ASSOCIATION MÉDICALE CANADIENNE / CANADIAN MEDICAL ASSOCIATION

CMA POLICY

Determining the Impact of Chemical Contamination on Human Health

Background

Industrialization and manufacturing have had enormous positive benefits for humankind, but the consequences of hazardous by-products (chemical contamination) to human health and the environment are less well recognized. A major incident such as Bhopal is an unequivocal example of catastrophic poisoning caused by industry. However, more subtle human health impacts can result from low levels of exposure to chemical and industrial by-products from agriculture, consumer products, manufacturing, and even medical sources. Chemicals from industrial sources have been found in the soil, water, air, food and human tissue. Due to improving technology, even minuscule amounts of potentially noxious substances can be detected.

Some exposures warrant remedial action, but in others the health impact may be negligible: the toxin, dose, route and duration of exposure must be considered. Of course, there are potentially toxic substances that have been found to pose little or no harm to human health, but there are many more for which the health effects are unknown. A substantial knowledge gap exists in that the effects of many chemical agents have not been fully studied. As a result, rigorous surveillance and assessment to ensure potential health impacts are reduced or avoided is necessary. Chemicals like dichlorodiphenyltrichloroethane (DDT) can persist in the environment or in living beings long after the product was pulled from the market, making it essential that full and rigorous testing of new and existing chemicals is undertaken. Finally, research is needed to determine whether emerging issues, such as the presence of pharmaceuticals in drinking water, pose a legitimate threat to human health.

Chemicals, properly managed, can and will continue to provide enormous benefits to society, but caution is warranted because of the potential health consequences. Provided below is a discussion of certain classes of chemicals that need to be regulated, monitored and properly researched.

Agriculture

Agriculture represents the largest component of the global economy. Rising pressures to

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meet the needs of a growing population have resulted in the mechanization of farming, and the widespread use of fertilizers and pesticides.[1] Fertilizer and pesticide run-off has been found in soil, water and the human food supply.[2] Approximately 40 chemicals classified by the International Agency for Research on Cancer (IARC) as known, probable, or possible human carcinogens, are EPA registered pesticides available on the open market.[3] Long-term low dose pesticide exposure has been linked to various cancers, immune suppression, hormonal disruption, reproductive abnormalities, birth defects, and developmental and behavioural problems.[4] Certain pesticides are also known to be persistent in the human body.[5] While many individual pesticides can be safely used, there is a lack of research on the effect of certain pesticides when used in combination.

Consumer Products

Modern technologies have led to advances with a positive impact on the quality of human life. While newer consumer products have benefits over earlier materials, their use is not without side effects. Both the chemicals used to make these products and those that form key components of the products themselves may be harmful. Bisphenol A (BPA) is an industrial chemical added to many hard plastic bottles and to metal based food and beverage cans since the 1960s.[6] In August 2010, Statistics Canada reported that measurable levels of BPA were found in the urine of 91 per cent of Canadians aged six to 79.[7] Concerns have been raised about effects on the brain, behaviour, and prostate gland from exposure to this chemical, particularly in fetuses, infants, and children.[8] In 2008, Canada banned BPA in infant bottles.[9] In October 2010, Canada went a step further by becoming the first jurisdiction in the world to declare BPA toxic.[10]

Manufacturing

With the growing demand for consumer products, there has been a corresponding growth in manufacturing. Manufacturing is one of the biggest contributors to outdoor air pollution, and contributes to soil and water pollution.[11] In 2004, US industry released 1.8 billion pounds of potentially toxic chemicals. Exposure to some of these chemicals has been linked to severe health effects, including cancer. [12] One of the released chemicals, dioxin, can be harmful at very low levels. Dioxins accumulate in fats and break down slowly. This leads to contamination of the food supply, and human exposure through the consumption of meat, dairy, fish and shellfish.[13] Even in the far north, animals have been found to contain dioxins.[14] The EPA estimates that the cancer risk from dioxins already present in the general public is 1-per-1,000.[15] In most cases the emissions pose minimal risk to human health. However, chemicals, and chemical combinations which remain unstudied should be properly assessed.[16]

Medical Practices

Advancements in medical science and the use of pharmaceuticals, diagnostic equipment and other medical treatments have prolonged life expectancy. However, these interventions can also contribute to environmental contamination. In 2008, the Associated Press reported pharmaceuticals in the water of 24 major metropolitan areas in the United States, serving 41 million people.[17] There is a concern that these pharmaceuticals could negatively impact male fertility, lead to birth defects, cause breast and testicular cancer in humans, and lead to antibiotic resistance.[18] For many pharmaceuticals found in water sources, no concerted environmental impact surveys have been carried out.[19]
Mercury is used in fever thermometers,

sphygmomanometers, gastrointestinal tubes, and oesophageal dilators[20]. Reports indicate that medical waste incinerators are among the largest sources of anthropogenic mercury emissions in both the United States and Canada.[21] Medical waste, while not the principle source of mercury poisoning, contributes to the mercury levels present in the environment. In fetuses, infants and children, low-dose exposure to mercury can cause severe and lifelong behavioural and cognitive problems.[22] At higher exposure levels, mercury may adversely affect the kidneys, the immune, neurological, respiratory, cardiovascular, gastrointestinal, and haematological systems of adults.[23] It has also been linked to cancer.[24]

These examples highlight the major categories of human exposure to chemicals. As the review suggests, some of these chemicals have been linked to harmful human health impacts. What is important to keep in mind, however, is that the harm is conditional on the level and lengths of exposure. For most people, these chemicals pose no harm because the exposure is so low. In some cases, such as BPA, it has been determined that the potential harm is not worth the risk: the Canadian government has decided to declare BPA toxic and regulate it accordingly. In other cases, such as pharmaceuticals, the evidence simply warrants further study and surveillance. Given the potential harm to human health, surveillance and research are vitally important in all categories. The more information that is available to policy makers and health care professionals, the better the chance of limiting human health impacts.

What has been done?

International Action

Concerns regarding chemical contamination and human health have led to numerous interventions from the international community. These include the International Programme on Chemical Safety (1980), the Inter-Organization Programme for the Sound Management of Chemicals (1995), the Globally Harmonized System of Classification and Labelling (2002), and the Strategic Approach to International Chemicals Management, which was adopted by governments and stakeholders at the first International Conference on Chemicals held in Dubai in 2006. [25]

Various conventions have also been passed, including the Stockholm Convention (2004) on persistent organic pollutants such as DDT, and the Rotterdam Convention (2004) which applies to pesticides and industrial chemicals.[26] There is some concern about the continued effectiveness of the Rotterdam convention. In 2006, the Canadian government was instrumental in preventing the listing of asbestos as a toxic chemical. Given the persuasive evidence of the harm caused by asbestos, this action undermines the legitimacy of voluntary international conventions.[27]

Canadian Action

In addition to being a signatory to all international agreements listed above, the Canadian government has programs for chemical management domestically. The main tool is the *Canadian Environmental Protection Act (CEPA) 1999*. Jointly administered by Environment Canada and Health Canada, it is intended to prevent pollution and address the potentially

dangerous chemical substances to which Canadians are exposed.[28] The plan calls for increased surveillance of certain chemicals to monitor exposure and health effects, and will increase focus on the management of the health and environmental risks of pharmaceuticals, personal care products, and chemical contamination in food.[29]

There were 23,000 chemical substances on the Domestic Substances List (DSL) in Canada in 1999. To date, only about 1,000 of these chemicals have been fully assessed. Of the remaining 22,000, 85% have been categorized as not requiring any additional action.[30]The most recent Canadian Chemicals Management Plan states that full assessments will be done on 550 substances identified as potentially harmful. Even with these additional assessments, more than 3,000 chemicals will not have been assessed.

Canadian Medical Association

In 2009, the Canadian Medical Association and the Canadian Nurses Association released a joint position statement on environmentally responsible activity for the health-care sector. Recommendations included the proper handling and disposal of toxic chemicals and the reduction of products using these substances. An adapted version of this position statement was then endorsed by a coalition of 12 national healthcare organizations and the David Suzuki Foundation.

In October 2010, the World Medical Association, of which CMA is a member, adopted a policy statement on environmental degradation and the management of chemicals. The statement calls for mercury-free health care, support for international efforts to restrict chemical pollution and to monitor harmful chemicals in humans and the environment, and mitigation of the health effects of toxic exposure to chemicals.

What needs to be done?

Research and Surveillance

Research on chemicals produced through man-made activities remains insufficient. While some of the more toxic chemicals have been reviewed and are now more closely regulated, thousands remain that have had neither health nor environmental assessments. The Domestic Substances List in Canada has 3,300 chemicals of concern that have not been assessed. There is limited research on the effect of these chemicals in combination or in different mediums. Finally, work must be done to ensure environmental and human surveillance of potential chemical exposure threats.

The CMA:

1. Urges the government to complete the health and environmental assessment of the chemicals on the Domestic Substances List.
2. Encourages research on the health impacts of chemical substances, as well as the combinations of these substances in different products (e.g. pesticides), and in different mediums (e.g. pharmaceuticals in drinking water). Long-term research programs are required to determine health impacts from prolonged low-dose exposures.
3. Encourages ongoing surveillance of chemicals in the environment.
4. Encourages ongoing research on the impact of regulations and monitoring of chemicals on human health and the environment.

Advocacy

Regulations have been developed both internationally and domestically to undertake chemical management. However, gaps remain, largely due to the voluntary nature of the frameworks. Canada can play a lead role by respecting its commitments, seeking continued adherence to these agreements and providing leadership in developing effective domestic programs and legislation.

The CMA:

5. Urges the government to continue to support international efforts to manage chemical pollution. In particular CMA urges the government to fully support the principles of the Rotterdam Convention and support the listing of Asbestos as an Annex III toxic chemical.
6. Supports government legislation and regulation which reduces dangerous chemical pollution, detects and monitors harmful chemicals in both humans and the environment, mitigates the health effects of toxic exposures, and requires an environmental and health impact assessment prior to the introduction of a new chemical. Regulatory frameworks should be favoured over voluntary frameworks in order to ensure a level playing field for all manufacturers and to secure rapid and equitable health protection for all Canadians. CMA encourages the government to advocate for similar legislation internationally.

Leadership

Physicians can participate in the monitoring of patients for potential health effects from chemical exposure. Additionally, physicians can be leaders in encouraging greener health care practices. Finally, physicians can support national medical organizations in developing clinical tools to assess patient risk to chemical exposure.
The CMA:

7. Supports the phase out of mercury and other persistent, bio-accumulating and toxic chemicals in health care devices and products.
8. Supports the development of effective and safe systems to collect and dispose of pharmaceuticals that are not consumed.
9. Supports the development of clinical tools for physicians to help assess their patients' risk from chemical exposures.

Education and Professional Development

Physicians have a role to play in educating their patients, the public, and current and future colleagues about the potential human health consequences of chemical contamination. Medical education and continuing professional development in this area could have a significant impact on human health.

The CMA:

10. Should assist in building professional and public awareness of the impact of the environment and global chemical pollutants on personal health.
11. Supports the development of locally appropriate continuing medical education on the clinical signs, diagnosis and treatment of diseases that are introduced into communities as a result of chemical pollution.
12. Encourages physicians to inform patients about the importance of safe disposal of pharmaceuticals that are not consumed.

Conclusion

National and International initiatives have

substantially reduced the incidence of harmful chemical contamination, but more work is needed. Evidence of health effects (or lack thereof) may be strong for certain chemicals, but for others it remains incomplete. Given the dangers of chemicals such as dioxin, which can cause severe effects with small doses, more comprehensive research is warranted. To ensure human health consequences are identified and risks are minimized, improved surveillance is essential.

Further policies and regulations are needed to ensure that chemicals utilized are as safe as possible. The Canadian BPA ban demonstrates the use of the precautionary principle in the presence of convincing if not complete evidence. While there are clear benefits associated with the use of chemicals, it is necessary to ensure that potential harmful effects are considered.'

Finally, public and health care provider information is sorely lacking. Physicians can play a role in correcting some of these deficiencies through their actions to support research and surveillance, advocacy, leadership, education, and professional development.

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