
Prevention of exposure to lead, international aspects

Poisoning by lead is a matter of great concern to countries who recognized it as a serious public health problem, affecting especially children. Chronic exposure to lead causes a myriad of effects, including anaemia, impaired learning abilities and neurobehavioural changes, which may be permanent. Acute effects are dramatic, leading in children to acute encephalopathy and other systemic effects which may produce death or permanent sequelae. Yet, the extent and real magnitude of the problem has not been recognized nor assessed in many developing countries.

Activities of the International programme on chemical safety¹

A number of international conventions have acknowledged the importance of exposure to lead as an environmental pollutant. The 1989 Convention of the Rights of the Child (dealing with the environment) and the 1992 Agenda 21 adopted by the United Nations Conference on Environment and Development (dealing with children) refer to the protection of children from the effects of pollution and toxic compounds. The 1997 Declaration of the Environment Leaders of the Eight on Children's Environmental Health acknowledged lead poisoning as a major environmental hazard called for further actions for reducing blood lead levels (to below 100 µg/l) and for fulfilling and promoting the Organisation for Economic Cooperation and Development (OECD) Declaration of Lead Risk Reduction (table I).

At the national and local level, most industrialised countries have undertaken actions for the assessment and remediation of the problem, based upon questionnaires, blood screening, dietary interventions (iron and calcium supplements), chelation therapy and environmental remediation (in houses, soil and water). However, the problem of lead exposure remains as a pervasive and serious health threat, particularly in developing countries.

One of the overall objectives of the International Programme on Chemical Safety (IPCS) is the prevention of poisoning and promotion of medical

1. The International Programme on Chemical Safety (IPCS) established in 1980, is a joint venture of the United Nations Environment Programme (UNEP), the International Labour Organisation (ILO), and the World Health Organisation (WHO).

Table I : Chemicals and children's health (Declaration of the Eight).

How to reduce children's exposure to lead ?
Reduce blood lead levels to below 100 µg/l
Reduce maternal exposure
Eliminate the use of lead (gasoline, products intended for use by children, paints and rust-proofing agents)
Restrict lead in products (that may result in ingestion in food and drinking water)
Conduct public awareness campaigns
Develop protocols and programs to monitor blood lead levels

response to the human health and environmental effects of chemicals. The IPCS aims to strengthen the capabilities of Member States to implement effective chemical safety programmes, including the development of human resources and training. A number of countries, especially developing ones, have requested the technical advice and financial support of the IPCS to deal with the clinical, analytical and treatment aspects of lead exposure, identification, assessment and prevention. This has been done on the basis of the outcome of IPCS activities and with the advice from selected experts in the area of clinical and analytical toxicology.

The IPCS has developed activities concerning the evaluation of lead as a pollutant and poison (table II). These activities have been undertaken in the areas of risk assessment and management (ARM) and the diagnosis, prevention and management of toxic exposures (PPT).

Table II : International program on chemical safety (OMS/OIT/UNEP).

ARM (Risk Assessment and Management)
Environmental Health Criteria documents (EHCs)
– Lead (n°3, 1977)
– Lead, environmental aspects (n°85, 1989)
– Lead, inorganic (n°165, 1995)
HSGs, ICSCs
Guidelines for Drinking Water Quality (1997)
Air-quality guidelines (1987, update 1995)
JEFCA (Joint FAO/WHO Expert Committee on Food Additives (1986, 1993, 2000)
PPT (Prevention and Treatment of Toxic Exposures)
Evaluation of antidotes : chelating agents
INTOX project

Risk assessment and management

The IPCS has evaluated the environmental aspects of lead and has published three Environmental Health Criteria documents : Lead (n° 3, 1977), Lead-environmental aspects (n° 85, 1989), and Lead, inorganic (n° 165, 1995). It has also prepared documents called Health and Safety Guides (HSG) and International Chemical Safety Cards (ICSC) aimed mainly at the occupational sector. Lead has been evaluated in WHO's Guidelines for Drinking Water Quality (1997) and Air Quality Guides (1987, updated in 1995) and evaluated as a food contaminant in the Joint FAO/WHO Expert Committee on Food Additives (JECFA, 1987 and 1993). All these evaluations provide the basis upon which national and international authorities make their risk assessment and subsequent risk management decisions. They represent a thorough evaluation of risk which may be used by countries to prepare their own regulations concerning the acceptable or tolerable levels of the pollutant in different media.

Prevention and treatment of toxic exposures

In order to support national programmes for the prevention and treatment of poisoning, and also for preparedness and response to chemical incidents, the IPCS prepared a Poisons Information Package for Developing Countries (INTOX), training material for the health sector, a programme for the evaluation of antidotes and guidelines for prevention of toxic exposures. All these activities make reference to or include the consideration of lead exposure as one of the most serious health hazards (table III).

In developing regions, there is lack of awareness about the possibility of lead poisoning and cases of lead poisoning, especially those affecting children are often undiagnosed. Even when appropriately diagnosed, the treatment methods and analytical techniques applied are frequently obsolete. For this reason, training courses, workshops and seminars organised by the INTOX project include the consideration of lead poisoning so as to raise the awareness of the health sector.

The INTOX Project of IPCS aims at supporting national programmes for prevention and treatment of poisoning and for response to chemical risks on a round-the-clock basis. Evaluated information on the characteristics of chemicals and on how to diagnose, treat and prevent poisoning by those agents is prepared as Poison Information Monographs (PIMs : Organic and Inorganic Lead). Clinicians, toxicologists, and pharmacists from different countries assist in the preparation and review of these monographs, which are then published, translated into English, French and Spanish, and distributed to specialised units in the countries. Sections on the high risk circumstances of poisoning and specific preventive measures to adopt are included in each

Table III : International program on chemical safety (OMS/WHO/UNEP).

Activities of the INTOX project
Prevention and treatment of poisoning in developing countries
International toxicovigilance
Harmonized collection of case data on poisoning cases
Provision of up-to-date toxicological information (CD-ROM)
<ul style="list-style-type: none">• Poison Information Monographs (PIMs)• Treatment protocols• Antidote monographs
Training courses
<ul style="list-style-type: none">• Diagnostic and treatment of poisoning• Use of the INTOX software and data base
Promotion of toxicovigilance and prevention
Antidotes evaluation
E-mail INTOX network of poisons centres

monograph. Treatment Guides for signs and symptoms (some of which relate to lead poisoning) have also been prepared to complement to the monographs.

INTOX also provides a standardised format for collecting case data on poisoning cases registered at the poisons centres and medical units and another for commercial product composition data. Training and advice on how to use the formats and analyse the data and results are also provided by INTOX. The recording of cases of poisoning and requests for information made to a Poisons centre allows the compilation of a valuable database on the toxicological status of the country. The epidemiological study of these cases and requests for information allows the identification of the main toxicological problems such as lead exposure, circumstances of exposure, population groups affected and severity of toxic effects. This data provide the evidence basis for planning prevention activities.

The analytical toxicology Working Group of INTOX has prepared guidelines on sampling, detection and quantification of lead in biological material, and is currently advising Member States on the most appropriate analytical techniques to be used according to local needs and available resources. Plans are in hand to test in a number of countries, a new portable blood lead testing device based on electrochemical technology. This device is promising for conducting field surveys, as it uses capillary blood samples collected from finger stick punctures and provides the result in a few minutes.

Within the context of the INTOX project, training courses and seminars on clinical and analytical toxicology take place on a regular basis, in different countries and these all include presentations and case studies on lead poisoning.

The Guidelines for Poisons Control (WHO 1997) have been prepared by the IPCS in order to help countries to establish and strengthen their capabilities for prevention and management of poisoning. They include a section on « Toxicovigilance and Prevention » where the key roles and responsibilities of the poisons centres and their partners are explained and advice is given on how to assess the need for prevention activities, and on how to plan and implement them. The recommendations include : establishment of a harmonized mechanism for collection and evaluation of data on poisoning cases, training and education in the field of toxicovigilance and prevention, and production and dissemination of poisoning prevention materials. Specific problems such as lead poisoning may be addressed following the guidelines but adapting the activities to the local problems, needs and resources available.

Within the context of the Antidote Project, the IPCS is evaluating information about the efficacy of chelating agents in the treatment of metal poisoning, including dimercaprol (BAL), 2-4 dimercaptosuccinic acid (DMSA) and CaNa_2 , ethylenediaminetetraetic acid (EDTA) and penicillamine. The Antidote Evaluation monograph is in its final stages of review and will be published in 1998.

Guidelines on the Prevention of Toxic Exposures are under preparation and a first draft will be circulated for review in August 1998. Their objective is to provide the essential information and advice to countries on the planning and implementation of education and prevention activities. The Guidelines contain examples on different prevention initiatives, addressing especially the susceptible and vulnerable groups such as children. These examples could be adapted to local situation and needs concerning lead exposure.

The IPCS provides guidance to Member States on the recognition and management of their toxicological problems, on the promotion of chemical safety and prevention of poisoning, including saturnism.

Prevention of lead exposure

Lead poisoning is a problem of great magnitude, but yet preventable through appropriate interventions and educational and information programmes. Health authorities, the scientific community and general public, should be made aware of the benefits that poison prevention activities offer in this area. Successful poison prevention campaigns held in several countries have already demonstrated that education and information are effective as « active »

prevention strategies. But also « passive » strategies aimed at screening and correcting environmental conditions and imposing regulations are essential (table IV).

Table IV : How to prevent lead exposure ?

Passive prevention strategies	Correcting environmental conditions (reducing pollution, imposing regulations) EHCs, Guidelines
Active prevention strategies	Education and information (information campaigns at the local and national level to educate people in charge of young children) Poison prevention campaigns Training of health professionals

Educational campaigns for the public, may be implemented in a relatively easy manner and are relatively inexpensive (especially if compared to the costs of poisoning !). Information campaigns at the local and national levels educate parents, grandparents, teachers and tutors in charge of young children. They are based upon simple recommendations on how to recognise sources of lead (e.g. : house paint, folk remedies, cosmetics) and reduce the risk of environmental exposure, on how to keep children safe through good hygiene and nutrition and how to recognise symptomatology of saturnism. The rehabilitation of hygiene (personal, public and social) is an effective method of reducing exposure and mitigating the effects of lead on human health and the environment.

Campaigns aimed at the education of the child are especially effective as they raise the interest of children in their own health. Educational activities aimed at women in their reproductive years and during pregnancy with information on toxicological risks during pre-conception and post-conception inform about the effects that exposure to lead may have on the mother and the child.

Poison prevention campaigns and educational activities on lead require the participation of professionals from different sectors, and especially professionals with toxicological experience and expertise on how to plan and implement the activities. Training of health professionals on the recognition and prevention of lead exposure is therefore a pre-requisite to an effective prevention campaign.

National and international organisations dealing with children's, women's and worker's welfare may play an important role in this area, as they may support activities and reach large community groups.

Currently WHO has no specific programme addressing specifically the problem of lead exposure and its prevention. However, through the activities of

the IPCS, it contributes to promote passive and active prevention strategies in countries. This is done through awareness-raising activities, promotion of regulatory measures, dissemination of advice on clinical and analytical matters and promotion of prevention and toxicovigilance. Primary, secondary and tertiary prevention may be addressed on the basis of the material prepared by the IPCS. IPCS has set up the basis which will enable national and international authorities to make risk assessment and management and advise the medical sector on the main clinical and analytical issues of saturnism (table V).

Table V : Lead poisoning prevention activities.

Primary	prevention of lead poisoning in an individual or population (reducing or eliminating lead in the environment)
Secondary	prevention of the progression of lead poisoning in affected individuals (identification of children with elevated blood lead levels and prevention of further exposure)
Tertiary	limitation of lead poisoning consequences and after-effects (use of antidotes and other treatment required)

Exposure to lead remains as a pervasive problem in industrialised countries and is a « hidden » problem in developing countries. All efforts should be made to raise awareness about saturnism, to better identify and assess its incidence and implement appropriate primary and secondary prevention strategies in all countries.

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