemTRAC program). We have also incorporated evaluation approaches as a means of testing effectiveness of interventions (e.g., research to assess reach to different groups with AQHI or fish messages), but also to assess the need for ongoing action (e.g., monitoring of arsenic levels plus review of ongoing science assisted us in scaling back the mitigation program for CCA-wood play structures after several years).

Why, when, and how to use the guide

Our experience with applying the Guide was that it provided an important structure to the decision making process. In particular, it allowed for a more systematic identification of the uncertainties, by unpacking the information on hazard and exposure. Pro-active use of our Guide should allow the user to highlight potential trade-offs (including consideration of both risks and benefits) and to explore alternative solutions to mediate those trade-offs. Using a predetermined template also allows for clearer documentation and review, as evidence evolves, as well as comparison across issues to ensure proportionality of responses. Our exercise of applying the guiding questions also supports a broader, more holistic framing of problems and supports a more thorough exploration of alternatives. We see the Guide as a tool that deepens the process of learning and enquiry on issue management in environmental health practice.

Unlike priority-setting tools used to proactively identify and establish broad priorities for public health action (e.g., see Alberta Health Services 2011), the Guide should be used to address emerging issues that reveal specific potential risks

to health. These issues are usually characterized by high community and stakeholder concerns that are not always aligned with each other or with the public health concerns that arise from emerging evidence. Public health attention to the former is understandably reactive, while in the latter it is proactive. In each case, evidence of effect or of exposure may be unstudied, weak, limited, inconsistent, or uncertain, or it may reveal disagreement among scientists. These suspected risks are often not among those traditionally dealt with by local public health teams. Jurisdiction to act on these threats may lie elsewhere or may be overlapping or dependent on the action of other levels of government. Nonetheless, because of local context, public health is asked to give an opinion and to take some action to address the potential threat for their particular community. The degree of precaution used and specific actions taken on the same issue may therefore vary between jurisdictions because of differences in context, stakeholder and institutional values, and available resources. The Guide is intended primarily for use at the municipal or local level, as it may be overly simplistic and not realistic as a tool for other levels of government.

The Guide will not answer the question of whether or not precaution is warranted. We agree with Beloin's (2008) conclusions that such decisions are highly dependent on values and judgement. Nor is the Guide a map or a "how to" for applying precaution; our review of the literature highlights that this is part of a reflective process. The questions help in documenting deliberations surrounding a complex environmental health issue and disclosing assumptions that underlie decisions. In that respect, as some have noted in reference to the PP itself, the Guide is more of a "compass" that assists in revealing possible ways forward on contentious public health challenges and clearly documenting thought processes and decision making (Scott 2004).

Conclusions

TPH's advocacy, education and outreach, and decision making regarding programs, practices, policy, and legislative responses have clearly been informed by the PP. The exercise of creating a Guide to Applying Precaution has proven valuable for highlighting the drivers and steps in our decision making on complex environmental health issues.

Our guide both builds on existing frameworks and extends them to incorporate important elements that are less explicitly dealt with elsewhere (e.g., evidence on the effectiveness of interventions). The guide would be appropriate for diverse local public health unit interventions and the complex processes for their development, with different questions being more important in different cases and contexts. In applying it, we discovered that some important considerations, such as monitoring and evaluation, were not consistently implemented across cases, but merit greater attention when applying precaution. We hope our Guide to Applying Precaution will help other local practitioners comprehensively assess uncertainties in evidence about risks and benefits of an activity, while exploring the feasibility of and evidence for innovative alternative measures. As our Guide is further applied, we think

it will merit additional feedback and refinement by public health colleagues when dealing with challenging environmental health issues.

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