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Lead Exposure and Public Health in India: A Comprehensive Analysis and the Imperative Role of Members of Parliament (MPs)

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This comprehensive study aims to analyse the multifaceted dimensions of lead exposure and its impact on public health in India. It delves into the acute and chronic health implications of lead poisoning, considering both global and Indian literature. Further, the study comments upon the prevalent sources of lead poisoning globally and in India, highlighting correlations with air pollution. Emphasising the importance of policy interventions, the research examines the effectiveness of global lead control measures, such as the phase-out of leaded gasoline, in improving public health outcomes. Within the Indian context, the study scrutinises existing policies and regulations regarding lead exposure, assessing their implementation and identifying challenges. It particularly focuses on gaps in monitoring frameworks for regulating lead content in paints and the geographical distribution patterns of lead exposure sources in India. Furthermore, the research entails an analysis of parliamentary interventions undertaken within the past five years concerning lead exposure, aiming to illustrate the discourse among Indian Members of Parliament (MPs) on this critical issue. Drawing insights from doctrinal research, empirical research, and case studies from various countries, the study formulates concrete action items and policy recommendations for Indian MPs to mitigate lead exposure and safeguard public health effectively.

Keywords: **Lead poisoning; members of parliament; public health; policy interventions; global best practices.**

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INTRODUCTION

Lead, a dense, malleable metal, poses significant health risks and exists in the environment in various forms. This study examines the origins of lead poisoning, considering prevalent sources globally and their presence in India. It particularly emphasises how lead poisoning has emerged as a significant health risk, impacting human health and vulnerable populations, while also discussing its correlation with air pollution. Despite this progress, yet only 48% of countries had officially implemented legally binding controls regarding the production, import, sale, and use of lead paints by March 31, 2023. The study also addresses India's policy landscape concerning lead, focusing on regulations such as the Regulation on Lead Contents in Household and Decorative Paints Rules, 2016, and the Battery Waste Management Rules, 2022.

The study identifies significant gaps and challenges contributing to the public health crisis stemming from lead exposure in India. These include difficulties the informal sector players encounter in meeting the mandated lead concentration regulations, emphasising the necessity for targeted interventions to aid compliance within this sector. Moreover, the sale of outdated paints containing high lead levels by local retailers is compounded by a deficient monitoring framework to regulate lead content in paints. The inadequate implementation of the 2016 Regulations despite its enactment in November 2017 reflects a broader failure to improve the situation nationwide. Other than that, the presence of unlabelled products in the market raises concerns about approval processes. The study also includes best practices and case studies from different countries including, such as Bangladesh’s fight against lead contaminated turmeric, USAID’s $4 million initiative to combat lead poisoning, et al. The study is aimed at answering the following questions-

- What is the current state of lead exposure in India, considering both acute and chronic health implications?
- What are the prevalent sources of lead poisoning globally and in India, and how do they correlate with air pollution?
- What is the effectiveness of global lead control measures, such as the phase-out of leaded gasoline, in improving public health?

- What are the existing policies and regulations regarding lead exposure in India, and how effectively are they implemented?
- What are the challenges faced in meeting mandated lead concentration regulations, particularly within the informal sector, and how can compliance be improved?
- What are the gaps in the monitoring framework for regulating lead content in paints in India, and how can it be strengthened?
- What are the parliamentary interventions undertaken in India regarding lead exposure in the past five years, and what is the discourse among Indian MPs on this subject?
- What role can Indian MPs play in mitigating lead exposure, and what specific actions and policies can they advocate to safeguard public health?

The research also includes an analysis of parliamentary interventions undertaken within the past five years concerning lead and lead exposure in India, thereby illustrating the discourse among Indian MPs on this subject matter. Based on the doctrinal and empirical research, the study includes what role Indian MPs can play in mitigating lead exposure by advocating specific actions and policies to safeguard public health. The recommendations entail concrete action items and initiatives for Indian Parliamentarians, addressing emerging research areas, potential interventions/ innovations, and offering policy recommendations for the future. The ideas for these recommendations have been taken from existing recommendations made by various entities (designed to what MPs may do), suggested actions for the gaps found through the doctrinal study carried out while creating this document and through the discussions with stakeholder(s)/ expert(s) in the field of lead poisoning. The study is novel in its approach as it provides action items for the Indian MPs to pursue in the domain of lead poisoning elimination, as that has never been done before.

The study starts with a brief discussion about lead and its poisoning. It covers and explains various prominent sources of lead exposure and how emissions are also a source of lead. It relates air pollution with lead exposure, and then comprehensively deals with its impact on public health. This section also explains what bodily functions are affected by lead exposure. Thereafter, the study includes a section on the policy landscape of lead exposure both at the local level and in India. This also entails the gaps which exist in the Indian policies. At the end, the

study is focused on the role of Indian MPs in the domain of domain exposure, commenting on the past parliamentary discussions and the action items for the future.

METHODOLOGY

Firstly, a thorough literature review was conducted, including global and Indian sources to explore various aspects of lead exposure, including acute and chronic health effects, prevalent sources of contamination, its correlation with air pollution, as well as examining the global policy landscape and India's existing policy framework. Following this, a policy analysis was undertaken to assess the implementation, challenges, and gaps in existing policies and regulations regarding lead exposure in India. Moreover, case studies and best practices from different countries were examined to derive insights applicable to the Indian context, aiming to identify effective initiatives for combating lead poisoning. At the end, a parliamentary analysis was conducted to evaluate interventions undertaken by Indian MPs concerning lead exposure over the past five years, including discussions among MPs. Finally, based on the findings from the literature review, policy analysis, case studies, and parliamentary analysis, concrete action items, interventions and policy recommendations were formulated for Indian Parliamentarians to mitigate lead exposure and safeguard public health effectively.

I. <u>What is Lead?</u>

Lead was one of the first metals mined and smelted by humans. It is denoted by the chemical symbol Pb and holds atomic number of 82 in the periodic table. It is found in small amounts in the earth’s crust with a dense, soft, highly malleable, and ductile texture with a bluish-white hue when freshly cut. However, it tarnishes to a dull grey colour upon exposure to air. It is practically an immobile element and natural occurrence of lead is very rare; it is found in ores with zinc, copper, and silver, and is later extracted from these elements. During the process of mining, it gets scattered and spreads rapidly in the environment, persisting for long periods of time in the ecosystem. Lead has a density of around 11,343 kg/m^3, making it one of the densest common elements. Moreover, it has a relatively low melting point of 327.5°C (621.5°F), making it easy to melt and shape. It is a relatively unreactive metal and forms a protective oxide layer when exposed to air, preventing further corrosion. Lead and lead compounds have been used in a wide variety of products found in and around our homes, **including paint, ceramics, pipes and**

plumbing materials, gasoline, **batteries, ammunition, and cosmetics**. The largest source of lead worldwide however is from secondary production (recycling). The **secondary lead** producers cater to about **55% of Indian lead demand**[1]. The metal is largely used for the manufacturing of automotive and industrial batteries, but it is also suitable for shielding against sound, vibrations and radiation (lead shielding is used to protect your eyes while using computers and TV screens**).** It is one of the handful of the elements which have been used in society from ancient times for making paints and pipes corrosion resistant. Lead, when utilised as a metal in applications such as batteries, cable sheathing, and radiation containment, is fully recyclable and retains its properties. It stands out as one of the most recycled base metals, capable of being re-melted numerous times. Once reprocessed, the resulting product, known as secondary lead, is virtually indistinguishable from primary lead extracted from ore.

A. What is lead Poisoning?

Lead (pb) toxicity is highly hazardous, causing potentially irreversible health effects. It interferes with various body functions, affecting the central nervous system, the reproductive system and the renal system resulting in severe disorders. Lead poisoning is one of the earliest and well-known occupational diseases. In the 20th century, there was a steep increase in lead production attributable to its extensive industrial and public use, including gasoline and paint. With the onset of the Industrial Revolution, a widespread epidemic of metal intoxication, prompted scientists and physicians of that time to investigate and pinpoint distinctive symptoms and organ changes associated with chronic lead poisoning. In the 20th century[2], increasing recognition of the occupational and environmental toxicity of lead led to public awareness and the implementation of legislation aimed at safeguarding health in the developed countries. However, it remained highly ignored in the under-developed/ developing nations.

The developed countries have phased out the use of lead products through domestic policy transitions. Although data is limited, the global estimates suggest that the scale of lead poisoning today remains extraordinary, **impacting an estimated 815 million children, i.e., one in three**

[1] Madan Sabnavis, & Urvisha H Jagasheth. (2018). Mining and Mineral Series: The lead Industry. CareEdge | Ratings. https://www.careratings.com/uploads/newsfiles/Lead%20Industry.pdf

[2] Riva, M. A., Lafranconi, A., D'Orso, M. I., & Cesana, G., (2012). *"Lead poisoning: historical aspects of a paradigmatic occupational and environmental disease"*, Safety and health at work. https://doi.org/10.5491/SHAW.2012.3.1.11

children worldwide[3]. The origins of the ongoing lead exposure differ within and across the countries particularly low- or middle-income countries. Sources include battery recycling, spice adulteration, ceramic and aluminium cookware, cosmetics, paint, traditional medicines, and more. However, it is important to note that the relative contribution of these different sources is not well defined.

B. Recognition of Lead as an Occupational Hazard in the global context

The history of lead poisoning traces its origin and the development of "Occupational Health" as a medical discipline. In the beginning of the 20th century, the identification of lead poisoning cases among children emerged as a crucial factor prompting the establishment of specific international legislation on lead paint. Elevated levels of lead were noticed in the blood of Australian children and concurrent occurrences of visual disturbances and impairments in ocular motility. Ophthalmologist John Lockhart Gibson inferred that these symptoms indicated chronic poisoning resulting from lead paint.[4]

During the early 1990s, American College of Occupational Medicine suggested incorporating the term "Environmental" into the discipline's title. This led to the establishment of a novel field, "Occupational and Environmental Health," dedicated to investigating diseases resulting from harmful agents present in both living and working environments. Lead poisoning, serving as a paradigm for such conditions, became a focal point of study[5].

II. An Overview of the Issue

A. Global Studies on Lead Exposure

This section highlights the comprehensive literature review on global studies concerning lead and its impact on health and consequently the existent literature in India. The existent studies reveal a substantial body of research highlighting the diverse ways in which lead exposure

[3] Bonnifield R.S (et.al), (2023). *Why ending childhood lead poisoning is a top-tier global development challenge. Centre for Global Development.*
https://www.cgdev.org/blog/why-ending-childhood-lead-poisoning-top-tier-global-development-challenge
[4] Gibson, J. L. (2005). A plea for painted railings and painted walls of rooms as the source of lead poisoning amongst Queensland children. Public Health Reports, 120(3), 301-304.
https://doi.org/10.1177/003335490512000314
[5] Ducatman, A. M., Chase, K. H., Farid, I., LaDou, J., Logan, D. C., McCunney, R. J., Milroy, W. C., Mitchell, F., Monosson, I., & Sunderman, F. W. (1990). What Is Environmental Medicine? *Journal of Occupational Medicine*, *32*(11), 1130–1132.
www.jstor.org/stable/45012701

affects individuals across various populations which encompass epidemiological, clinical, and environmental perspectives, shedding light on both acute and chronic health implications associated with lead.

According to the World Health Organisation, lead happens to be one of the ten chemicals of major public health concern and lead exposure is ranked fourth among major environmental health risk factors.[6] The latest study conducted by the American Heart Association in 2023[7] on the risk associated by the metals in cardiovascular diseases recognised Lead as a risk factor for cardiovascular toxicity. The study further indicated that there is an association with lead exposure and premature death linked through an elevated risk of cardiovascular disease (CVD). The findings of a 2023 Lancet Study[8] also revealed that in 2019, children younger than 5 years of age lost **765 million IQ points due to lead exposure in low- and middle-income countries.** The loss of IQ was 80% higher than the previous estimate and deaths due to cardiovascular deaths were six times higher than the Global Burden Disease estimate in 2019. Lancet findings also suggested that the health and economic costs of lead exposure are at par with PM2.5 air pollution.

A 2018 study conducted in the United States concluded that deteriorating lead-based paint and lead dust were the primary environmental factors responsible for almost 90% of all cases of childhood lead poisoning, and housing continued to be a major problem.[9] Given that children are more susceptible to the risk of lead poisoning, despite large improvements in the environmental regulations in the US, it was estimated that approximately 4.3 million children[10] resided in homes with lead paints in 2019.

[6] 10 chemicals of public health concern. (n.d.). World Health Organization (WHO). https://www.who.int/news-room/photo-story/photo-story-detail/10-chemicals-of-public-health-concern

[7] Lamas, G. A., Bhatnagar, A., Jones, M. R., Mann, K. K., Nasir, K., Tellez-Plaza, M., Ujueta, F., & Navas-Acien, A. (2023). Contaminant metals as cardiovascular risk factors: A scientific statement from the American Heart Association. Journal of the American Heart Association, 12(13). https://doi.org/10.1161/jaha.123.029852

[8] Larsen, B., & Sánchez-Triana, E. (2023). Global health burden and cost of lead exposure in children and adults: A health impact and economic modelling analysis. The Lancet Planetary Health, 7(10), e831-e840. https://doi.org/10.1016/s2542-5196(23)00166-3

[9] Kent County Lead Task Force. (2018, January). Ending child exposure in Kent County. accessKent.com - Kent County, Michigan. https://www.accesskent.com/Health/Lead/pdf/2018_Report.pdf

[10] Jacobs, D. E., & Brown, M. J. (2023). Childhood Lead Poisoning 1970-2022: Charting Progress and Needed Reforms. Journal of public health management and practice : JPHMP, 29(2), 230–240. https://doi.org/10.1097/PHH.0000000000000166

USA domestic and global interventions[11]: The United States has implemented a comprehensive strategy to combat lead poisoning, domestically and globally, through the Lead Exposures subcommittee of the President's Task Force on Environmental Health Risks and Safety Risks to Children. The Federal Action Plan to Reduce Childhood Lead Exposures and Associated Health Impacts guides collaboration among 18 federal agencies. Internationally, the Environmental Protection Agency (EPA) leads efforts in The Global Alliance to Eliminate Lead Paint, supports global projects, and collaborates with WHO. The FDA addresses lead levels in infant foods, engaging in international standards development. The Consumer Product Safety Commission monitors lead in products globally, and the CDC provides guidance. This multifaceted approach demonstrates a commitment to address lead poisoning comprehensively, both domestically and through active participation in global initiatives.

Similarly, a joint report by UNICEF and Pure Earth (2020) "The Toxic Truth: Children's Exposure to Lead Pollution Undermines a Generation of Future Potential" shed light on the widespread occurrence of lead in the environment largely due to the result of human activity. Approximately **nearly 800 million children are poisoned by lead globally with over 5 µg/dl in their blood.** The Study highlighted the sources through which lead exposure **can occur through inhalation of particles released by industry or recycling,** secondly through ingestion of contaminated soil or dust, particularly when children play on the ground ingest particles through soil and lastly through lead- containing products such as lead- glazed ceramics and some traditional medicines, cosmetics and spices. While most of the children impacted live in Africa and Asia but several were affected in Eastern Europe and Central America.[12] It is important to highlight that while the blood lead levels have declined substantially in high-income countries since the phasing out of leaded gasoline and paints, this number remains dangerously high in low to middle income countries and some pockets of high- income countries.[13]

In 2022, the Center for Global Development convened a multistakeholder Working Group on Understanding and Mitigating the Global Burden of Lead Poisoning and its impact on children's cognitive development. **It estimated that lead exposure contributes to more than 20% of the educational disparity between high-income countries and Low- to Middle-Income**

[11] Rachel Silverman Bonnifield, & Rory Todd. (2023). Opportunities for the G7 to address the global crisis of lead poisoning in the 21st century: A rapid stocktaking report. Center for Global Development. https://www.cgdev.org/publication/opportunities-g7-address-global-crisis-lead-poisoning-21st-century-rapid-stocktaking
[12] *Ibid*
[13] *Ibid*

Countries (LMICs). According to a recent analysis by the World Bank, lead exposure is linked to a substantial economic setback, causing a loss of income amounting to US$1.4 trillion, equivalent to 1.6% of the global GDP.[14] This pervasive issue acts as a significant obstacle to achieving the Sustainable Development Goals (SDGs), hindering progress in areas such as poverty reduction, inequality, and early childhood development. Despite its substantial scale and repercussions, lead poisoning has been largely overlooked in low-income countries. The lack of effective systems for detecting or preventing lead exposure have further exacerbated the problem.

B. Lead Exposure in India

High lead concentrations were detected in some of the lead paint manufacturers in India in 2009 and 2011. Recognising it as a major concern, the Government of India acted upon the issue and notified that lead contents in paints should not exceed 90 ppm under the "Regulation on Lead Content in the households and decorative paints rules, 2016". However, there have been significant challenges in the implementation of the regulations on the use of lead in paints even after the rules came into effect from 2017. Multiple studies have pointed out towards the concern raised on the approval of products in the market and the lack of a proper system for the certification of lead-safe paints[15]. Furthermore, a 2018 study by the Aligarh Muslim University highlighted the role of lead-based paints as a source of lead exposure for children in between the ages of 6-14 months in Aligarh, Uttar Pradesh.[16]

Data examined from the Indian studies on the Assessment of Lead Impact on Human and India's Response, NITI Aayog and Council of Industrial Research (CSIR) which included 89 data sets from 36 studies carried out between 1970 and 2014 revealed that the average blood levels in 23 states of India was well above 5 µg/dl.[17] Depending on the quantity and length of the contamination, the symptoms of Pb poisoning can be mild. However, the World Health Organization and US Centers for Disease Control and Prevention have declared that there is no

[14] World bank. (2023, September 19). Pollution. World Bank. https://www.worldbank.org/en/topic/pollution
[15] Piyush Mohapatra. (2021, October 20). *Despite regulations, lead in paint remains a health concern in Indi*a. Gaonconnection | Your Connection with Rural India. https://en.gaonconnection.com/lead-wall-paint-health-effects-children-india-laws-toxic-harmful-poisoning-causes/
[16] *Ibid*
[17] Rakesh Kumar et al. (2022). Assessment of Lead Impact on Human and India's Response. NITI Ayog and Council of Scientific and Industrial Research (CSIR). https://www.pureearth.org/wp-content/uploads/2022/06/Lead-Report-India-CSIR-NITI-Ayog-June-2022.pdf

safe level of Pb in blood and 5 µg/dl is the threshold for intervention.[18] Though other metal contaminations are also of concern at a few places, lead continues to remain one of the major health concerns due to its prevalence and occurrences amongst the young children and impending upon their cognitive growth and development.

In 2020, UNICEF and Pure Earth jointly released a report titled "The Toxic Truth: Children's Exposure to Lead Pollution Undermines a Generation of Future Potential". Data demonstrated that out of 900,000 premature adult deaths worldwide, lead pollution was linked to 230,000 premature adult deaths in India per year. Furthermore, out of 800 million children worldwide, or 1 in 3, **275 million children in India had excessively high blood lead levels, or more than 5 micrograms per deciliter.** According to this report, up to 800 million children worldwide, or roughly 1 in 3 have blood lead levels at or above 5 micrograms per deciliter (µg/dL).

A pilot study was undertaken with 41 children near a lead battery manufacturing unit in Patna with the aim of assessing blood lead levels (BLLs) and haemoglobin levels among children aged 3 to 12 years. The study concluded that 91% of the children had BLLs above 5 µg/dl[19].

Georgia's fight against lead poisoning amongst its children[20]: In recent years, Georgia, a nation with a population of 3.7 million in the Caucuses, has emerged as a noteworthy example among Low- and Middle-Income Countries (LMICs) for its swift and seemingly successful endeavours to comprehend and alleviate the impact of childhood lead poisoning. Prior to 2018, Georgia lacked comprehensive data on the prevalence or severity of lead poisoning. Triggered by small-scale surveys and international collaborations, the government-initiated investigations, revealing alarming lead levels in spices, paint within educational institutions, and other sources. Subsequent blood lead testing in children exposed significant levels, prompting governmental actions. The Government of Georgia, in collaboration with organisations like UNICEF and Pure Earth, implemented measures such as creating an Inter-sectoral Coordination Council, launching an action plan, introducing testing and treatment protocols, and establishing regulations for lead in toys and spices. The enforcement campaign and public information initiatives yielded positive outcomes, showcasing a notable reduction in lead contamination levels. Georgia's remedial actions, particularly in regulating spice contamination, likely contributed to broader positive effects, as evidenced by a significant decline in blood lead levels among NYC children with Georgian

[18] Wani, A. L., Ara, A., & Usmani, J. A. (2015). Lead toxicity: a review. Interdisciplinary toxicology, 8(2), 55–64. https://doi.org/10.1515/intox-2015-0009

[19] Ansari, J. A., Mahdi, A. A., Malik, P. S., & Jafar, T. (2020). Blood Lead Levels in Children Living Near an Informal Lead Battery Recycling Workshop in Patna, Bihar. *Journal of health & pollution*, *10*(25), 200308. https://doi.org/10.5696/2156-9614-10.25.200308.

[20] Rachel Silverman Bonnifield, & Rory Todd. (2023). Opportunities for the G7 to address the global crisis of lead poisoning in the 21st century: A rapid stocktaking report. Center for Global Development. https://www.cgdev.org/publication/opportunities-g7-address-global-crisis-lead-poisoning-21st-century-rapid-stocktaking

ancestry between 2017 and 2020. These efforts underscore the importance of comprehensive approaches and international collaborations in addressing lead poisoning challenges.

III. Status of Lead- Application, Employment and Economy

A. Status of Lead

Production: Lead is obtained from various ores extracted through underground mining. Several ores contain varying percentages of lead, but typically only three are utilised for lead production. Galena is the most prevalent ore, primarily consisting of lead and sulphur. The other two ores employed in lead production are Cerussite and Anglesite. Collectively, these three ores contribute to 95% of the total lead mining output. However, these deposits commonly feature other ores more prominently, such as silver and zinc. Consequently, lead is often a by-product of silver and zinc mining activities. Only 50% of global lead production arises from direct mining efforts, with the remaining half sourced from recycling, notably from used car batteries.[21]

As per information provided in the Mineral Commodity Summaries - Lead 2022 Report[22] from the United States Geological Survey, China holds the top position as the leading global producer of lead, producing a substantial two million metric tonnes in 2021. Following China, the countries with significant lead production include Australia, the United States, Peru, and Mexico. India is ranked as the seventh-largest lead producer worldwide.[23]

Application: Lead has been used since Roman times for making paints, pipes corrosion resistant, plumbing, coinage, and as an ingredient in cosmetics.[24] Given its widespread availability, it finds application in the manufacturing of storage batteries and the production of chemicals, paints, and fuel additives. Additionally, lead is utilised in the production of various metal products such as sheets, solder, and pipes. Lead is an important part of chemical tank liners and of radiation shields in telephone and power cable conduit. It also is used in solder for

[21] Lead. (2021, March 18). Agiboo. https://www.agiboo.com/lead/
[22] (U.S. Geological Survey, Mineral Commodity Summaries. (2022, January). U.S. Geological Survey Publications Warehouse. https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-lead.pdf
[23] (n.d.). Illinois Department of Public Health. https://dph.illinois.gov/content/dam/soi/en/web/idph/files/publications/leadin-industry-042016.pdf
[24] *Ibid*

plumbing and some paints, especially those for ships where corrosion can be a significant problem. Bullets, pottery, crystal glassware, wire, and stained-glass windows all may require lead.[25]

The main application of lead is in the battery production industry, with vehicle batteries accounting for **80% within the industry**. Other types of batteries are produced for motorcycles, planes, tanks, trains, tractors, factories, energy, wharves, and export.[26] In the contemporary era, our growing dependence on technology has led to an increasing need for rechargeable batteries. These batteries have become omnipresent, serving a variety of purposes from handheld devices to the automotive sector and household inverters. While small electronic gadgets may use different types of batteries, most rechargeable batteries employed today are based on lead-acid technology. Lead-acid batteries are particularly in high demand in the automotive sector, closely followed by household inverters and decentralised electrification systems. Notably, in India, the vehicle count surged from 55 million in 2001 to 326.3 million in 2022[27], contributing to a heightened demand for lead-acid batteries.

Lead oxide is mainly used for battery paste in lead-acid batteries, as well as in the production of plastic stabilizers, rubber vulcanization agents, ceramic glaze additives, ray proof glass, optical glass and crystal glass, and various kinds of paints, coatings etc.[28] In addition, it can also be used in the post and telecommunications industries, metallurgy, chemical industry, railways, transportation, construction, weapons, aerospace, aviation, oil and other industries.

Global Demand

Even though there is increasing resistance to new lead projects worldwide, primarily due to environmental apprehensions, the lead market is anticipated to expand significantly. The market size is projected to increase from USD 19.6 billion in 2022 to USD 30.78 billion by 2030, indicating a Compound Annual Growth Rate (CAGR) of 5.8% during the forecast period from

[25] *Ibid*
[26] Asian Metal. (n.d.). Lead: Uses, applications-metalpedia. Metalpedia - The World's Largest Metalpedia Information Center. https://metalpedia.asianmetal.com/metal/lead/application.shtml
[27] Number of vehicles in operation across India from the financial year 1951 to 2020. (2023, February 7). Statista. https://www.statista.com/statistics/664729/total-number-of-vehicles-india/
[28] *Lead: Uses, applications-metalpedia*. (n.d.). Metalpedia - The World's Largest Metalpedia Information Center. https://metalpedia.asianmetal.com/metal/lead/application.shtml

2023 to 2030[29]. A key contributing factor to this growth in the global lead market is the rising demand for batteries, particularly in the automotive sector. Lead-acid batteries, extensively utilised in vehicles to power starting, lighting, and ignition systems, play a pivotal role in driving this market expansion. The Chinese and Indian automotive sectors are expected to be the main drivers of global demand along with other Asian countries. As per information extracted from the Ministry of Mines' Monthly Summary on Minerals and Non-Ferrous Metals in November 2023[30], global lead metal production for the period of April to November 2023 amounted to approximately 6,418 thousand metric tonnes, while global consumption reached 6,248 thousand metric tonnes. Notably, India contributed 8% to the world's lead metal production during the same April-November 2023 timeframe.

B. Scenario in India

In 2021, lead consumption in India saw a slight increase from 1 million metric tons (Mt) to 1.11 Mt, while refined lead production rose from 1 Mt in the calendar year 2020 to 1.14 Mt in the calendar year 2021.[31] Within the production, 0.23 Mt was attributed to primary production, and 0.91 Mt was from secondary production. India remains an appealing market for lead, with anticipated demand showing a steady growth trajectory averaging 6.4% until 2031, according to WoodMac's estimates[32]. This growth is expected to be primarily fuelled by the automotive sector and the market for inverter batteries. Additionally, emerging opportunities such as energy storage for electricity generated from photovoltaics (PV) are expected to contribute to increased demand, aligning with India's ambitious plan to significantly expand its solar PV capacity by 2030.

Leading domestic battery manufacturers are actively expanding their capabilities for lead-acid battery production in response to sustained demand. Beyond the automotive sector, the industrial battery segment, serving data centres, financial institutions, and the telecom industry, continues to experience robust growth, in line with the ongoing digitalization trend in the country.

India Working Group on Lead Poisoning: India Working Group (IWG) on Lead Poisoning, chaired by Dr.

[29] Global lead market size and forecast to 2030. (2023, July). Top Market Research Intelligence and Consulting Firm | SkyQuest Technology Consulting Pvt. Ltd. https://www.skyquestt.com/report/lead-market
[30] Monthy Summary on Minerals and Non-ferrous Metals. (2023). Ministry of Mines, Government of India. https://mines.gov.in/admin/storage/ckeditor/_for_November_2023_1704092479.pdf
[31] *Lead. (*n.d.). HZL. https://www.hzlindia.com/E-Annual-Report/2021-22/lead.html
[32] Global lead market size and forecast to 2030. (2023, July). Top Market Research Intelligence and Consulting Firm | SkyQuest Technology Consulting Pvt. Ltd. https://www.skyquestt.com/report/lead-market

Indu Bhushan, Distinguished Fellow at Pahle India Foundation and Former CEO of Ayushman Bharat, has been established through a collaboration between Pahle India Foundation and Pure Earth. With India's senior-most doctors, scientists, and public health professionals as members, the IWG convened its inaugural meeting in New Delhi in September 2023. During this session, the group collectively formulated specific action points aimed at expanding the research foundation and enhancing available data pertaining to lead poisoning.[33]

IV. Sources and Pathways of Lead Exposure

Lead is an inherent heavy metal known for its harmful effects on living organisms, especially when present at high levels. Over thousands of years, lead has naturally existed without significant risks in its original state. However, due to human activities such as mining, extraction, and industrial utilisation, lead has become more pervasive, leading to increased exposure to humans. Lead toxicity arises from multiple sources, including occupational exposure, household items like lead-based paint, and contaminated food, particularly spices. The situation is exacerbated by weak enforcement of regulations, such as those related to lead-acid battery recycling and lead content in paints.

Unfortunately, lead is now pervasive in the surroundings where children reside. This includes the air they breathe, the water they drink, the soil they traverse, the food they consume, the painted surfaces they touch, and even some of the toys they engage with. Lead can enter the body through ingestion, inhalation, and dermal contact. In one of the cases of lead poisoning found in a child in Uttar Pradesh, the source was traced back to his father's battery recycling operation at home, highlighting the various ways lead can enter the human body.[34]

Here are a few sources and their pathways listed below:

a. **Leaded Petrol**

The practice of mixing lead into petrol can be traced back to the first half of the 20th century. The reason was that it is an 'antiknock agent' which improved the efficiency of vehicles and the

[33] Pahle India Foundation. (2023, October). Lead poisoning https://pahleindia.org/lead-poisoning/

[34] Element of mystery: Lead poisoning is a huge public health concern for India; here's why. (2023, February 16). https://www.downtoearth.org.in/news/health/element-of-mystery-lead-poisoning-is-a-huge-public-health-concern-for-india-here-s-why-87098

performance of the engine.[35] It turned clunky engines into smoothly running engines. But lead proved to be a toxic pollutant – particularly for children. Using it in gasoline was polluting the air in towns and cities across the world, with large impacts to human health.[36] Humans can encounter lead through air pollution either by directly inhaling it or by incidentally ingesting lead that has settled onto soil or dust. **The primary way humans are exposed to lead initially released into the air is through the ingestion of lead settled on surfaces.**[37] Ingestion of lead settled onto surfaces is the main route of human exposure to lead originally released into the air. Between 1926 and 1985, 7 million tonnes of lead were combusted as gasoline additives in the United States. As a result, lead particulate matter was released into the air and became a major historical source of lead exposure for both children and adults. It wasn't until 1969 that the first clinical studies showed that it had toxic impacts on humans. From there, the evidence of the extent of lead poisoning, and its potential link with poor cognitive performance in children, continued to grow.

In response, many countries began to phase out leaded gasoline in the 1970s. The US Environmental Protection Agency, for example, issued guidelines to reduce lead content in 1983. But it wasn't until 1986 – six decades after its introduction – that Japan became the first country to ban it completely. Three and a half decades later – in 2021 – Algeria became the last country to ban it.[38]

In India, the National Ambient Air Quality Standards (NAAQS) set forth permissible thresholds for lead levels in the atmosphere.[39]

Following the phase-out of leaded gasoline in 2000, India experienced a significant shift in its atmospheric lead emissions landscape.[40] Prior to the ban, approximately 2100 tons of atmospheric lead were emitted annually from gasoline combustion. However, with the

[35] How the world eliminated lead from gasoline. (n.d.). Our World in Data. https://ourworldindata.org/leaded-gasoline-phase-out#:~:text=The%20US%20Environment%20Protection%20Agency,4

[36] EL-Fadel, M. & Hashisho, Z. (2001). Phase-out of leaded gasoline in developing countries: Approaches and prospects for Lebanon. *Journal of Environmental Assessment Policy and Management*, *3*(1), 35–59. http://www.jstor.org/stable/enviassepolimana.3.1.35

[37] Texas Commission on Air Quality. (n.d.). Air pollution from lead. https://www.tceq.texas.gov/airquality/sip/criteria-pollutants/sip-lead

[38] Leaded petrol era 'officially over' as Algeria ends pump sales. (2021, August 30). The Guardian. https://www.theguardian.com/environment/2021/aug/30/leaded-petrol-era-officially-over-as-algeria-ends-pump-sales

[39] Ministry of Environment, Forest and Climate Change. (2019). National Clean Air Programme. Government of India. https://moef.gov.in/wp-content/uploads/2019/05/NCAP_Report.pdf

[40] Singh, R. P. (2022). Chapter 23 - Sources of lead (Pb) in atmosphere over Indian cities and health impacts. In Asian atmospheric pollution: Sources, characteristics and impacts (pp. 435-452). Elsevier. https://www.sciencedirect.com/science/article/abs/pii/B9780128166932000147

prohibition of leaded gasoline, coal combustion emerged as the predominant source of atmospheric lead in the country.[41]

A study examining atmospheric lead levels across various Indian cities, indicates that following the phase-out of leaded gasoline, air quality in most urban areas adhered to the National Ambient Air Quality Standards.[42] However, instances of lead concentration exceeding these limits were observed, particularly in the National Capital Region, during specific periods of the year.[43]

This underscores the complexity of managing lead pollution in India's urban environments, necessitating targeted strategies to mitigate emissions from multiple sources and ensure compliance with air quality standards. Nevertheless, there exists a lack of research assessing compliance with these standards and identifying if any specific regions within India are prone to lead exposure or serve as hotspots for diseases which may be caused by lead exposure.

b. Lead Acid Batteries

The expanding automotive industry has led to an increased demand for lead, primarily to produce lead-acid batteries essential for the efficient operation of vehicles. This trend persists despite mounting environmental apprehensions regarding lead usage. The well-established performance of lead-acid batteries, their availability and lower capital cost has made them a prevalent choice, particularly in electric vehicles, owing to the familiarity of vehicle designers with this technology. Today, approximately 85% of the lead used worldwide goes into the production of lead-acid batteries.[44]

Nearly all the lead utilised in lead-acid batteries can be reclaimed and reused. However, in many low- and middle-income nations, the absence of similar regulations and the lack of enforcement mechanisms pose challenges in ensuring the safe and environmentally responsible recycling of used lead-acid batteries (ULAB). In India, over 50,000 tons of battery waste, encompassing both dry and wet lead-acid batteries[45], is generated annually. Initially, the legal framework addressing battery waste was confined to lead-acid batteries. However, the Government of India, Ministry of

[41] *Ibid*
[42] *Ibid*
[43] *Ibid*
[44] *Used lead acid batteries (ULAB) - Waste lead acid batteries (WLAB)*. (2024, February 13). UNEP - UN Environment Programme. https://www.unep.org/topics/chemicals-and-pollution-action/pollution-and-health/heavy-metals/used-lead-acid-batteries#:~:text=Approximately%2086%25%20of%20the%20total,supplies%20(ILA%2C%202019)
[45] Lead acid batteries may be wet or dry- wet means the acid is in liquid form, whereas dry means it is in solid form- like power, gel, etc.

Environment, Forest, and Climate Change, introduced the **Battery Waste Management Rules, 2022**, replacing the Batteries (Management and Handling) Rules, 2001. These 2022 rules broaden their scope to cover all types of batteries, including those found in automobiles, portable devices, industrial equipment, and electric vehicles.[46]

c. Spices, Cosmetics and Toys

Spices, while enhancing the flavour of food and providing various bioactive compounds, unfortunately, can also be tainted with potentially harmful substances such as the heavy metal lead (Pb). Additionally, the spice grinding machinery may contain lead, thereby contaminating processed foods. In certain instances, lead is intentionally added to spices to improve their colour and weight.

In a study conducted by Pure Earth, a US-based environmental non-profit, examining the contamination levels in commonly consumed spices in India, chilli powder and turmeric powder exhibited the highest lead levels, significantly surpassing permissible limits[47]. During the study from December 2022 to March 2023 across eight districts in Bihar, almost half of the samples not only exceeded the Food and Safety Standards of India (FSSAI) limit for lead in turmeric but also in three other spices (chilli, coriander, and mixed curry powder). Turmeric recorded the highest levels at 4,139 ppm, exceeding the FSSAI standard by over 400 times.[48]

Bangladesh victory over adulterated turmeric: In just two years, Bangladesh successfully eradicated lead contamination from its turmeric industry, once tainted due to lead-based pigments added for enhanced colour. From 2017 to 2021, a comprehensive approach was implemented, incorporating stringent regulations, swift detection of lead contamination, and public education to minimise lead-contaminated turmeric. Through a comprehensive campaign, authorities raised awareness, monitored markets, penalised illegal practices, and provided training to mill owners.[49] A study[50] revealed a significant reduction in the percentage of turmeric samples with detectable lead, decreasing from 47% before the intervention in 2019 to zero percent in 2021. Moreover, the affected population witnessed a median decrease of 30% in blood lead levels 16 months post-

[46] Batteries Waste Management Rules, 2022. (2022). Lawbrit. https://www.lawrbit.com/article/batteries-waste-management-rules/
[47] Sonal, S. (2023, November 12). Trendy to toxic: Is turmeric losing its golden hue?. The Times of India. https://timesofindia.indiatimes.com/home/sunday-times/trendy-to-toxic-is-turmeric-losing-its-golden-hue/articleshow/105159206.cms?from=mdr
[48] Sonal, S. (2023, November 12). *Trendy to toxic: Is turmeric losing its golden hue? - Times of India.* The Times of India. https://timesofindia.indiatimes.com/home/sunday-times/trendy-to-toxic-is-turmeric-losing-its-golden-hue/articleshow/105159206.cms?from=mdr
[49] Lead-tainted turmeric: How Bangladesh triumphed over a silent killer in golden spice. (2024, January 13). The Business Standard. https://www.tbsnews.net/analysis/lead-tainted-turmeric-how-bangladesh-triumphed-over-silent-killer-golden-spice-774026
[50] Forsyth, J. E., & Et.al. (2023). Food safety policy enforcement and associated actions reduce lead chromate adulteration in turmeric across Bangladesh. Environmental Research, 232, 116328. https://doi.org/10.1016/j.envres.2023.116328

intervention. An initial assessment conducted by the New York-based environmental NGO Pure Earth revealed that the campaign to eliminate lead from Bangladesh's turmeric industry resulted in an additional year of healthy life for merely one dollar. In stark contrast, achieving equivalent health benefits through alternative means would have incurred an estimated cost of approximately $836.[51] This underscores the remarkable cost-effectiveness of the campaign and reinforces its significance in promoting public health at an exceptionally low economic expense. This successful intervention serves as a model that can be replicated in other neighbouring regions.[52]

A variety of chemicals are used in cosmetics as ingredients, and some are used as preservatives. These chemicals have different health effects. Lead is frequently included in cosmetic products, including traditional eyeliners found in many regions globally. The eyeliners, although widely used, pose a significant health risk as they often contain substantial quantities of lead along with other heavy metals. Items containing ingredients like kohl have been associated with lead poisoning, particularly in children, and are prohibited from being sold in the U.S. However, such products occasionally find their way into specialised markets within the country.[53]

According to the Bureau of Indian Standards (BIS), cosmetics can contain no more than 20 parts per million (ppm) of lead[54]. Despite the limit prescribed by the BIS, surma or kajal found in the market often contain excessive amounts of lead.

Conference to address lead poisoning in Bihar[55]: In July 2023, Pure Earth, the Institute of Environment and Eco-Development (IEED), Vital Strategies, and Mahavir Cancer Institute and Research Center organized a conference in Patna, Bihar, to address the issue of lead poisoning. The conference presented recent findings from blood lead level testing and home-based assessments in Bihar, aiming to understand the prevalence of lead poisoning and identify potential sources of exposure. Over 60 participants, including government and non-governmental representatives, attended the event. Results from assessments, including a survey of blood lead levels among children and pregnant women in eight districts, revealed alarming rates, with over 96% of urban children and over 88% of rural children having Blood Lead Levels (BLLs) above 5 µg/dL. Consumer product

[51] Sonal, S. (2023, November 12). *Trendy to toxic: Is turmeric losing its golden hue? - Times of India.* The Times of India. https://timesofindia.indiatimes.com/home/sunday-times/trendy-to-toxic-is-turmeric-losing-its-golden-hue/articleshow/105159206.cms?from=mdr

[52] Bhushan, I., & Swaminathan, S. (2023, August 26). Indu Bhushan and Soumya Swaminathan write: India's hidden Adversary, lead poisoning. The Indian Express . https://indianexpress.com/article/opinion/columns/a-hidden-adversary-despite-being-a-recognised-global-concern-lead-poisoning-is-unaddressed-8909773/

[53] Lead in cosmetics. (2022, February 25). U.S. Food and Drug Administration. https://www.fda.gov/cosmetics/potential-contaminants-cosmetics/lead-cosmetics

[54] Sahu, R., Saxena, P., & Johnson, S. (2014, January). Heavy Metals in Cosmetics. Centre for Science and Environment. https://cdn.cseindia.org/userfiles/Heavy_Metals_in_Cosmetics_Report.pdf

[55] Berg, S. (2023, November 8). India: Government committees to make Bihar a lead pollution-free state. Pure Earth. https://www.pureearth.org/india-government-committees-to-make-bihar-a-lead-pollution-free-state/

samples collected from households showed approximately 55% containing high lead levels, notably in spices, aluminium cookware, paint, and toys. Bihar has the highest average BLL among Indian states. The conference emphasised the urgent need for action, with the Minister of Industries, Sri Samir Kumar Mahaseth, calling for immediate steps to identify, control, and remove lead contamination, particularly in the supply chain of local turmeric and spices. The government expressed commitment to making Bihar lead pollution-free.

Several recommendations were proposed for the Government of Bihar to address the lead poisoning crisis.[56] Firstly, the establishment of an Interdepartmental Lead Coordination Group, housed in the Department of Health, was suggested to oversee all activities related to lead exposure. Blood lead level testing for children and pregnant women was suggested to be integrated into state health and wellness clinics, primary health centres, maternity centres, and schools, or added to state and national health surveys. Source analysis was suggested to be crucial to identify reasons for elevated BLLs in specific urban and rural areas, informing targeted interventions. Effective actions were outlined to eliminate known lead exposure sources, such as adulterated spices, inexpensive cookware, improper battery recycling, lead in local paint, Ayurvedic medicines, and traditional cosmetic products. Additionally, a state-led awareness campaign was recommended to bridge knowledge gaps, raise awareness about the issue, and emphasise the urgency and solutions through various media channels and public events.

Lead is employed in the manufacturing of toys to impart flexibility to plastic. Lead is invisible to the naked eye and has no smell. Children may be exposed to lead from consumer products through normal hand-to-mouth activity. As part of normal development, young children often place their toys, fingers, and other objects in their mouth, which puts them in contact with the lead paint or dust. Children may encounter lead exposure through toys either imported from other nations or inherited as antique toys and collectibles passed down through family generations[57]. The interdependence of the global supply chain means that the presence of lead in spices, cosmetics, and toys in one country can impact children's exposure to lead in another country. Other products that have been found to contain lead include crayons, chalk, and clothing.

d. Ceramics and Cookware

In the context of cookware, lead exposure can occur when it is present in the materials used to manufacture pots, pans, and other cooking utensils. While lead was historically used in the

[56] *Ibid*
[57] Toys and Childhood Lead Exposure. (n.d.). National Center for Healthy Housing | NCHH. https://nchh.org/resource-library/Fact_Sheet_Lead_In_Toys.pdf

production of some cookware, modern health and safety standards generally prohibit its use due to its potential health hazards. In September 2023, Pure Earth released the results of its worldwide Rapid Market Screening (RMS) investigation into the sources of lead contamination, covering over 5,000 samples of consumer goods and food items across 25 low- and middle-income countries.[58] This extensive global survey, the most comprehensive of its kind, revealed elevated levels of lead surpassing established reference levels outlined in public health guidelines or regulatory standards. Specifically, metal foodware exhibited a prevalence rate of 52%, ceramic foodware at 45%, various types of paint ranging from 11% to 48%, toys at 13%, and cosmetics at 12%.[59] These findings align with recent World Bank data featured in The Lancet Planetary Health, underscoring the significant health risks associated with lead exposure.

Addressing a roundtable convened by the Center for Global Development, in partnership with Pahle India Foundation, Pure Earth, Asian Development Bank and UNICEF last year, Union Health Secretary had emphasised the presence of lead in cheap cookware, traditional medicines and in cosmetics is a problem and there is still a significant lack of awareness of this problem at the highest levels. He had further stressed that there is a need to build awareness of lead poisoning into the network of 160,000 Ayushman Bharat Health and wellness clinics operating in India.[60]

e. Paints

Lead exposure through paint is a significant health concern, particularly in older buildings where lead-based paint may have been used. Paint is a frequently utilised commodity, making it the nearest and most immediate origin of lead exposure for humans. The addition of lead shortens the drying time of the paint, increases its durability, and its moisture resistance.[61] It has adverse effects on the children as they have the tendency to chew on the surfaces of the walls which tastes sweet thereby encouraging more chewing. In response to the risk posed by the lead paints, the United States banned the lead paint for households in 1978.

[58] Lead in Consumer Goods: A 25-Country Analysis of Lead (Pb) levels in 5000+ Products and Goods. (n.d.). Pure Earth. https://www.pureearth.org/wp-content/uploads/2023/11/Pure-Earth-RMS-Final-Report.pdf
[59] *Ibid*
[60] *Need to create awareness about lead poisoning, says health Secretary.* (2023, April 25). ET Health World. https://health.economictimes.indiatimes.com/news/policy/need-to-create-awareness-about-lead-poisoning-says-health-secretary/99764382
[61] *Lead in paint.* (2020, June 16). Sandberg. https://www.sandberg.co.uk/laboratories/chemistry/lead-in-paint/

90% of paint samples tested contain lead above permissible limits in India: A recent study by Toxics Link and International Pollutants Elimination Network (IPEN) reveals alarming levels of lead in paints used for houses in India. The analysis of 51 paints available in the Indian market shows that over 90% of them contain lead concentrations exceeding the Central government's permissible limit of 90 parts per million (ppm). Furthermore, 76.4% of these paints exceed the limit by more than 111 times. The study emphasises the poor market surveillance and the need for stricter enforcement of regulations to curb the sale of paints with excessive lead content.[62]

A noteworthy aspect is that many of the above-mentioned sources are associated with small-scale manufacturers (SMEs), making it challenging to effectively monitor and regulate the adulteration transpiring in various pockets of the country.

Lead Contamination in Tamil Nadu Paints: In a study conducted by New Delhi-based Toxics Links in November-December 2019 had revealed a disturbing reality of lead contamination persisting in paints in Tamil Nadu, India, despite the enforcement of a new law (Regulation on Lead Contents in Household and Decorative Paint Rules 2016) enacted two years earlier to regulate lead presence. The analysis of 32 paint samples from various states, including Tamil Nadu, exposed a critical issue – a sample from the state exhibited an alarming lead content of 1,82,000 parts per million (ppm), significantly exceeding the permissible 90 ppm limit. The study underscored a nationwide problem, indicating poor implementation of regulations and raising questions about product approval processes. Notably, all four paint samples from Tamil Nadu surpassed the permissible limit, with one reaching 1,86,062 ppm and another 1,61,052 ppm. The absence of a certification system for lead-safe paints and the call for strict enforcement by regulatory bodies, such as the Central Pollution Control Board and State Pollution Control Boards, were crucial findings, emphasising the need for urgent and effective measures to address this public health concern.[63]

V. Health Impacts of Lead Exposure

A. Impact on various aspects of health

Lead exposure, albeit a global impediment on human health remains a severely overlooked threat to health. Exposure to lead exacts a significant toll on human health across ages and across nations. Annual deaths due to lead exposure accounts to 900,000, with 230,000 (26%) deaths in

[62] *90% of paint samples tested contain lead above permissible limits in India: Study.* (2023, October 27). The Hindu. https://www.thehindu.com/news/national/90-of-paint-samples-tested-contain-lead-above-permissible-limits-in-india-study/article67463217.ece
[63] Oppili, P,. (2020, June 23). Tamil Nadu: Paints continue to have more lead than prescribed. *The Times of India*. http://timesofindia.indiatimes.com/articleshow/76528281.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.

India alone.[64] Deaths due to lead exposure have also increased by 21% in India since 1990.[65] People get exposed to lead commonly through ingestion, inhalation, and skin absorption. Lead impacts almost every organ within the human body, leading to a range of physical and mental impairments.[66] As per WHO, there is no safe blood lead concentration[67] and even the lowest levels of lead in blood can cause damage on the permanent side, more so in children than in adults. Lead exposure is projected to contribute to the loss of 21.7 million years in terms of disability and death globally, as measured by disability-adjusted life years (DALYs). This estimation considers the enduring health consequences, including 30% of the worldwide burden of idiopathic intellectual disability, 4.6% of the global burden of cardiovascular disease, and 3% of the global burden of chronic kidney diseases.[68]

MoU for preventing childhood lead poisoning[69]: Vital Strategies, a global Public Health Organization has entered into a memorandum of understanding (MoU) with the Commissionerate of Health Services in Maharashtra province, with an aim to extend its existing partnership on environmental health. This expanded collaboration will specifically focus on preventing childhood lead poisoning. It is proposed that the organisation will offer technical support to enhance surveillance, enabling a better understanding of the issue's severity. Additionally, the organisation will work towards building the capabilities of healthcare professionals to effectively recognize, treat, and prevent childhood lead poisoning.

a. Neurological and Cognitive Impairments

A 2020 report[70] found that one in three children globally gets exposed to lead poisoning. The metal is a potent neurological and cardiovascular toxicant.[71] It can cause permanent damage affecting both brain development and development of the central nervous system in children,

[64] Rakesh Kumar et al., (2022). Assessment of Lead Impact on Human and India's Response. https://www.pureearth.org/wp-content/uploads/2022/06/Lead-Report-India-CSIR-NITI-Ayog-June-2022.pdf
[65] *Ibid*
[66] Kumar, S. (2018). Occupational and environmental exposure to lead and reproductive health impairment: An overview. *Indian Journal of Occupational and Environmental Medicine*, *22*(3), 128. https://doi.org/10.4103/ijoem.ijoem_126_18 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6309352
[67] Lead Poisoning. (2023, August). World Health Organization https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health
[68] Rakesh Kumar et al., (2022) Assessment of Lead Impact on Human and India's Response. https://www.pureearth.org/wp-content/uploads/2022/06/Lead-Report-India-CSIR-NITI-Ayog-June-2022.pdf
[69] *Working to eliminate the threat of childhood lead poisoning in India*. (2024, January 16). Vital Strategies. https://www.vitalstrategies.org/working-to-eliminate-the-threat-of-childhood-lead-poisoning-in-india/.
[70] *Ibid*
[71] *Ibid*

including foetuses in the womb.[72] Blood lead concentration as low as 3.5 µg/dL can result in decreased intelligence in children, behavioural difficulties and learning problems.[73] Whereas higher blood lead concentration can cause severe damage to the brain and central nervous system resulting in coma, convulsions and even death. A study[74] found that children with blood lead levels as low as 5 µg/dL have been found to score 3-5 or more points lower on intelligence tests than do their peers without elevated blood lead levels. Children exposed to high levels of lead might experience lasting intellectual disability and behavioural changes like reduced attention span, antisocial characteristics as well as reduced educational attainment. Some studies have also highlighted the nexus between aggression and criminal behaviour in persons exposed early in life.

One measurable neuropsychological effect of lead exposure in early childhood is IQ loss.[75] A study[76] found that children under the age of five experienced a staggering loss of 765 million IQ points globally, with Indian children accounting for up to 154 million estimated IQ points lost due to lead exposure. Anaemia, hypertension, renal impairment, immunotoxicity and toxicity to the reproductive organs are some of the other health effects of lead exposure in children.[77]

b. Cardiovascular Effects

Lead exposure contributes to a major portion of global burdens, including 12.4% of idiopathic developmental intellectual disability, 2.5% of ischemic heart disease, and 2.4% of stroke. A report[78] revealed that lead exposure significantly increases the risk of cardiovascular disease, accounting for nearly 95% of deaths associated with the same. In 2019, approximately 5.5 million adults globally, and 1.06 million in India, succumbed to lead exposure-related cardiovascular disease. The burden is disproportionately higher in low- and middle-income

[72] *Ibid*
[73] World Health Organization. (2023). Lead Poisoning. https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health
[74] Rakesh Kumar et al., (2022). Assessment of Lead Impact on Human and India's Response. https://www.pureearth.org/wp-contehttps://www.pureearth.org/wp-content/uploads/2022/06/Lead-Report-India-CSIR-NITI-Ayog-June-2022.pdf
[75] Larsen, B., & Sánchez-Triana, E. (2023). Global health burden and cost of lead exposure in children and adults: A health impact and economic modelling analysis. *The Lancet Planetary Health*, *7*(10), e831-e840. https://doi.org/10.1016/s2542-5196(23)00166-3 https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(23)00166-3/fulltext
[76] *Ibid*
[77] World Health Organization. (2023). Lead Poisoning. https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health
[78] Larsen, B., & Sánchez-Triana, E. (2023). Global health burden and cost of lead exposure in children and adults: A health impact and economic modelling analysis. *The Lancet Planetary Health*, *7*(10), e831-e840. https://doi.org/10.1016/s2542-5196(23)00166-3 https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(23)00166-3/fulltext

countries, constituting around 90–95% of the global impact. In India, this statistic stands at 19%, underscoring the severe health consequences.

c. Reproductive Health

Apart from neurological and cognitive impairments, and cardiovascular diseases, lead also contributes to severe reproductive health problems in adults. Studies have highlighted a link between lead exposure and reproductive disturbances, emphasising the wide-ranging impact on human health. Women exhibit greater susceptibility to lead than men. Lead, accumulated in bones from previous exposure, is released into the bloodstream during pregnancy, impacting target organs and endangering the foetus. Even at low levels, maternal exposure to lead can lead to diminished foetal growth, lower birth weight, premature birth, and spontaneous abortion. However, pregnant women exposed to high lead levels may experience miscarriage, premature birth, stillbirth, and low birth weight.[79] Heavy metals are known to cause miscarriages among women in developing nations. For instance, Nigerian women who had experienced previous miscarriages exhibited blood lead levels exceeding 25 µg/dL during pregnancy, linked to an approximately 41.61% rise in the incidence of miscarriage.[80]

Other Effects

Other health effects from long-term lead exposure also include chronic kidney diseases and elevated blood pressure in adults. Current scientific investigations are examining the possibility that even minimal lead exposure might additionally contribute to conditions like amyotrophic lateral sclerosis, Alzheimer's disease, and antimicrobial resistance.[81] However, it's important to note that these connections are yet to be substantiated.

B. Correlation between Lead, Air Pollution, and its impact on health

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) identifies lead exposure as the fourth major environmental health risk factor, following ambient particulate matter air pollution, household air pollution from solid fuels, and unsafe household drinking water, sanitation, and handwashing. Humans are exposed to lead through suspended particles in the air,

[79] UNICEF. (2022). Childhood Lead Exposure: Key Messages https://mail-attachment.googleusercontent.com/attachment/
[80] Amadi CN, Igweze ZN, Orisakwe OE. (2017). Heavy metals in miscarriages and stillbirths in developing nations. *Middle East Fertil Soc J.*;22:91–100.
[81] Silverman Bonnifield, R., Todd, R., & Center for Global Development. (2023). A call to action to end childhood lead poisoning worldwide [Report]. Center for Global Development. https://www.cgdev.org/sites/default/files/call-action-end-childhood-lead-poisoning-worldwide.pdf.

as lead can be inhaled through the respiratory system in the form of lead or lead dust[82], particularly during the lead-acid battery recycling process.

Lead acid batteries are made up of lead plates and sulfuric acid that are contained within a plastic cover. These batteries often undergo recycling or disposal. However, inadequately regulated ULAB recycling processes contribute significantly to toxic exposure. For instance, the melting of lead plates without proper fume control mechanisms can disperse heavy metals up to 15-20 km, exposing individuals involved in recycling and posing a threat to surrounding communities. It is to be noted that ULAB recycling mostly takes places in low- and middle-income countries, particularly in densely populated urban areas[83], often managed by the economically vulnerable population, unaware about the potential dangers associated with the recycling process.[84] Inhalation of lead toxins, especially during the melting of lead plates, remains a significant exposure pathway. Metal particles released during this process can enter respiratory and circulatory systems, with excess lead dust accumulating on various surfaces such as clothing, bedding, furniture, and even food posing pervasive hazards in communities. Dry soil contaminated with lead particles further spreads lead dust, increasing risk of inhalation or direct contact.

Lead Source Apportionment Studies[85]: Pure Earth's inaugural lead source-apportionment study conducted in Patna in 2020 brought to light the significant role of spices, especially lead-laden turmeric and red chili powder, in contributing to elevated blood lead levels (BLLs) in approximately 85% of tested children. These spices, integral to daily Indian meals, are susceptible to adulteration, a well-known issue in the South Asia region. The study underscores the critical need to monitor lead contamination in these essential ingredients due to the associated serious health risks. In collaboration with Stanford University and others, Pure Earth is actively involved in collecting authentic information on supply chains and comprehending the scope of adulteration in four states (Bihar, eastern parts of Uttar Pradesh, West Bengal, and Jharkhand). Additionally, Rapid Market Screening Programs in Maharashtra, Uttar Pradesh, and Tamil Nadu have identified commonly contaminated products with lead in India, including aluminium cookware and food wares, ceramic food wares, toys, local paint, spices, khol (eyeliner), among others.

[82] Centers for Disease Control and Prevention. (n.d.). "Health Effects of Lead Exposure https://www.cdc.gov/nceh/lead/prevention/health-effects.htm

[83] Used Lead Acid Batteries (ULAB) - Waste Lead Acid Batteries. (n.d.). UNEP UN Environment Programme https://www.unep.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/used-lead-acid-batteries-ulab-waste-lead

[84] *Ibid*

[85] "Lead Crisis- A solvable environmental health crisis", Pure Earth.

VI. Vulnerable Populations

Even though lead harms people across ages, children and pregnant women are more susceptible to its harm than others. Even minimal lead exposure endangers their health, potentially causing irreversible damage to brain development. Childhood lead poisoning often affects the poorest children most severely, with no visible symptoms, underscoring the urgent need for targeted interventions to protect vulnerable populations from this pervasive and overlooked threat.

Children, with their developing nervous systems, are more prone to the effects of lead exposure than adults receiving the same magnitude of exposure.[86] As per a 2021 WHO report, children absorb 4-5 times more Pb from the gut than adults which makes them more vulnerable to lead poisoning. Furthermore, during the oral phase of child development, infants are prone to ingesting Pb-coated substances as they habitually put various objects into their mouths. This constitutes the primary pathway of lead intake in children, especially those with a psychological disorder known as pica, characterised by persistent and compulsive cravings to consume non-food items (WHO, 2021).

A 2020 report highlighted that children globally face a heightened risk of lead exposure, with up to 800 million children, or one in three, exhibiting elevated blood lead levels at or above 5 µg/dL, a concern exacerbated in low and middle-income countries. The economic burden of childhood lead exposure is estimated to cost low- and middle-income countries nearly 1 trillion international dollars, impacting society's most vulnerable members, including children and pregnant women. The report reveals that India is home to more than 275 million children, roughly half (50%) of the nation's child population, with blood lead levels (BLLs) exceeding the considered safe threshold of 5 µg/dL. This alarming statistic represents the highest number of lead poisoning cases in children recorded in any country. Regional disparities are evident, with states like Uttar Pradesh, Bihar, Madhya Pradesh, Jharkhand, Chhattisgarh, and Andhra Pradesh reporting average blood lead levels exceeding 7 µg/dL. Children living near Pb-acid battery recycling centres exhibit significantly higher BLLs, reaching alarming levels of 190 µg/dL.

[86] Kumar, S. (2018). Occupational and environmental exposure to lead and reproductive health impairment: An overview. *Indian Journal of Occupational and Environmental Medicine*, *22*(3), 128. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6309352

Social Inequalities - India bears the highest health and economic burden due to lead exposure in the world. It needs to be highlighted that socio-economic disparities play a significant role in increasing the amount of lead exposure among the vulnerable population including women, children, and the marginalised communities. It might be due to the occupations they are engaged in or the environment they inhabit. For instance, Pure Earth approximated that more than half of the batteries in India undergo recycling within the informal sector. People residing in proximity to these hazardous sites, predominantly consisting of impoverished and marginalised communities, face heightened exposure. Pure Earth assessed 500 toxic sites in India, revealing that over 80% of them were tainted with heavy metals, particularly in locations where hazardous lead-acid battery recycling was occurring.[87] Similarly, socio-economic disparity in lead poisoning is evident in low- and middle-income countries. A study[88] highlighted the existence of many hazardous waste sites in seven Asian countries, including India, Indonesia, and Philippines, where lead has been found as one of the main toxic pollutants. Additionally, the study highlighted that exposure patterns often point towards existing inequalities in socio-economic status, gender, culture, and education. The disparity in exposure patterns also compounds to inter-generational poverty resulting from past lead exposure, as the cognitive impairments from the same makes it difficult for people to exit the cycle of poverty either through education or formal employment.[89]

Portable tools for lead testing: Following discussions with Mr. Sandeep Dahiya, Director of Advocacy and Communication at Pure Earth[90], it was found out that portable testing tools like XRF devices hold the potential for assessing lead levels in the food supply chain, spanning from manufacturing units to local vendors. Mr. Dahiya highlighted the practicality of such devices, especially in areas where the ICP-MS technique employed by FSSAI may not be readily available. Despite potential accuracy differences compared to the FSSAI mechanism, these portable tools, including LeadCare II[91] which uses anodic stripping voltammetry (ASV) for lead testing, proving valuable for remote lead presence testing. Looking ahead, Vital Strategies and the Health Department of Tamil

[87] Singh, Ananya. (2022, October 14). How Social Inequalities Drive Lead Poisoning in Half of India's Children. *The Swaddle* https://www.theswaddle.com/how-social-inequalities-drive-lead-poisoning-in-half-of-indias-children

[88] Kordas, K., Ravenscroft, J., Cao, Y., & McLean, E. V. (2018). Lead exposure in low and middle-income countries: Perspectives and lessons on patterns, injustices, economics, and politics. *International Journal of Environmental Research and Public Health*, *15*(11), 2351. https://doi.org/10.3390/ijerph15112351 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6266944/

[89] Singh, Ananya. (2022, October 14). How Social Inequalities Drive Lead Poisoning in Half of India's Children. *The Swaddle* https://www.theswaddle.com/how-social-inequalities-drive-lead-poisoning-in-half-of-indias-children

[90] The Authors had a discussion with Mr. Sandeep Dahiya on January 19, 2024 to understand the intricacies of lead poisoning and the work being undertaken by Pure Earth in that regard.

[91] Nakata, H., Nakayama, S. M., Yabe, J., Muzandu, K., Toyomaki, H., Yohannes, Y. B., Kataba, A., Zyambo, G., Ikenaka, Y., Choongo, K., & Ishizuka, M. (2021). Assessment of LeadCare® II analysis for testing of a wide range of blood lead levels in comparison with ICP–MS analysis. *Chemosphere*, *271*, 129832. https://doi.org/10.1016/j.chemosphere.2021.129832

Nadu are collaborating to conduct surveillance in the state using the portable analyzer LeadCare II in the upcoming months.[92]

VII. Policy and Legislative Framework

A. Global Policy Landscape

The most effective measure to safeguard individuals from the adverse effects of lead is the elimination of lead exposure at its source, achieved through the enactment of legislation prohibiting the manufacture, sale, and import of lead paint. In the 1970s and 1980s, numerous industrialised nations implemented laws or regulations aimed at controlling the lead content in residential and decorative paints.[93] These measures were driven by conclusive evidence indicating that lead-containing household paint constitutes a primary source of lead exposure in children. Despite these advancements, the persistence of lead usage in paint in various regions globally remains a noteworthy contributor to exposure. To ensure human health protection, it is imperative to establish and enforce laws, regulations, or standards in every country that effectively cease the production, sale, and importation of paints containing lead.[94]

In 2009, the International Conference on Chemicals Management (ICCM2) recognized lead in paint as a critical policy concern for collaborative risk reduction within the framework of the Strategic Approach to International Chemicals Management (SAICM). In response to this, the Global Alliance to Eliminate Lead Paint (Lead Paint Alliance) was established in 2011 through the joint efforts of the United Nations Environment Programme (UNEP) and the World Health Organization (WHO).[95] The primary objective of the Alliance is to globally phase out lead paint by advocating for the implementation of legally binding control measures in all countries. Subsequently, in 2017, the World Health Assembly endorsed a roadmap that seeks to enhance the engagement of the health sector in SAICM, with a specific emphasis on national initiatives to eliminate the use of lead paint. Additionally, in 2017, the United Nations Environmental

[92] *Working to eliminate the threat of childhood lead poisoning in India*. (2024, January 16). Vital Strategies. https://www.vitalstrategies.org/working-to-eliminate-the-threat-of-childhood-lead-poisoning-in-india/.
[93] *"Update on the global status of legal limits on lead in paint"*, WHO and Global Alliance to eliminate Lead Paint, December 2021.
[94] *Ibid*
[95] The Hindu Bureau. (2023, October 26). 90% of paint Samples Tested Contain Lead Above Permissible Limits in India: Study. *The Hindu*. https://www.thehindu.com/news/national/90-of-paint-samples-tested-contain-lead-above-permissible-limits-in-india-study/article67463217.ece.

Assembly adopted a resolution urging the elimination of lead paint exposure and endorsing the environmentally sound management of lead-acid batteries.[96]

The successful phase-out of leaded gasoline in a majority of countries, combined with various lead control measures, has demonstrated significant public health advantages, leading to a marked decrease in population-level blood lead concentrations across numerous nations.[97] As of July 2021, leaded fuel for automobiles and trucks is no longer available for sale globally.[98] However, as of March 31, 2023, only 48% of countries have officially confirmed the implementation of legally binding controls pertaining to the production, import, sale, and utilisation of lead paints.[99]

Mexico found Pottery as a source of lead exposure[100]: Mexico conducted a national survey in 2019 that shed light on the prevalence of lead poisoning, particularly in rural areas. The survey, encompassing 1400 individuals and led by the National Institute of Public Health (INSP), revealed that 22 percent of children exhibited elevated blood lead levels (BLLs), placing Mexico in the lower to middle range among Lower Middle-Income Countries. A notable finding implicated lead-glazed pottery as a significant source of exposure in rural Mexico, with 43 percent of children from households using such cookware showing elevated Blood-lead levels. Geographic and ethnic variations were observed, with the south and indigenous language speakers facing higher risks. Efforts to mitigate lead exposure from pottery included initiatives like Barro Aprobado, which encourages potters to adopt lead-free alternatives. However, challenges persisted, including lax enforcement of lead limits on pottery since 1993 and the intricate nature of the pottery manufacturing industry involving thousands of artisans. Other potential sources of lead exposure, such as lead paint and ULAB recycling, contribute to the complexity of the issue. Current regulations on lead in paint in Mexico fall short of global standards, and ULAB recycling faces challenges in terms of regulations and enforcement. The General Health Council of Mexico initiated an action program in 2019 to address lead exposure, encompassing monitoring, treatment, and initiatives to encourage the transition to non-lead glazes. The effectiveness of these measures awaits evaluation.

Numerous international agreements and initiatives address the global challenge of lead exposure. The Convention on Long-Range Transboundary Air Pollution, implements a protocol limiting

[96] World Health Organization. (2020). Global Elimination of Lead Paint Why and How Countries Should Take Action https://iris.who.int/bitstream/handle/10665/333812/9789240005167-eng.pdf?sequence=1.
[97] *End of Leaded Fuel Use a 'Milestone for Multilateralism'*. (2021, September 3). UN News. https://news.un.org/en/story/2021/08/1098792
[98] Angrand, R.C., Collins, G., Landrigan, P.J. *et al.* (2022) Relation of blood lead levels and lead in gasoline: an updated systematic review. *Environ Health* 21, 138 https://doi.org/10.1186/s12940-022-00936-x .
[99] World Health Organization. *Legally Binding Controls on Lead Paint.* https://www.who.int/data/gho/data/themes/topics/indicator-groups/legally-binding-controls-on-lead-paint.
[100] *"Opportunities for the G7 to Address the Global Crisis of Lead Poisoning in the 21st Century: A Rapid Stocktaking Report"*, Centre for Global Development, 2023.

emissions of heavy metals, including lead. The Organization for Economic Cooperation and Development (OECD) issued a 1996 Declaration on Risk Reduction for Lead, advocating national and international actions to diminish lead exposure, encompassing the reduction of lead in paint, ceramics, and crystal, as well as air emission restrictions. The 2002 World Summit on Sustainable Development committed to phasing out lead in various sources, including paints, to prevent human exposure, especially in children, emphasising monitoring, surveillance, and lead poisoning treatment. Many nations participate in the Strategic Approach to International Chemicals Management (SAICM), supporting international collaboration on chemicals management, and contribute to the Global Alliance to Eliminate Lead Paint.[101]

WHO is presently in the process of developing guidelines for the prevention of lead exposure, intending to furnish policymakers, public health authorities, and healthcare professionals with evidence-based recommendations on measures to safeguard the health of both children and adults against lead exposure.[102]

USAID launches a $4 million initiative to combat lead poisoning[103]: The US Government, through USAID, has launched a $4 million initiative to combat lead poisoning, with a focus on supporting developing nations in reducing lead in widely used consumer products such as paints and toys. USAID made this announcement at the World Economic Forum in Davos in January 2024, emphasising the need for a global effort to implement and enforce binding regulations on lead across various consumer goods. USAID announced its commitment of an initial $4 million toward identifying and addressing common sources of lead exposure in low- and middle-income countries, including blood testing and sampling initiatives. That money is going to fund pilot programs in **India and South Africa** focused on lead mitigation[104], while also announcing $1.1 million to survey blood lead levels in children under five years of age in Bangladesh through UNICEF's 2024 Multiple Indicator Cluster Survey.[105] Moreover, USAID will collaborate with the Global Alliance to Eliminate Lead Paint to advance legally binding controls in nearly 40 countries and advocate for lead mitigation in countries lacking such regulations. Despite the global phase-out of lead in petrol, concerns persist about lead in paint, prompting this concerted effort to address the ongoing issue.

[101] *Ibid*
[102] (2023, August 11). *Lead Poisoning*. World Health Organization https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health.
[103] Shetty, Disha. (2024, January 19). At Davos: USAID Launches New Initiative to Tackle Global Plague of Lead Poisoning. *Health Policy Watch*. https://healthpolicy-watch.news/us-government-commits-4-million-to-tackle-lead-poisoning/.
[104] USAID. (2024, January 17). *Administrator Samantha Power During a Conversation on a Lead-Free Future.* https://www.usaid.gov/news-information/speeches/jan-17-2024-administrator-samantha-power-during-conversation-lead-free-future.
[105] (2024, January 23). Lead poisoning: USAID announces $1.1 million for nationwide survey in Bangladesh. *The Business Standard* https://www.tbsnews.net/bangladesh/health/lead-poisoning-usaid-announces-11-million-nationwide-survey-bangladesh-779686.

As of December 31, 2021, the legal status in each global region was as follows[106]-

As of December 31, 2021, the regulatory landscape regarding lead paint laws varied across global regions. In Africa, only seven countries (13%) had established lead paint laws, with Morocco implementing a mandatory standard in August 2021. Several other African nations, including Benin, Congo, Ghana, Liberia, Senegal, Madagascar, Sierra Leone, Tunisia, Rwanda, Zambia, Guinea, Nigeria, and South Africa, were in the process of drafting or finalising lead paint laws. The East African Community (EAC) regional standard was in the final stages of approval in Rwanda, while West Africa discussed a draft regional standard on paint and varnishes.

In Asia and the Pacific, twelve countries (31%) had enacted lead paint laws, including the Lao People's Democratic Republic, which implemented a 90-ppm lead limit. Malaysia was in the process of developing a draft lead paint standard, and Indonesia revised its voluntary lead paint standard, lowering the limit to 90 ppm. In West Asia, five countries (45%) had implemented lead paint laws, with varying lead levels exceeding targets. Europe showed substantial progress, with 44 countries (81%) implementing lead paint laws, including recent developments in Georgia and Ukraine. Moldova was progressing towards adopting a law. In Latin America and the Caribbean, 14 countries (42%) had lead paint laws, with Argentina, Brazil, Mexico, Peru, and Ecuador actively working to update laws and standards. The North America Region exhibited full compliance, with both countries having lead paint laws, although no paint testing was conducted in this region.

B. Indian Policy Landscape

The Indian policy framework comprises several legislations addressing the issue of lead poisoning directly and indirectly. Each of these legislations play a specific role in managing and mitigating the impact of lead exposure in various contexts. Some significant legislations have been provided below:

[106] *"Update on the global status of legal limits on lead in paint"*, WHO and Global Alliance to eliminate Lead Paint, December 2021.

- The Ministry of Environment, Forest, and Climate Change (MOEFCC), Government of India had passed a notification in November 2016 as **"Regulation on Lead contents in Household and Decorative Paints Rules, 2016"** and had prohibited manufacture, trade, import as well as export of household and decorative paints containing lead or lead compounds in excess of 90 ppm.[107] This Regulation outlined key provisions aimed at controlling lead exposure. The rules mandated self-certification on paints manufactured or imported after November 2017, requiring labels indicating lead levels not exceeding 90 ppm along with the production/import date. A transitory provision allowed the sale of paints manufactured before November 2017 for two years. Manufacturers and importers were required to annually test their products, with the Central Power Research Institute designated as the authorised testing agency. Additionally, the Central Pollution Control Board had established a procedure, effective October 31, 2017, for measuring lead contents in these paints, detailing applicability, requirements, testing procedures, and authorised agencies for testing, implementation, and monitoring.

- The **Battery Waste Management Rules, 2022**, issued by the Ministry of Environment, Forest and Climate Change on August 24, 2022, mark a significant update replacing the Batteries (Management and Handling) Rules, 2001, which exclusively covered lead-acid batteries. The new rules extend their scope to various battery types, encompassing electric vehicle batteries, portable batteries, automotive batteries, and industrial batteries. A pivotal feature is the introduction of Extended Producer Responsibility (EPR), placing the onus on producers (entities involved in manufacturing, selling, importing, or refurbishing batteries) to ensure environmentally sound management of batteries.[108] This initiative aims to mitigate the adverse environmental and health impacts of waste batteries, mandating producers to refrain from landfill and incineration disposal and instead opt for recycling, refurbishing, or repurposing. The 2022 Rules set specific targets for producers to meet EPR obligations, including a requirement for a defined quantity of recycled material in manufactured batteries. Producers have the flexibility to engage other entities for recycling or refurbishment, with the Central Pollution Control Board issuing EPR certificates based on the recycled or refurbished

[107] *"High Blood Lead Levels"*, Lok Sabha Unstarred Parliamentary Question No. 4034 of 2023.
[108] AZB & Partners. (2023, January 11). India: Battery Waste Management Rules, 2022: A New Era For Battery Recycling. Mondaq.https://www.mondaq.com/india/waste-management/1269730/battery-waste-management-rules-2022-a-new-era-for-battery-recycling.

quantity. These certificates can be traded with producers for waste batteries. Additionally, producers must comply with battery labelling requirements, and consumers are mandated to dispose of battery waste separately from other waste streams.

Apart from the legislations, various other legal frameworks reference lead as a restricted or prohibited substance. For instance, the Food Safety and Standards Authority of India (FSSAI) standards addressing lead content in food items establish distinct permissible limits for various categories of food products.

C. Gaps in the Regulatory Framework and Lead Poisoning space in India

Even in the presence of a regulatory mechanism, there exist various gaps in the framework as listed below:

- Although India implemented a law in 2016 stipulating that lead concentration in paints should not exceed 90 ppm, a 2019 study by Toxics Link, a non-profit organisation based in New Delhi, revealed that out of the 20 samples collected, only three adhered to this limit. The remaining samples exhibited lead content ranging from 101 ppm to an alarming 130,797 ppm. Notably, all these samples were produced post the enforcement of the lead law in 2017 and were collected from various states, including Andhra Pradesh, Delhi, Gujarat, Jharkhand, Kerala, Uttar Pradesh, Maharashtra, Manipur, and Rajasthan. A prior study in 2009-10 by the New Delhi-based Centre for Science and Environment had already indicated a significant non-compliance issue, with 72 percent of paint samples exceeding the lead limits set by the Bureau of Industry Standards.[109] This underscores the persistent challenge of achieving reduced lead levels in paints despite the implementation of regulatory measures.

- The Food Safety and Standards (Food Products Standards and Food Additives) Regulations, 2011, set a lead threshold in food at 10 PPM. However, a 2014 study conducted by a researcher at KPC Medical College and Hospital, Jadavpur, and published in the International Journal of Current Medical And Applied Science, discovered elevated lead levels in spice samples obtained from local markets in Kolkata. The study specifically highlighted excessive lead content in chilli powder and turmeric powder, surpassing the

[109] (2019, October 20). Only 38% UN Members Have Laws For Minimum Lead Concentration in Paints. *DownToEarth.* https://www.downtoearth.org.in/news/pollution/only-38-un-members-have-laws-for-minimum-lead-concentration-in-paints-67336.

permissible limits. This prompts a necessity to explore the potential presence of lead in various other food items, reminiscent of the case of Maggi instant noodles. In 2014-15, Nestlé, the Swiss company behind Maggi, faced a ban due to high lead levels detected during testing for monosodium glutamate (MSG). The brand eventually returned to the market after meeting health standards.[110]

- Over time, Toxics Link's investigations have consistently identified challenges faced by Small and Medium Scale Enterprises (SMEs) in complying with the stipulated regulation of 90 ppm for lead concentration. This suggests that SMEs encounter obstacles or limitations that hinder their ability to adhere to the specified regulatory standards, highlighting the need for targeted interventions or support mechanisms to facilitate compliance within this sector.[111]

- There is sale of antiquated paints by retailers, which have been found to contain elevated levels of lead.[112] The concern is compounded by the absence of a robust monitoring or compliance mechanism to assess and regulate lead levels in paints. This lack of oversight creates a significant challenge, allowing the distribution and sale of paints with potentially harmful lead concentrations to persist unchecked in the market. The absence of a monitoring framework not only poses a direct risk to consumers but also contributes to the perpetuation of an unsafe environment.

- The existence of unlabelled products in the market is a cause for concern, prompting questions about the approval process for these products. Additionally, there is no formal mechanism for certifying paints as lead-safe in India.[113]

VIII. Role of Indian Members of Parliament (MPs)

This section provides an examination of the endeavours undertaken by the **Indian Parliament and Parliamentarians concerning lead exposure**, including a thorough analysis of

[110] Deol, Taran. (2023, February 16). Element of Mystery: Lead Poisoning is a Huge Prublic Health Concern For India; Here;s Why. *DownToEarth* https://www-downtoearth-org-in.cdn.ampproject.org/v/s/www.downtoearth.org.in/news/health/amp/element-of-mystery-lead-poisoning-is-a-huge-public-health-concern-for-india-here-s-why-87098?amp

[111] Mohapatra, Piyush. (2021, October 20). Despite Regulations, Lead in Paints Remains a Health Concern in India. *GaonConnection.* https://en.gaonconnection.com/lead-wall-paint-health-effects-children-india-laws-toxic-harmful-poisoning-causes/.

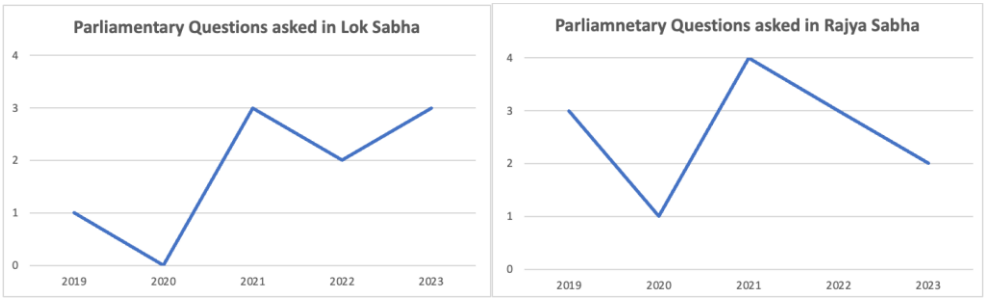
[112] Mohapatra. Piyush., Arora. Tripti., & Rajankar., Dr Prashant. (2019). *Study on Lead in Paints in India* https://toxicslink.org/wp-content/uploads/2022/08/Lead%20in%20Paints%20in%20India%202019.pdf.

[113] *Despite regulations, lead in paint remains a health concern in India.* (2021, October 20). Gaonconnection | Your Connection with Rural India. https://en.gaonconnection.com/lead-wall-paint-health-effects-children-india-laws-toxic-harmful-poisoning-causes/

parliamentary interventions, discussions within standing committees, and any reported field interventions which have taken place from 2019 till present.

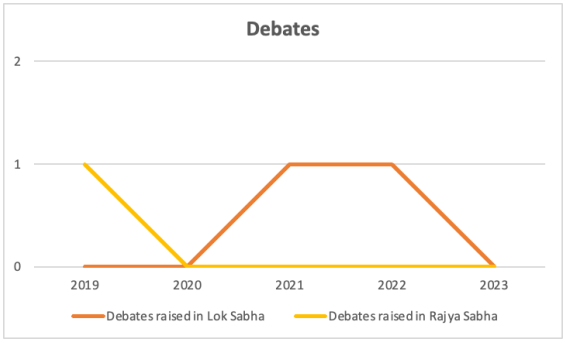
During the period of 2019-23, a total of 22 Parliamentary **Questions** were raised regarding lead/ lead poisoning comprising **9 in Lok Sabha and 13 in Rajya Sabha.** The predominant focus was on e-waste management, specifically addressing lead, as a component in e-batteries primarily directed towards the Ministry of Environment, Forest, and Climate Change. However, only 3 questions were directly raised pertaining to lead, covering toxic lead in paints and blood lead levels in children in both Lok Sabha and Rajya Sabha.

In response to queries about toxic leaded paints, the Ministry specified that paints exceeding 90 ppm (0.009 per cent) of the weight of the total non-volatile content in the dried paint film are prohibited. Regarding blood lead levels in children, the Ministry referenced the NITI Aayog and CSIR's study on the Assessment of Lead Impact on Human and India's Response. Notably, the Ministry of Environment enacted regulations in 2016 prohibiting lead in household paints. It is important to note that despite comprehensive responses from the concerned Ministry, there appeared to be lack of governmental interventions in this context.



For **debates** which include Zero Hours, Motion under Rule 377, Special Mention, et al. interventions in the Parliament; the data for the year 2023 was not found on the official websites of Rajya Sabha and Lok Sabha. For the years 2019-22, a total of three **debates** were held - **2 in Lok Sabha** (Rule 377) and **1 in Rajya Sabha** (Special Mention). These debates focussed on lead pollution in drinking water and improper disposal of lead containing fly ash. Concern for improper disposal of lithium-ion batteries, an improvement over existing lead batteries, was also raised. Interestingly, Government guidelines already exist for management/monitoring of these

lead associated pollution. The debates highlighted the lack of enforcement of such guidelines on part of the Government.



For the **Private Member Bills**, no such Bill was introduced between 2019-23 about lead/ lead exposure. Similarly, for the **Standing Committee Reports**, no reports were found directly talking about lead/ lead exposure. However, the 25th report on "Solid Waste Management including Hazardous Waste, Medical Waste and E-Waste" by the Standing Committee on Urban Development (2018-19) published in 2019, talks in detail about E-waste, thereby also mentioning lead as a toxic constituent used in the manufacturing of electric devices. Moreover, the Committee had recommended the Government to make the e-waste management regulations more efficiently implemented in the country.[114]

Subsequently, the Action Taken Report was published as the 7th report of the Standing Committee on Urban Development (2020-21)[115] mentioning the action taken by the Government on the recommendations made in the previous report. In this report, the Government had responded by saying the following-

- The Ministry of Environment, Forests and Climate Change serves as the central agency for environmental programs, administering the E-Waste (Management) Rules, 2016. The rules task the Central Pollution Control Board (CPCB) with formulating guidelines on E-Waste management, covering aspects like extended producer responsibility, channelization, collection centres, transportation, and environmentally sound dismantling.

[114] 25th report on "Solid Waste Management including Hazardous Waste, Medical Waste and E-Waste" by the Standing Committee on Urban Development (2018-19).
[115] Action taken by the Government on the Recommendations contained in the 25th Report (17th Lok Sabha) of the Standing Committee on Urban Development on the subject 'Solid Waste Management including Hazardous Waste, Medical Waste and E-waste'.

- The Ministry of Electronics and Information Technology (MeitY) leads research and development for eco-friendly e-waste management solutions. Successful initiatives include PCB recycling processes developed by C-MET, Hyderabad, and E-Parisara, Bengaluru, yielding capacities of 1000 Kg/day and 100 Kg/batch. Additionally, a novel process recovers and converts 76% of e-waste plastics into a master batch suitable for virgin plastic products.

- Hazardous waste management involves two categories, Domestic and Industrial, with local bodies establishing collection centres for domestic hazardous waste. Industrial Hazardous Waste is regulated under the Hazardous & Other Waste (Management & Transboundary Movement) Rules, 2016, with State Pollution Control Boards authorising industrial units for waste handling, recycling, and disposal, working in tandem with State and UT departments to set up recycling units and Treatment, Storage, and Disposal Facilities (TSDFs).

DISCUSSION

Over a period of approximately 4 to 5 years, there were merely three direct questions raised in Parliament concerning lead poisoning. When compared with parliamentary questions raised regarding other topics, such as air pollution initiatives like the National Clean Air Programme (NCAP), the parliamentarians raised a total of 24 questions over a brief period spanning 8 months, from July 2022 to February 2023.[116] This suggests that, in contrast to other concerns, lead poisoning has not received a good level of attention among parliamentarians in their inquiries. Similarly, only three debates were initiated on this topic, and it was addressed by just one standing committee, which produced two reports addressing the matter (that too relating to e-waste which includes lead). The analysis indicates a deficiency in the direct discourse surrounding the issue of lead poisoning within the Indian Parliament, highlighting a notable lack of thorough discussion on this crucial matter. Therefore, it is imperative that efforts are made to elevate the level of discussion and attention given to the issue of lead poisoning by the Indian Parliamentarians, within the Indian Parliament and at the constituency level.

[116] Mapping the evolution of parliamentary conversations on air pollution: A focus on India's national clean air program and electric vehicles. (n.d.). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4467184

EU's Parliamentary Committee chooses worker's health by lowering limit values for lead and diisocyanates[117]: The Parliament's Employment and Social Affairs Committee (EMPL) has approved an agreement aimed at enhancing workers' health protection by reducing limit values for lead and diisocyanates. The agreement was reached between the Commission, Parliament and the Council on 14 November 2023 and now must be endorsed by both the Parliament and the Council. This is the fifth revision of the EU legislation on cancer-causing substances– bringing essential changes to the Carcinogens, Mutagens and Reprotoxic Directive and the Chemical Agents Directive. Lead limit values, not updated since 1982, and those for diisocyanates, regulated for the first time in the EU, are included. Based on the European Commission's impact assessment performed before the proposal was presented, 100,000 workers in the EU are exposed to lead at work, making it responsible for around half of all occupational exposures to reprotoxic substances. Exposure happens in lead mining and primary processing and subsequent use in products such as batteries. In addition, workers can be exposed to lead due to its historical application in renovations, waste collection, recycling, and environmental remediation. Approximately 300 cases of ill-health occur annually in the EU due to past exposure to lead. The agreed rules set occupational exposure limits, and the European Commission has decided to review them within specified timelines.

Below is a table which includes what pivotal role Indian MPs can play in mitigating lead exposure by advocating specific actions and policies to safeguard public health. The recommendations entail concrete action items and initiatives for Indian Parliamentarians, addressing emerging research areas, potential interventions/ innovations, and offering policy recommendations for the future. The ideas for these recommendations have been taken from existing recommendations made by various entities (designed to what MPs may do), suggested actions for the gaps found through the doctrinal study carried out while creating this document and through the discussions with various stakeholders/ experts in the field of lead poisoning.

[117] Peseckyte, Giedre. (2024, January 12). Parliament's committee gives go-ahead to agreed rules for exposure to lead. *Euractiv*. https://www.euractiv.com/section/health-consumers/news/parliaments-committee-gives-go-ahead-to-agreed-rules-for-exposure-to-lead/.

S. No.	Recommendation	Recommended role for the Parliamentarians	Nature
Commencing the Conversation			
1.	**Awareness and Education:** A pervasive lack of awareness regarding the issue and its solutions, or, in cases where some awareness exists, a deficiency in understanding the extensive gravity and long-term consequences of lead, contributes to a state of inaction. Therefore, it is the most important aspect to reduce the lead exposure that people are made more aware about the issue and its repercussions.	- Involvement of radio stations/community radio on disseminating awareness to masses regarding lead and effect of its exposure. - Posting on MPs' social media handles about the issue or reaching out to people via Op-eds, media, news channels. - Organising public events for this issue in collaboration with organisations working in the domain or speaking about lead exposure at events where the MP has been invited as a speaker. - Conducting live sessions on platforms like Facebook Live or Instagram Live to directly engage with people and discuss everyday products that may contain lead. Collaborating with a health expert to join the live sessions to raise awareness about the potential consequences and recommend safer alternatives. - Periodically meeting with the retailers with the help of experts/ organisations to make them aware about the repercussions of selling lead based goods and food items. - Creating a group of experts/ organisations who conduct periodical awareness sessions in schools for impacting knowledge about lead poisoning among students, parents and teachers. - Initiating a campaign for the consumers to always check the labels on paints and opting against lead-containing paints. - Distributing information materials to make vendors/retailers aware.	Community Engagement/ Field Intervention

S. No.	Recommendation	Recommended role for the Parliamentarians	Nature
2.	**Stakeholder Meetings:** It is important to bring all stakeholders including manufacturers, recyclers, distributors, regulators, scientists, and philanthropists in the domain of lead-acid batteries in their State/ constituency to recommend improvements and facilitate the faster adoption of good practices.	- Constitute a Local Innovation System (LIS) with the stakeholders to resolve the issue of lead acid batteries waste management and recycling. The LIS may focus on- adopting eco-friendly ways to handle lead waste; facilitating a conversation between the stakeholders to understand the issues they face and finding solutions for the same; discussion regarding the existing best practices in India in the domain of lead acid batteries recycling.	Community Engagement
Addressing the Matter in Parliament			
3.	**Parliamentary Questions** may be asked in the Parliament in relation to lead poisoning.	Questions may be asked for constituency specific matters relating to lead poisoning or on other topics such as: 1. Measures taken for lead contaminated sites 2. Government education and awareness programs for consumers and producers regarding lead exposure 3. Child deaths related to lead poisoning 4. Data of pregnant women currently suffering from lead poisoning 5. Development of infrastructure for lead recycling 6. Applicability and status of UN Model Law and Guidance for Regulating Lead Paint in India 7. Accessibility of devices to detect lead 8. Steps taken to strengthen the FSSAI standards related to lead content	Parliamentary Intervention
4.	**Standing Committee Interventions:** Lead poisoning and allied issues may be taken up by different Standing Committees.	- Members of the Standing Committee on Housing and Urban Affairs may take up the review of E-waste management to understand whether the lead acid battery waste or other toxic waste is being recycled properly. - Members of the Standing Committee	Parliamentary Interventions

S. No.	Recommendation	Recommended role for the Parliamentarians	Nature
		on Housing and Urban Affairs may also plan visits at the lead acid battery recycling sites to check whether all compliances are being fulfilled or not. - Members of the Labour, Textiles And Skill Development Committee may plan field visits to industry hotspots, where lead exposure is prominent, identified by the Government for checking whether occupational safety methods are being adopted to protect labours for lead exposure. - Members of the Labour, Textiles And Skill Development Committee may discuss the existing occupational safety protocols for the labourers working in industries which expose them to lead. - Members of the Education, Women, Children, Youth and Sports Committee may take cognizance of the CSIR and NITI AAYOG 2020 report which revealed that the average blood levels in 23 states of India was well above 5 µg/dl. Subsequently, responses may be sought from the Ministry of Women and child Development; and the Ministry of Health and Family Welfare for the actions they have undertaken in this regard.	
Institutionalising the Concept			
5.	**Requesting the Government and its agencies for stricter guidelines:** It is important to have a strong legal and policy framework to explicitly outline health and safety standards for the production and recycling of lead-acid batteries, e-waste, and other products with lead. Enforcing stringent regulations on paints and water pipes is essential.	- Writing to FSSAI to enhance the enforcement of the Food Safety and Standards Act, 2006, particularly focusing on improving standards and monitoring procedures for lead levels in spices. - Writing to the CPCB/ SPCBs for cleaning up of contaminated sites, especially those located near schools	Institutional/ Parliamentary Intervention

S. No.	Recommendation	Recommended role for the Parliamentarians	Nature
	Additionally, it is necessary to enact efficient laws against informal recycling and the utilisation of lead-containing waste, strictly ban child labour in e-waste collection and metal mining, and limit access to hazardous sites.	and residential areas.[118] - Writing to the Ministry of Environment, Forest and Climate Change, Center/State Pollution Control Board are requested for formulating some strict guidelines on lead acid battery (ULAB) recycling and for the stricter enforcement of Lead Contents in Household and Decorative Paints Rules, 2016. - Raise the recommendations regarding stricter laws/ regulations regarding lead poisoning in the Parliament through tools like Motion under Rule 377, Zero Hour Debates, Special Mention, etc. Such recommendations may also be sent to the Government Departments.	
6.	**Healthcare Workers' Training:** Integrating lead crisis management into India's healthcare system is crucial for resolution. To achieve this, training healthcare stakeholders is essential. Conducting training sessions for healthcare workers on lead poisoning testing, its causes, and symptoms is vital. These trained professionals can then extend their knowledge by raising awareness among women and children about lead poisoning. This integrated approach aims to enhance the healthcare system's capacity to address and prevent lead-related issues effectively.	- Approaching DMHO for having regular training for Accredited Social Health Activist (ASHA), Anganwadi Workers (AWW), Auxiliary Nurse and Midwife (ANMs) on lead poisoning, its impact, early signs and precautions. - Approaching the Ministry of Health and Family Welfare to mandatorily introduce training for healthcare workers to monitor, detect and treat the lead poisoning condition.	Institutional
7.	**Blood Lead Level Testing**[119]: Conducting baseline blood lead level (BLL) testing is crucial to comprehend variations in lead exposure across different geographical and demographic contexts. This testing not only enhances our understanding of the extent of	- Advocating for mandatory BLL testing in the Health Melas organised under the National Health Mission and urging the Government for effective childhood lead poisoning prevention. - Organising Health camps at local	Institutional/ Field Intervention

[118] Bhusan. Indu., & Swaminathan. Soumya. (2023, August 26). India's Hidden Adversary, Lead Poisoning. *The Indian Express* https://indianexpress.com/article/opinion/columns/a-hidden-adversary-despite-being-a-recognised-global-concern-lead-poisoning-is-unaddressed-8909773/.

[119] Pure Earth. (2023). *Lead Crisis- A solvable environmental health crisis.* https://www.pureearth.org/wp-content/uploads/2023/10/Updated-India-Lead-Fact-Sheet_12-Oct-2023.pdf

S. No.	Recommendation	Recommended role for the Parliamentarians	Nature
	exposures and establishes a baseline but also pinpoints highly exposed households, enabling further source analyses.	levels for BLL testing. - Supporting the institutionalisation of mandatory lead testing in all primary healthcare centres in their constituencies/ States by approaching the District Medical Health Officer (DMHO) in the district(s).	
8.	**Need for enhancing capacity for testing:** The country currently lacks systematic screening mechanisms for identifying potential lead exposure in populations. While India has around 48 national referral centres for lead projects where blood lead levels can be tested, screening is typically conducted on a voluntary basis or during health camps organised by non-profit organisations.[120] There is a need for a comprehensive and structured screening system to address lead exposure across the population effectively.	- Writing to the Ministry of Health and Family Welfare to create facilities for blood lead level screenings at every district hospital. - Raise the issue in the Parliament through tools like Motion under Rule 377, Zero Hour Debates, Special Mention, etc.	Institutional/ Parliamentary Intervention
9.	**Periodic and Surprise Testing to check compliance:** It is important that the locally available goods such as turmeric, chilli, toys are tested randomly for checking whether these contain lead in impermissible limits. Such surprise tests will deter the local market stakeholders from introducing lead positive goods in the supply chain.	- Request the District Authorities or the relevant authorised agencies under the Regulation of Lead Contents in Household and Decorative Paints Rules, 2016 to conduct surprise testing of goods that may contain lead.	Institutional
10.	**Monitoring of regulations governing the lead poisoning in India:** Monitoring of lead poisoning regulations in India is essential, as the existing rules have not effectively addressed the persisting issue. The problem primarily stems from inadequate oversight of these regulations. It is crucial to monitor these provisions closely. The 2016 Regulation of Lead Contents in Household and Decorative Paints Rules designates the Central Pollution Control Board as the nodal	- Requesting the District Administration to include the agenda of Lead Poisoning in the District Development Coordination and Monitoring Committees (DISHAs) meetings. - Monitoring the working of these regulations in the DISHA meetings. - Approaching District Authorities to conduct a training for the Waste Management Authorities including Village Panchayats, Municipal	Institutional/ Community Engagement

[120] Taran Deol, 2023 February 16. *Element of Mystery: Lead poisoning is a huge public health concern for India; here's why* https://www-downtoearth-org-in.cdn.ampproject.org/v/s/www.downtoearth.org.in/news/health/amp/element-of-mystery-lead-poisoning-is-a-huge-public-health-concern-for-india-here-s-why-87098?

S. No.	Recommendation	Recommended role for the Parliamentarians	Nature
	agency, along with authorised agencies by the Ministry of Environment, Forest and Climate Change for product testing. Additionally, the 2022 Battery Waste Management Rules specify the involvement of various waste management authorities, including Village Panchayats, Municipal Corporations, Municipalities, and Pollution Control Boards.	Corporations, Municipalities for proper waste management of lead batteries.	
11.	**Monitoring Stations for checking Lead in the air:** The National Ambient Air Quality Standards (NAAQS) establishes acceptable limits for Lead (Pb) in the air.[121] To ensure compliance with these limits and prevent lead exposure through air, it is crucial to employ monitoring sensors capable of accurately detecting the presence of lead in the air. These sensors play a vital role in safeguarding the population and maintaining air quality within the prescribed limits.	- Advocating for air quality monitoring sensors in their State/ Constituency by writing letters/ scheduling meetings with CPCB and SPCBs. - Raising the agenda for lacking monitoring stations in District Development Coordination and Monitoring Committees (DISHAs) meetings. - Mobilising private funds for local monitoring stations through private/ philanthropic entities.	Institutional
12.	**Establishing effective mechanisms for the collection of lead scrap:** Developing cost-effective and durable technologies for recycling is crucial. Effective control measures in lead recycling plants, emphasising worker health, environmental safety, and high-quality plant design, are vital. Advanced and eco-friendly smelting processes are preferred over open furnaces. Comprehensive pollution control measures should be applied, especially where pollutants are retained within plants. To prevent occupational lead exposure, additional measures such as air quality improvement, health inspections, equipment protection, and hygiene practices are necessary. The informal recycling sector, often lacking awareness of lead toxicity, significantly contributes to lead poisoning, and manufacturing	- Approaching the CPCB/ SPCBs to conduct awareness programs for lead recyclers, guiding them on the proper handling, collection, and scientific recovery of lead scrap. - Writing to SPCBs to ensure that the organised lead recycling sector/ industries in their constituency are implementing pollution control equipment and employing environmentally friendly processes. - Writing to the Labour Department to check that the organised lead recycling sector is adhering to the occupational safety standards for the workers in order to prevent occupational lead exposure. - Writing to the Ministry of Environment, Forest and Climate Change to initiate an efficient electronic waste recycling programme	Institutional/ Field Intervention

[121] Sundaray. Shri Nikunja K., & Bhardwaj. Dr Shruti Rai., (2019) *NCAP National Clean Air Programme* https://moef.gov.in/wp-content/uploads/2019/05/NCAP_Report.pdf.

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	industries using lead byproducts contribute to environmental lead penetration.[122]	with a recommendation to place local/ informal recyclers to become linkages between consumers and formal recyclers for a just transition.	
13.	**Supporting Small and Medium Scale Enterprises (SMEs) to adopt lead-free manufacturing:** SMEs are facing challenges in complying with the 90-ppm lead regulation. There is a crucial requirement for providing support, either in the form of technical guidance or financial resources, to assist SMEs in transitioning to lead-free paints. Hand Holding initiatives can play a significant role in helping these enterprises navigate and meet the regulatory standards effectively.[123]	- Writing to the Government to come up with a scheme/ programme, (detailing clear incentives, technical assistance, and transition plans) to support the SMEs in adopting lead-free manufacturing of paints. - Identifying such SMEs in the constituency/ State and holding awareness sessions for them with the help of experts. - Holding a conversation/ meeting with industry associations at the constituency/ State level regarding the harmful impact of lead and initiating a programme to adopt lead-free manufacturing of paints. - Mobilising private/ CSR funds for such SMEs.	Institutional/ Community Engagement
14.	**Formulation of an Interdepartmental Lead Coordination Group:** At the Bihar interventions conference, it was suggested to establish an Interdepartmental Lead Coordination Group to plan and supervise all activities. This group, based in the Department of Health, would include representatives from different departments due to the cross-cutting nature of lead poisoning. The group could create sub-groups to address specific issues, organise technical and expert working groups, and issue guidance documents for effective implementation.[124]	- Approach the State Government / District Administration to advocate for the establishment of Interdepartmental Lead Coordination Group. - Raise the recommendation regarding establishment of Interdepartmental Lead Coordination Group at district/ state levels in the Parliament through tools like Motion under Rule 377, Zero Hour Debates, Special Mention, etc.	Institutional/ Parliamentary Intervention
Advancing Innovation Initiatives			

[122] Rakesh Kumar et al., 2022 *Assessment of Lead Impact on Human and India's Response* https://www.pureearth.org/wp-content/uploads/2022/06/Lead-Report-India-CSIR-NITI-Ayog-June-2022.pdf.
[123] Mohapatra. Piyush., Arora. Tripti., & Rajankar., Dr Prashant. (2019) *Study on Lead in Paints in India* https://toxicslink.org/wp-content/uploads/2022/08/Lead%20in%20Paints%20in%20India%202019.pdf.
[124] Sandeep Dahiya., (2023 September 27). *India: Government Committees to Make Bihar a Lead Pollution-Free State* https://www.pureearth.org/india-government-committees-to-make-bihar-a-lead-pollution-free-state/.

S. No.	Recommendation	Recommended role for the Parliamentarians	Nature
15.	**Source Identification Studies[125]:** Conducting thorough source analyses, including house-based assessments (HBAs) and Rapid Market Surveys (RMS) to identify widespread lead sources such as spices, toys, and cookware is important. Utilising toxic site assessments to pinpoint industrial sources of exposure may also be helpful. These analyses are crucial in determining industry contributions to elevated blood lead levels in the targeted area. This is also helpful in designing source-specific interventions.	- Nudging Government to take up a source apportionment study regarding lead at national/ state/ constituency level through parliamentary tools, letters, or meetings. - Approach Institutes/ Organisations working in the domain of lead exposure to request for a source apportionment study in each local region of the constituency. Support from the District authorities may be sought for the same. - Taking up source-specific interventions once the study is complete.	Institutional/ Parliamentary Intervention

[125] *Ibid*

CONCLUSION

Indian parliamentarians, like their counterparts in other democratic nations, are entrusted with responsibilities such as deliberating on legislations, ensuring government accountability, and conducting oversight.[126] Moreover, they represent the perspectives and aspirations of their respective constituencies. They have also taken on the unique role of advancing the developmental agendas of their constituencies, ensuring progress and welfare of the constituents. To exercise these roles, parliamentarians have the power to use legislative tools, at times, which are instrumental in advancing these causes to pursue governments for actions.

Therefore, parliamentarians have the agency to deploy these tools strategically to enhance the government's attention to the emerging issue of lead poisoning which needs stronger regulation and its proportionate implementation. They can also actively engage with different stakeholders including the state governments, district administrations, local bodies, industry associations, civil societies, through the tools postulated in the last section of the study to impact the entire lead exposure landscape.

By addressing key action items as mentioned in the study, such as strengthening regulations, raising awareness, and advocating for effective implementation of policies related to lead exposure, parliamentarians can play an important role in safeguarding public health and mitigating the long-term impacts of lead exposure. Their advocacy and legislative efforts can contribute significantly to creating a safer and healthier environment for the citizens of India.

This proves that the Indian parliamentarians may play a crucial role, both within the Parliament and at the constituency level, in addressing the issue of lead poisoning.

As every research endeavour has its limitations, this study is also limited in covering the stance or voice of Indian MPs for whom it has been designed, and the small-scale industrialists for whom the change from lead to non-lead-oriented manufacturing style would be of great significance. There is scope to further this study to include the perspectives of the said stakeholders to make it more comprehensive and inclusive.

[126] Understanding roles & responsibilities of members of Parliament. (2022, June 6). B.PAC. https://bpac.in/understanding-roles-responsibilities-of-member-of-parliament/