COLLEGIUM RAMAZZINI STATEMENT

CALL FOR WORLDWIDE REDUCTION IN EXPOSURE TO LEAD

Lead is a pervasive occupational and environmental hazard. Despite great progress in reducing lead exposure, lead toxicity remains a major health problem, and lead use is increasing worldwide. Lead poses serious hazards to workers' health and also to the health of infants and children. Recent research has proven conclusively that lead can cause permanent damage to human health and injury to multiple organ systems at relatively low levels of exposure that previously were considered "safe". Moreover serious, previously unrecognized hazards to health are now understood to result in both adults and children from chronic, cumulative low-level exposure to lead.

To eliminate the global burden of disability, disease and death caused by lead, the Collegium Ramazzini calls for a worldwide ban on all non-essential uses of lead, as defined in this document, and for coordinated action in countries around the world to reduce lead exposures through source identification, control, and elimination.

The Collegium Ramazzini calls additionally for substantial strengthening of legal standards regulating exposure to lead in the workplace and general environment, as well as for reduction in the blood lead concentrations officially recognized as causing harm in workers, adults, infants and small children, to better align these standards with current scientific knowledge of lead toxicity.

The Collegium Ramazzini is an international scientific society that examines critical issues in occupational and environmental medicine with a view towards action to prevent disease and promote health. The Collegium derives its name from Bernardino Ramazzini, the father of occupational medicine, a professor of medicine of the Universities of Modena and Padua in the late 1600s and the early 1700s. The Collegium is comprised of 180 physicians and scientists from 35 countries, each of whom is elected to membership. The Collegium is independent of commercial interests.

Background

Lead poisoning is a pervasive occupational and environmental hazard. Its consequences for health are grave. Lead has caused millions of cases of disease, disability and premature death. It continues today to pose widespread hazards.

Worldwide use of lead is greater now than in any previous era, and lead use continues to increase in response to strong demand for lead in microelectronics and in batteries, especially in large batteries for fuel-efficient vehicles.

Lead poisoning was first diagnosed more than 2,000 years ago, and for millennia lead poisoning was seen as principally a disease of workers. The cardinal features of occupational lead poisoning - anemia, colic, neuropathy, nephropathy, sterility, coma and convulsions - were described by Hippocrates, and Nikander in ancient times and by Ramazzini, Thackrah, Hamilton, and Lilis in the modern era.

In the past 100 years, uses of and environmental contamination from lead have increased sharply. The largest increase in the use of lead and the most widespread environmental contamination resulted from the addition of tetraethyl lead to gasoline as an octane enhancer. As a result of these trends, lead exposure in the 20th century was more widespread than in any previous era, and lead poisoning moved beyond the workplace to cause epidemics of lead poisoning in children, pregnant women and non-occupationally-exposed adults in many countries. The most severe of these non-occupational exposures have resulted from the use of lead in paint, from smelter emissions that pollute communities, and from lead recycling under uncontrolled work practices.

The Collegium Ramazzini observes that the profound tragedy of this epidemic is that the disability, disease and deaths caused by lead toxicity are almost entirely preventable.

Lead toxicity. Lead is toxic even at very low levels of exposure that previously were considered “safe”. It is now understood that even exceedingly low levels of exposure to lead - levels below current legal standards in many countries and below published guidelines - are associated with an increased risks of disability, disease and premature death.

In infants, children and adolescents, lead exposure elevates the risk for diminished intelligence, shortened attention span, reading problems, attention deficit hyperactivity disorder (ADHD), school failure, delinquency and criminal behavior (1-5). There is no evidence of a threshold below which lead does not

cause neurodevelopmental toxicity (6-9). Moreover the decrements in intellectual function per unit increase in blood lead concentration are greater at blood lead levels below 100 μg/L (10 μg/dL) (6-9), the level that was previously considered to be the threshold for harm (10). On average, there is an estimated 2 to 3-point decrement in IQ occurring in children whose blood lead levels rise from 100 to 200 μg/L (10 to 20 μg/dL), but a decrement of 4 to 7 IQ points occurs in children whose blood lead levels rise from 10 μg/L to 100 μg/L (1 to 10 μg/dL) (7).

In adults exposed in either the workplace or the general environment, lead has been associated with some of the most highly prevalent diseases of industrialized societies: hypertension and cardiovascular disease (11-13), miscarriage (14), renal dysfunction (15,16) and neurocognitive decline (17-18). Lead is classified by the International Agency for Research on Cancer (IARC) as a "probable" human carcinogen (Group 2A) (19). Evidence is emerging that many of these health impacts occur at blood lead levels well below current occupational standards and guidelines. Indeed, there is considerable evidence that the risk of premature death from heart attacks and stroke, as well as the risk for chronic kidney disease, is elevated among adults with blood lead levels considerably <100 μg/L (10 μg/dL) (12,13,16). Cumulative lead exposure, as measured by non-invasive assessment by K-X-ray fluorescence analysis of the quantity of lead stored in long bones is positively correlated with many of these adverse health outcomes (17,18).

Prevention of lead poisoning. Reduction in the use of lead and elimination of environmental exposure to lead, termed 'primary prevention', is critical to preventing lead poisoning (20-24). Primary prevention is the most efficient and cost-effective approach to disease prevention. Primary prevention is accomplished by replacing hazardous materials such as lead in consumer products and the environment with safer substitutes. Safer substitutes exist for many non-essential uses of lead, including paint and other surface coatings, ceramics, toys, gasoline, solder, and consumer-based microchips and electronics. In addition, any lead used for essential and non-replaceable purposes should be recovered after its use and recycled so that lead mining and smelting can be reduced (25). A cradle-to-grave management and monitoring system should be instituted for all lead use.

The serious health hazards of exposure to lead - coupled with the availability of safer substitute materials have encouraged a growing number of countries to reduce or eliminate many uses of lead. Especially important progress has been made in the removal of lead from gasoline (26-30). These reductions have produced dramatic declines in blood lead levels among children and adults in nations worldwide. Less uniform has been the progress towards eliminating other equally prevalent sources of lead exposure such as lead in paints, toys and consumer products in global commerce (31).

Existing lead exposure limits, those established for workers as well as those for the general population, while technologically achievable in highly industrialized countries, still result in unacceptably increased disease risks.

In newly industrializing countries engaged in lead mining, primary and secondary smelting and manufacturing, lead exposures for workers and the general population are often much higher than in the developed nations, standards may be outdated, and compliance with norms and regulations is often poor. Widespread contamination of the environment may affect communities in developing countries long after industrial activities have ceased. The potential for epidemics of lead-induced disability, disease and premature death is high in these areas. Today with the globalization of trade, we are in the unfortunate situation where countries with strong regulations on environmental and consumer lead exposures may be exporting lead-using processes to lesser-developed nations, where regulation may be less stringent, thus increasing the potential for harm to the general population and to workers. Ironically, developing countries, in turn, may export their lead-containing products back to the developed nations (31).

Conclusions. Despite recent, sometimes dramatic, progress in reducing population exposures to lead and in reducing blood lead levels, there is increasing recognition that chronic low-level exposure to lead continues to be a major cause of disease, disability and death in adults and children worldwide.

The key to preventing lead toxicity is to eliminate exposure by ceasing all unnecessary uses of lead and to eliminate or drastically reduce environmental lead exposure by using control technology at the source. Government agencies use a variety of regulatory strategies, including the promulgation of blood lead and air lead standards, and the enforcement of regulatory controls, to prevent unacceptable exposures to lead. In many countries around the world, these actions have achieved substantial successes in controlling lead exposure.

A major persistent problem is that virtually all of the existing regulatory standards for lead were promulgated many years ago, long before research became available showing that lead causes harmful effects to health at blood lead levels below 100 μg/L (10 μg/dL). Because it is now understood that there is no known safe level of exposure to lead, lead exposures below existing standards cannot be considered "safe." Regulatory strategies need therefore to be revised in light of new scientific knowledge.

Recommendations: To control the global epidemic of occupational and environmental lead poisoning, the Collegium Ramazzini calls for the following actions:

1. Tetraalkyllead must be eliminated without delay from the gasoline supplies of all nations. This recommendation is consistent with a number of recommendations made nationally and internationally in recent years, including the Bangkok Declaration on Children's Environmental Health and the Declaration of Brescia, a declaration strongly supported by the Collegium Ramazzini (32). The removal of lead from gasoline has produced declines of over 90% in population mean blood lead levels in many developed nations, and similar effects are beginning to be observed in developing nations. This action represents one of the great public health accomplishments of the late 20th century and needs to be extended to all nations.

2. Review of all uses of lead, including recycling, in all nations. All non-essential uses of lead that contribute to environmental and human exposures, such as the use of lead in toys, paints, water pipes, building materials, solder, electronics, medications and cosmetics should immediately be ended.

3. Transfer of lead-containing products, materials for recycling and waste from one country to another must be prohibited, except under the most closely controlled circumstances (25). A universal United Nations protocol on the use and disposal of lead needs to be developed to assure international uniformity in the development, implementation, use, monitoring and trade in lead and lead products. This protocol must be monitored by international organizations such as UNEP and the Basel Convention, the Rotterdam Convention, WHO and ILO and the WTO.

4. Development and adoption of new technologies that do not depend on lead should be encouraged. Great care must, however, be exercised in selecting materials to replace lead. In particular, concern should surround the introduction of organic manganese compounds into motor fuels as substitutes for tetraalkyllead. Manganese, like lead, has been shown to be a developmental neurotoxicant that can damage the fetal brain to produce developmental delays and loss of intelligence. It is also responsible for impairment of motor function and has been associated to with an increased risk of parkinsonian symptoms in exposed populations (33). The Declaration of Brescia called specifically for prohibition of organic manganese in motor fuels worldwide (32).

5. All countries need to establish programs for the safe return and recycling of lead-acid batteries. A most immediate technological need is to develop a process for recycling spent storage batteries without generating airborne exposures to lead and ground contamination. Ultimately, a safer substitute for lead-acid batteries needs to be developed.

6. Current occupational and environmental exposure standards for lead in workers, adults, pregnant women, and children need to be immediately reduced to reflect current knowledge of low-level lead toxicity. Existing standards were established many years ago and do not reflect recent advances in scientific knowledge about the toxic effects of lead at lower levels of exposure.

7. For workers, the standard for lead in blood should be reduced substantially in a stepwise manner to reach a level no greater than 100 μg/L (10 μg/dL) in nations worldwide within the next decade. Permissible levels of lead in workplace air should be reduced to achieve this result. Workers removed from lead exposure based on an elevated lead in blood level or on the advice of health care professionals conducting medical monitoring must suffer no loss of pay, promotion, seniority or other employment rights and benefits. Reduction of the occupational lead standard will substantially reduce the risk of subclinical neurotoxicity and other forms of disability, morbidity and mortality that are permitted to occur under current exposure standards, including risks of dementia in later life (17-18) and of death from cardiovascular disease (11-13). This recommended reduction in occupational lead exposure will also reduce incidence of fetal neurotoxicity in the offspring of women workers.

8. Exclusionary policies that preclude specific categories of workers from work with lead, such as women of child-bearing age, must be eliminated (20).

9. For children, the level of lead in blood that triggers community prevention efforts to reduce sources of lead exposure should be reduced drastically, with the ultimate goal of lowering this limit to a blood lead <10 μg/L (1 μg /dL) or even <5 μg/L (0.5 μg/dL). Any level adopted to protect children should be revised if new evidence demonstrates toxicity at still lower blood lead levels.

10. For children, the level of lead in blood that triggers preventive action for an individual child should be reduced immediately to ≤50 μ/L (5 μg/dL) in nations worldwide. This level is proposed as a temporary standard that may need to be revised further downward in future years as new evidence accumulates on toxicity at still lower blood lead levels.

11. Research is needed to investigate correlations between chronic, cumulative exposure to lead and damage to health. In adults, such research should incorporate newer biological markers of chronic lead exposure, such as K-X-ray fluorescence analysis of the quantity of lead stored in bone (34). This type of research will enable the development of strategies and standards for worker protection that move beyond current, outdated strategies based solely on the measurement of lead in blood.

12. Vigorous enforcement is necessary in all countries. The number of labor inspectors in the field and their capabilities must be increased. Government agencies must be able to levy severe fines for violations. Criminal penalties must be used much more frequently than heretofore to punish employers who commit repeated or willful violations. Variances from standards must provide equivalent protection, and exemptions from standards must be eliminated.

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