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EVIDENCE-INFORMED DECISION MAKING

This backgrounder provides insight into the science process and its use in policy. It includes illustrative examples of how evidence-informed decision making could help the policy process by framing issues, facilitating solutions and evaluating the results.

EVIDENCE-INFORMED DECISION MAKING

What is it?

When making a decision, we often face a fundamental problem: We don't know what we don't know. To paraphrase either Tolstoy or the movie The Big Short - the real trouble starts when we think we know something for sure – but it just isn't so.[1]

That's where evidence helps. But what do we mean by evidence?

For those trained in science, social sciences research or engineering this means the best research evidence available at the time a decision must be made.

The Organisation for Economic Co-operation and Development (OECD) defines research evidence as "any investigation undertaken in order to acquire new knowledge based on planning and systematic inquiry" (OECD 2012).

Along with research evidence, policy makers also need to consult with industry, public interest groups and now, the voices of constituents that resonate through social media. Additionally, they need to consider their options and the costs associated with each.

Governments can collect considerable amounts of data through activities such as disease surveillance and environmental monitoring. While not considered research per se, this "related scientific activity" also provides substantial forms of evidence to inform policy decisions.

WHAT IS RESEARCH EVIDENCE?

Where does it come from?

Research evidence is knowledge generated by scientists using an approach originating in the 16th century. Using what is known as the Scientific Method, scientists try to find consistent and reproducible ways of reviewing, testing and solving problems.[2] This involves first making an observation or asking a question, then designing an experiment to test assumptions and finally replicating important findings through multiple studies by different groups. This is the foundation of innovation: answering questions and examining the unexpected. Today, research often occurs in a global collaborative group. For example, the Cochrane Collaboration is an independent international network of researchers, patients and professionals from many different disciplines who are interested in health. Their systematic reviews on health issues are used to guide informed decision making.[3]

HOW DO YOU EVALUATE EVIDENCE?

The measure of good science is that it is unbiased, transparent and repeatable. Society attempts to get around the problem of bias in scientific research by funding and encouraging competing voices and external challenge, promoting innovation. Evidence is gathered. The study is sent for publication where it is "peer reviewed" or scrutinized by at least two subject matter experts who can recommend rejection, or ask for revisions or for more research before publication. This is the scientific way of performing "due diligence" as one would do in the business world.

COMMON PITFALLS:

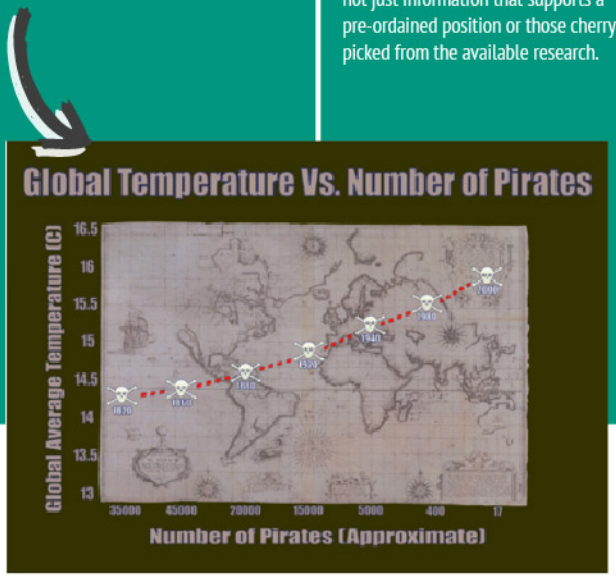
We deal with uncertainty every day. We don't know for certain how long we will live or what the stock market will do. When it comes to answers for health and safety concerns or big issues like climate change, people want a high degree of certainty from politicians and scientists. But science is represented in probabilities, and not absolutes. Scientific uncertainty is sometimes exploited to delay policy decisions; climate change and smoking are particular examples. Dealing with uncertainty remains a challenge for policy makers. Uncertainty can propel the research agenda when a pressing need for information arises.

Faced with uncertainty in daily life, we manage. The best decision making, in policy as in life, takes into account the circumstances and the most reliable evidence available, considers the options, risks and benefits and then acts accordingly.

People can often see a risk as greater or smaller than it actually is.
Train travel is relatively safe per passenger mile but news reports of a series of derailments can cause people to take to the highways, a much riskier means of travel when it comes to fatalities.
Research shows that the public can have a differing view of a health risk than health experts like doctors and researchers. Take natural health products (NHPs): experts see them as a higher risk than prescribed drugs and chemicals, the public may take the reverse position. This may be the result of where each group gets its information. The public tend to use media whereas experts may rely more on academic colleagues and journals.[4]

A risk is perceived as greater if it is involuntary not voluntary; if it affects pregnant women or children; if the cause is unknown; if leaders are seen to be concealing facts or if scientists are baffled. Risk, it seems, can be associated with uncertainty. In scientific terms, the hazard is the element that can cause harm, risk is calculated by the chance that it will. Risk communication evidence can show how to respect and respond to perceived and real risks.

Just because two effects are observed together doesn't mean one is the cause of the other.
For example the average global temperature rose from 1820 to 2000. This rise coincides with the decline of pirates at sea. Therefore it must be that pirates prevent global warming – hardly![5]



Social science shows that we come to an issue bringing our own set of values and perspective. Cultural norms frequently reflect and reinforce our own experience. The information derived from well-executed research can help minimize bias, as can an understanding of our own pre-conceived ideas. The best decisions are not made to support one's own experience, the consensus of colleagues, anecdotes, expert opinion or even journal articles. Decisions should be based on a systematic review of all quality evidence, not just information that supports a pre-ordained position or those cherry picked from the available research.

WHAT SCIENTIFIC EVIDENCE CAN DO FOR POLICY

The more robust the evidence, the greater its chances of forming a basis for policy.[6]
Better decisions result from working with information from the life sciences, social sciences and engineering. This process can identify problems and possible solutions complete with their strengths and weaknesses. In the political sphere the economic, social and environmental costs of policy actions must also be considered, but even these should be informed by evidence, not just expert opinion. Evidence provides a means to evaluate those choices and move the best one into position as policy. When the policy is in place, research evidence can be used to assess its impact. For example, the Ontario Institute for Studies in Education examined the outcome of full-day kindergarten, a controversial policy in Ontario when implemented in 2010. Compared with half-day kindergarten the research showed that the full-day program was helping better prepare children for school and facilitated parents' ability to work (Pelletier OISE).[7]

THE STEP-BY-STEP APPROACH TO EVIDENCE-INFORMED POLICY

1. Formulate a clear question that can be answered from an evaluation of the literature (not too broad; not too specific).
2. Track down all the relevant knowledge (use pre-defined inclusion/ exclusion criteria).
3. Evaluate the quality of the evidence
4. Commission additional research as necessary
5. Draw a conclusion and make recommendations

ENGAGING THE STAKEHOLDERS AND THE COMMUNITY - THE BERGER INQUIRY

The Berger Inquiry produced over 40,000 pages of text and evidence, but became a landmark in Canadian policy history that laid the groundwork for future environmental assessment processes.[10] In 1974 a gas pipeline was proposed that would run from Alaska to Alberta, crossing the Northern Yukon and the Mackenzie River Valley of the Northwest Territories. Justice Thomas Berger was appointed to lead a Royal Commission to investigate the pipeline's social, environmental, and economic impact.[11] Researchers from industry, government and environmental groups presented a wealth of environmental and technical studies and economic analysis. Detailed studies on the technical challenges of permafrost, the spawning grounds of fish and the movement of caribou were presented. The interpretations of results were often conflicting- shown through the lens of competing priorities and interests, and because the science was sometimes incomplete. However, it was the range of stakeholder involvement, particularly the engagement of 35 northern communities, and the decision to hear evidence from residents in their own languages that made the Berger Inquiry a ground- breaking approach to integrating Indigenous knowledge into resource management.[12]

Taking account of what you don't know (as well as what you do know) is an intrinsic part of science.

A FEW TIPS FOR EVALUATING EVIDENCE

NOT ALL STUDIES ARE EQUALLY STRONG

There are experimental, observational and systematic review studies but not all carry the same weight. The higher the quality of design, experimental measurement and analysis, the more reliable the data and the conclusions that can be drawn from them. Even well designed studies can sometimes yield results that imply different conclusions. There are ways to establish a consensus of what experimental evidence is telling us at any given time. Governments often use expert panels charged with providing a collective view of the evidence before making or changing policy.

SAMPLE SIZE COUNTS

A study result from 20 people doesn't hold the same value as one that enlisted 2000 people. Also, outcomes that apply to special places or groups may not apply universally. These same perspectives apply to studies in all areas of science. Although a small sample may be helpful in providing an incentive for a larger study, or as a proof of concept, it's normally not considered more than a starting point.

IS IT STATISTICALLY SIGNIFICANT?

Statistics are used to verify whether an effect or relationship could have occurred simply by chance, or whether it might have other origins. But, just like it is essential to use the correct experimental approach, it is just as important to use the right statistical approaches to analyze data. Otherwise you can get improper interpretation of data and experiments.

OBSERVING AND INVESTIGATING THE UNEXPECTED TO DEVELOP INNOVATIVE POLICY
INDOOR MOLD

During the first energy crisis in the mid-1970s, substantial investments were made to insulate existing buildings. Among other consequences, ventilation rates in buildings were reduced and complaints of poor indoor air quality rose. A Federal-Provincial Committee on Indoor Air Quality was created in 1981 to investigate. While developing the evidence-based guidelines for chemicals in indoor air, scientists observed increasing reports of visible mold.

At that time mold in buildings was considered simply an unsightly nuisance. However, Health Canada investigated this issue more carefully and in 1987 produced a landmark paper on potential health issues of indoor molds.

This led to a major study across Canada to assess mold and dampness in 15,000 homes and record the respiratory health of 15,000 children and 18,000 adults. The results were startling: Molds were reported in 32.4% of the homes, flooding in 24.1%, and moisture in 14.1%. Respiratory symptoms were consistently higher in homes with reported mold and dampness. People who lived in moldy homes were at increased risk for upper respiratory disease and allergic reactions to all allergens. While these findings are fully understood today, at the time this, and similar data from the Harvard School of Public Health were considered far-fetched , an unfortunate perception of well conducted studies. At the same time, mold and dampness was associated with about 20% of the asthma cases in Canada, a serious issue. By 2007, Health Canada had enough evidence to issue a formal guideline. This was based on the evidence gathered from epidemiology, mechanism of the health effects and detailed information on changes to the relevant codes.[15]

MAKING POLICY DECISIONS

A first step may be to commission research in an area where a need for information has been identified. For example, how much air pollution is tolerable? What is the impact of poor housing on the health of children in remote indigenous communities? What are the best strategies to reduce obesity?

The next step is to gather all available evidence, not just in Canada but from the global pool as well. This is becoming more difficult. A 2010 study from the University of Ottawa reported that 50 million scientific papers have been published since 1965 with 2.5 million new papers appearing each year.[8] There are nearly 30,000 peer reviewed journals[9] plus another 1,000 from so-called "predatory publishers" who produce enormous volumes of poor-quality research. Managing this tsunami of literature to separate the wheat from the chaff is a huge problem.

Policymaking is a complicated business. Ensuring that the best evidence is used to inform policy is an essential goal, balancing systematically obtained evidence with considerations given to information from stakeholders, such as industry, the public and to traditional knowledge of Canada's indigenous people. Doing so in a truly transparent fashion serves both science and society, acting in the interest of good governance.

USING EVIDENCE TO INFORM POLICY
THE STORY OF IQALUIT AIRPORT

Changing climate is affecting all modes of transportation in Canada. Roads and rail lines are affected by freeze/thaw cycles, flooding and landslides. Storm surges, ice cover and coastal erosion impact marine travel, while wind speed and frost can alter aviation.

The impact on infrastructure can mean billions of dollars to the economy. The narrow land bridge between mainland Canada and Nova Scotia, known as the Chignecto Isthmus, represents $20 billion a year in trade, and Port Metro Vancouver, this country's busiest port, $187 billion dollars in trade.[13]

Policies to protect vulnerable infrastructure from the changing climate are in development and evidence factors largely in decisions. Iqaluit international airport, the key gateway to the Eastern Arctic, is already being disrupted. Asphalt runways sink as permafrost, the frozen ground just below the surface melts. Decision makers needed to know how best to protect and maintain the airport from further damage, and how to expand safely and cost effectively. Air traffic is expected to intensify in the coming years as the exploitation of natural resources in Nunavut increases. A team of earth scientists from Canada-Nunavut Geoscience Office (CNGO) and Université Laval (Centre d'études Nordiques) identified sensitive zones, mapped the depth of thawing and forecast changes in the underlying permafrost. The Government of Nunavut used this information to relocate airport runways and develop the engineering and design of the airport expansion and revitalization.[14]

DEALING WITH UNCERTAINTY
THE COLLAPSE OF THE COD

Near the end of the 1980's, fisheries scientists detected a decrease in the productivity of the cod stocks. Surveys and catch data were indicating a dramatic decrease in both adult growth and maturation rates and the number of young cod - but the scientists did not know the cause. Annual assessments of the cod stocks were used to determine how big the fishing quota should be the following year. Could this be a temporary dip or was it the sign of something likely to persist? What, if anything, should be done? The policy decision had to consider the economic and cultural impact on Newfoundland if the cod fisheries were curtailed or stopped for more than a season. Scientists had differing hypotheses on what was causing the decrease. Without an explanation for the scientific observation, decisions were made to carry on fishing with reduced quotas. The cod fishery collapsed, resulting in $4.1 billion dollars in social assistance for Newfoundland and Labrador over 5 years. Sometimes decision makers don't have enough evidence for a single clear choice; other times, even well-designed studies can produce conflicting results, but decisions need to be made in the face of uncertainty. In the interim, precaution needs to be a guiding consideration. As one fisheries scientist at the time explained, "When a warning light appears in your car, your first response is usually to pull over, stop and try to figure out what's happening." Sometimes further investigation is warranted.[16]

Further Readings:
VakaYiko Evidence-Informed Policy Making Toolkit
http://www.inasp.info/en/training-resources/courses/229/
What counts as good Evidence Alliance for Useful Evidence
http://www.alliance4usefulevidence.org/assets/What-Counts-as-Good-Evidence-WEB.pdf
Using Evidence: What Works Alliance for Useful Evidence
http://www.alliance4usefulevidence.org/assets/Alliance-Policy-Using-evidence-v4.pdf
Making Better use of Science and Technology in Policy making
http://irpp.org/research-studies/report-2016-03-08/
A Pan-Northern Approach to Science
http://www.anorthernvision.ca/documents/A16_Brochure_PanNorthernApproachtoScience_71402_English_WEB-Final.pdf

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