

A review of literature on healthy environments for children in the Eastern Mediterranean Region:

Status of

childhood

lead

exposure



World Health Organization
Regional Office for the Eastern Mediterranean
Regional Centre for Environmental Health Activities

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FOREWORD

Children are highly vulnerable to environmental threats to health, as they are in a dynamic state of growth and their organ systems are still developing. Compared to adults, children breathe more air and consume more food and water in proportion to their weight. A larger surface area to body weight ratio and longer “shelf-life” enhances a child’s vulnerability to environmental risks. Moreover, as children’s immune, digestive, reproductive and central nervous systems are more vulnerable than those of adults, exposure to certain environmental toxins can lead to irreversible damage as well as to adulthood diseases.

Work by WHO and other key international players shows that there is real potential for improving child health and creating a better future for the coming generations through scaling up action to confront environmental dangers. The Healthy Environments for Children Alliance brings together governments, nongovernmental organizations, scientists and other concerned entities to harmonize efforts to protect children’s health and safeguard the environment. Most importantly, the Alliance will empower communities, especially poor communities, to stimulate action to improve their environment and to ensure that their children have access to basic needs and services.

Many countries of the Eastern Mediterranean Region share certain difficult conditions, including limited resources, harsh climate and fragile environments, that pose special risks to children’s health. Regional conflicts and violence magnify those risks and add to the suffering of children. Creating “healthy places” for children to live in is a critical task that will require the concerted efforts of many different sectors.

Lead is known for its toxicity, and its detrimental health effects are enormous for children, even at low concentrations. The most serious of these effects is damage to a child’s developing brain and nervous system. Maternal lead poisoning may cause premature birth, low birth weight, miscarriage and birth abnormalities including neurological damage. With the increasingly high levels of pollution caused by industrial and traffic emissions, particularly in urban areas, along with unhealthy practices such as use of traditional remedies and cosmetics containing lead, childhood lead exposure has become a major environmental health concern in the Region that requires urgent action from all countries. Eliminating childhood exposure to lead is a significant step in ensuring a better future for our children.



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PREFACE

This review was prepared by the WHO Regional Centre for Environmental Health Activities (CEHA) and aims at taking stock of ongoing work and consolidating and disseminating scientific knowledge and experience as two important elements in the process of implementing the Healthy Environment for Children initiative effectively in the Eastern Mediterranean Region. This document reflects the status of childhood lead exposure as a significant environmental issue affecting children's health and well-being, and offers a comprehensive review of the available literature and studies on childhood lead issues investigated in countries of the Region.

The reviewed studies were identified after conducting a search on the CEHA database and other databases available at CEHA library (such as *Water Resources Abstracts*, *Pollution Abstracts*, *EMBASE/Pollution and Toxicology*, *Index Medicus for the Eastern Mediterranean Region* and MEDLINE 1966–2003), as well as the internet. In addition, information on children's environmental health (in the form of reports, studies and surveys) was requested from countries of the Region. The studies identified were used to establish the healthy environment for children bibliographic database (HEC database) for the Eastern Mediterranean Region. The HEC database currently includes 333 entries on different issues of children's environmental health, among which 37 are related to childhood lead and are reviewed in this document (Annex 1). The commonly measured parameters and indicators along with the investigated factors and health outcomes of lead exposure were all identified and highlighted and used to build up a childhood lead database.

This overview is the first in a series of regional reviews CEHA is planning to produce within the framework of the Healthy Environments for Children Initiative in the Region. Other reviews will focus on issues of: unintentional childhood injuries; water, hygiene and sanitation; and housing quality in relation to children's health. Review reports such as this pave the way for thorough analysis, evaluation and planning by highlighting both the areas of concern and the gaps in available information.

ABBREVIATIONS

Pb	lead
µg	microgram
µg/dl	microgram per decilitre
µmol/L	micromole per litre
ppm	part per million
µg/g	microgram/gram
WHO	World Health Organization
EMRO	Eastern Mediterranean Regional Office
CEHA	Centre for Environmental Health Activities
EMR	Eastern Mediterranean Region
HEC	Healthy Environments for Children
CDC	Centers for Disease Control and Prevention (Atlanta, USA)
USAID	United States Agency for International Development

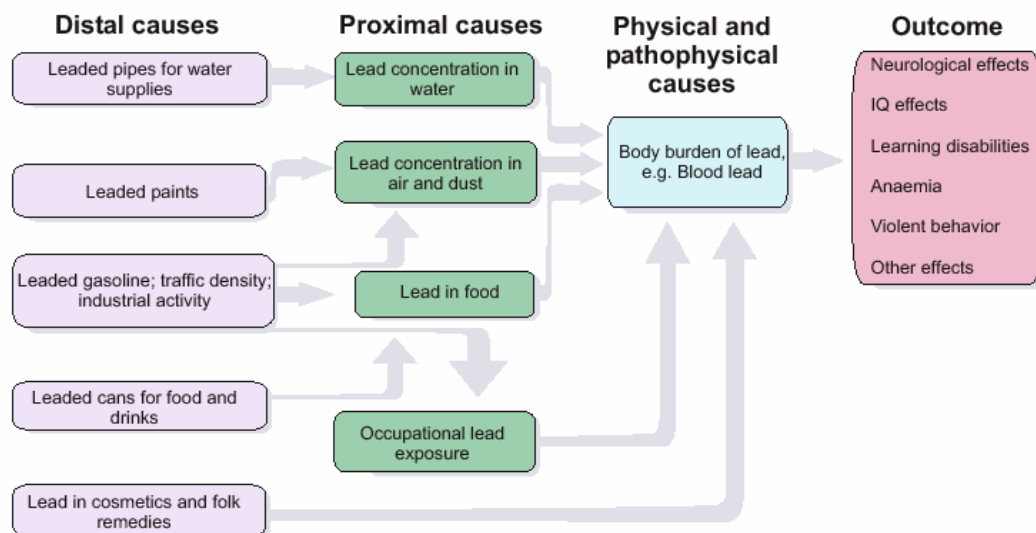
1. INTRODUCTION

1.1 Childhood lead exposure: a priority issue

The toxic nature of lead has been recognized since ancient times. In a recent estimate of the global burden of disease, lead was found to account for 0.9% of the total disease burden based on its role in lead-induced mental retardation and increased blood pressure [1]. Lead poisoning affects people in all geographical areas and among all socioeconomic groups; hence, it affects the well-being of entire nations [2].

Children are particularly vulnerable to the adverse effects of lead, as their brain and central nervous system are still forming. Compared to adults, children are more frequently exposed to lead, and their bodies absorb a larger percentage of lead. Due to its detrimental effect on the intellectual ability of the new generations, lead poisoning has been referred to as “the most common and societally devastating environmental disease of young children” [2]. The extent of global lead exposure problem is still unknown because data on childhood lead poisoning are very limited [3]. However, it is estimated that more than one third of the children in some developing regions still suffer high levels of lead exposure. In industrialized countries, only a small minority of children (mainly the urban poor) are still affected by high levels of lead [4].

Sources and pathways of lead exposure vary with local conditions and lead concentrations, and health interactions can be quite complex. Figure 1 outlines a number of exposure patterns and health outcomes associated with lead.



Source: [4]

Figure 1. Sources, routes and health outcomes of lead exposure

1.2 Sources of lead

Young children are usually in close contact with sources of lead in the environment. They often spend time on the floor or the ground, exposed to lead in dust and soil. They may also put toys that are dusty or dirty into their mouths, or play with domestic animals and birds that have been in contact with dust or dirt. Very young children may ingest lead as they explore their environment or try to ease teething discomfort by mouthing painted surfaces [2]. The health effects of lead exposure are cumulative.

The major sources of lead exposure are leaded gasoline and paint, lead-glazed ceramics, emissions from smelters, battery manufacturing and recycling industries, lead water pipes and lead-contaminated food, traditional medicines and cosmetics. [4]. Causes of lead exposure may be described as proximal, referring to the lead concentration in air, dust, food and water, or as physical and pathophysical, referring to the body burden of lead. Generally speaking, the body burden (such as blood lead, tooth lead, bone lead or hair lead) is closely related to health outcomes and gives an accurate reflection of lead exposure [1].

Exposure to airborne lead depends on factors such as tobacco use, occupation, proximity to motorways and lead smelters and leisure activities. Lead intake from air can vary from less than 4 micrograms (μg) per day to more than 200 $\mu\text{g}/\text{day}$. Although water from drinking-water sources usually contains less than 5 $\mu\text{g}/\text{day}$ of lead, tap water in homes where lead is present in plumbing can contain more than 100 μg per litre (L). The level of dietary lead exposure depends on lifestyle factors such as types of food consumed, use of lead-glazed ceramics and presence of lead in water. Levels of lead in household dusts depend on factors such as age and condition of housing, use of lead paints and urban density [5].

1.3 Health effects of lead exposure

Health effects from lead exposure vary with age and degree of exposure. The most serious effect by far is damage to a child's developing brain and nervous system. A variety of health outcomes have been reported from different exposure levels [2].

- Decrease in intelligence quotient (IQ) by 1–3 points for every 10 μg lead per decilitre (dl) of blood in children.
- Minor impairments in hearing, balance, attention and learning.
- Sleep problems, depression, hyperactivity and aggression.
- Slowing of nerve conduction and failure to reach normal height at blood lead levels over 20–30 $\mu\text{g}/\text{dl}$.
- Kidney damage and serious anaemia at blood lead levels over 20–30 $\mu\text{g}/\text{dl}$.
- Lead encephalopathy accompanied by convulsions and followed by coma and death at blood lead levels over 80–150 $\mu\text{g}/\text{dl}$.
- In cases of maternal lead poisoning, premature birth, low birth weight, miscarriage, stillbirth and birth anomalies, including neurological damage.

1.4 Risk reduction interventions

Although a number of interventions have been initiated in many countries, much remains to be done to reduce the risk of childhood lead exposure. Actions at country level should aim at banning or restricting the use of leaded gasoline and leaded paint. Awareness must be raised on the dangers of using traditional cosmetics and medicines (such as kohl, henna and *farouk*) containing lead, and families must be educated on safe practices to reduce childhood lead exposure.

2. STATUS OF KNOWLEDGE IN COUNTRIES OF THE REGION

2.1 Accessible literature

A comprehensive search for literature was conducted to determine the status of knowledge on childhood lead in countries of the Eastern Mediterranean Region. Sources searched included the CEHA database and other databases available at the CEHA library (such as *Water resources abstracts*, *Pollution abstracts*, *EMBASE/Pollution and Toxicology*, *Index Medicus for the Eastern Mediterranean Region* and MEDLINE 1966–2003), as well as the internet. In addition, information on children's environmental health (e.g. reports, studies, surveys) was requested from countries of the Region. These efforts resulted in the establishment of the healthy environment for children bibliographic database (HEC database) for the Eastern Mediterranean Region. The HEC database includes, to date, 333 entries on different issues of children's environmental health. The database is current and new records are identified and added as they become available. Among the records entered to date, 37 were identified as related to childhood lead and were used to produce this report (see Annex 1). A thorough review was carried out for the available information from full text (if available) or from the abstract.

2.2 Localities investigated

The review showed poor distribution of studies among countries of the Region. As seen in Table 1, around 75% of the studies were conducted in 3 countries (Egypt, Pakistan and Saudi Arabia); the remaining studies were distributed among another 8 countries (Bahrain, Cyprus*, Jordan, Kuwait, Oman, Palestine, Qatar and United Arab Emirates). No literature on childhood lead was found elsewhere in the Region (12 countries). This is an important information gap that calls for immediate action in light of the dangers of lead exposure in children.

* Cyprus was a Member State of the WHO Eastern Mediterranean Region until 1 January 2004.

Table 1. Geographical distribution of identified literature on childhood lead among countries of the Region

Country	Number of identified studies/reports on childhood lead
Bahrain	2
Cyprus	1
Egypt	7
Jordan	1
Kuwait	1
Oman	1
Pakistan	7
Palestine	1
Qatar	1
Saudi Arabia	14
United Arab Emirates	1
Total	37

2.3 Issues investigated

- Blood, tooth, or hair lead levels in children at different ages
- Sources of lead exposure and lead concentration in some of those sources
- Symptoms, health and behavioural outcomes of lead poisoning
- Correlation between lead exposure and different factors

Each issue and the corresponding number of relevant studies identified are listed in Table 2.

Table 2. Distribution of the issues investigated among the identified literature

Issues investigated	Number of identified studies/reports on childhood lead
Blood lead (maternal + umbilical cord)	2
Blood lead (infants + preschool children)	15
Blood lead (schoolchildren + adolescents)	18
Tooth lead	2
Hair lead	1
Sources of lead: cosmetics and traditional medicines	10
Sources of lead: food	5
Sources of lead: vehicular emissions and gasoline	7
Sources of lead: paint	5
Sources of lead: industry	4
Sources of lead: water, soil, dust, air	5
Sources of lead: other (printing ink, medication)	2
Symptoms, health and behavioural outcomes	13

2.4 Influencing factors investigated

In the reviewed literature, the investigators tried to identify the factors influencing childhood lead exposure. They studied a number of socioeconomic, cultural and environmental variables and correlated them to lead levels in children.

- Child's sex and age
- Residence and school location and conditions (urban/rural, proximity to traffic/pollution source; old/new; leaded paint)
- Occupational exposure
- Habits of children and mothers
- Socioeconomic status (crowding index, monthly family income per capita, number of siblings and literacy of parents)
- Hygienic conditions

Each factor and the corresponding number of relevant studies identified are listed in Table 3.

Table 3. Distribution of the factors investigated among the identified literature

Factors investigated	Number of identified studies/reports on childhood lead
Child's sex and age	10
Residence/school location and conditions	7
Occupational exposure	4
Habits of children and mothers	9
Socioeconomic status	9
Hygienic conditions	1

3. EXPOSURE PATTERNS AND HEALTH OUTCOMES

3.1 Blood lead level

Bahrain

Blood lead level was measured in a Bahraini infant (6 weeks old) admitted to Salmaniya Medical Centre with acute lead encephalopathy [6]. The blood lead level was estimated to be 109 µg/dl. The infant had a 5-day history of vomiting, irritability and constipation, and 2 episodes of generalized tonic-clonic convulsions (each episode lasting for about 10 minutes). The child's mother admitted using kohl (*surma*) on the umbilical cord for 15–20 days after birth and in both eyes until admission to hospital.

In the follow-up at the age of 2 years, the child showed no fine or gross motor developmental delay. The child's speech was delayed and he could not form sentences at that age. He was described as an "overactive" child.

Cyprus

It was reported that 7% of children in the village of Ergates aged 1–11 years and nearly 10% of those aged 1–5 years had blood lead levels exceeding the limit recognized by WHO and CDC as acceptable (10 µg/dl). The British medical team who conducted the investigation also reported lower birth weight and higher cancer rates in Ergates. The team attributed the findings to the existence of a foundry that had exposed the villagers of Ergates to lead and toxins in smoke [7].

Egypt

A study was conducted to measure teeth and blood lead levels in 60 schoolchildren aged 6–12 years from an urban city (Alexandria) and from a rural area (Kafr El-Sheikh). The results indicated that 56.7% of schoolchildren in Alexandria and only 6.7% of children in Kafr El-Sheikh had blood lead levels of more than 20 µg/dl [8].

Another investigation was carried out to assess the problem of lead toxicity among 408 working children and adolescents in Alexandria [9]. Results showed that 20.1% of working children and adolescents aged 7–18 years had blood lead levels of 25 µg/dl. In children working in battery workshops, smoking and anaemia were found to be significantly associated with higher risk of lead toxicity.

A three-part study was conducted in Egypt to investigate blood lead in children. The first part aimed at assessing blood lead of infants and children aged 0–12 years and showing the relationship between certain demographic and environmental factors and blood lead levels in children [10]. The study included 482 infants and children (exposed group) randomly selected from El-Shatby Children's Hospital irrespective of their diseases, and 18 newborns randomly selected from El-Shatby Maternity Hospital (non-exposed control group). Interviews were conducted with mothers about demographic and environmental data. The mean blood lead level in the exposed group was 15.64 µg/dl (ranging from 1.74 to 42 µg/dl). The mean in the control group was 6.17 µg/dl (ranging from 0.44 to 16.92 µg/dl). Mean blood lead levels in exposed females (16.47 µg/dl) were significantly higher than those in exposed males (with a mean of 15.12 µg/dl). The study also indicated that for every 1-year increase in age, blood lead increased by 0.584 µg/dl, attributed to the cumulative effect of prolonged exposure. Results showed that parental education had no significant effect on childhood blood lead; however, high risk occupations (solderers, plumbers, cable markers, automobile repair mechanics, ship repair workers, storage battery manufacturers, lead glaze blowers, pottery glaze makers, painters, varnish markers, welders, traffic police, taxi drivers, garage workers) significantly affected blood lead levels in children. Also investigated were socioeconomic factors (crowding index, monthly family income per capita, and number of siblings). Blood lead levels were higher among those living in crowded districts (due to overcrowding and high levels of automobile exhaust). Results showed that infants living at El-Gomrok district, which is known for its overcrowding, narrow streets and excessive automobile exhaust, had the highest mean blood lead level (17.71 µg/dl). Infants and children living in residences near workshops had significantly higher mean blood lead level (17.29 µg/dl) than those living away from workshops. Also, the mean blood lead level of children residing near factories

(19 µg/dl) was significantly higher than in children living away from factories. With respect to type of internal wall cover, the highest mean blood lead level was detected among infants and children living in homes where the internal walls were covered with oil paint (21.83 µg/dl) and was significantly higher than that of those covered with cement, limewater or glue.

The second part of the study investigated habits of children and mothers that may increase blood lead levels of infants and children [11]. It was conducted among the same population as the first part of the study (482 children chosen randomly from El-Shatby Children's Hospital). Mothers were asked, through interviews and questionnaires, about their habits with regard to material used for wrapping sandwiches, type of utensil used for cooking and serving food, and material used for absorption of excess fat or water, for storing food and as a table covering. They were also asked about the habits of their children with regard to type of juice ingested and type of material used as toys. The study indicated that ingesting canned juice and sandwiches wrapped with newspaper, and playing with toys made of paper were associated with higher levels of blood lead in children. Use of zinc utensils and use of newspapers or magazines for absorbing excess fat or water, storing food and covering tables were also associated with increased blood lead in children.

The third part of the study focused on the symptoms among infants and children in relation to blood lead and examined the association between their symptoms and the factors contributing to increased blood lead investigated in the first and second parts [12]. The study indicated that children complaining from neurobehavioural symptoms such as irritability, mood instability, lack of interest in school, decreased playing activities and easy fatigability had significantly higher blood lead levels than symptom-free children. In addition, blood lead levels in children complaining from gastrointestinal symptoms such as anorexia, abdominal colic, vomiting and bouts of diarrhoea alternating with constipation were significantly higher than those of children with no gastrointestinal symptoms. The associations between 9 symptoms and 9 factors (3 environmental factors, 3 child habits and 3 maternal habits) were studied. The environmental factors were from the first part of the study and included residence wall cover, proximity to workshops and proximity to factories. Child and maternal habits were from the second part and related to type of: toy material; juice ingested; wrapping used for sandwiches; cooking utensil used; and paper used to absorb excess water and fat, store food and cover tables. Decreased playing activity and vomiting were significantly associated with all 9 factors. Irritability and anorexia were significantly associated with 8 factors. Easy fatigability and colic were associated with 7 and 6 of the factors, respectively.

An investigation of environmental lead concentrations in Cairo was conducted for the Egyptian Environmental Affairs Agency, Technical Cooperation Office for the Environment and was funded by the United States Agency for International Development, Cairo Mission as a part of a programme for developing a lead exposure abatement plan. The goal was to estimate the magnitude and extent of children's exposure to lead through various environmental media in the greater Cairo metropolitan area. Investigators collected samples of soil, dust, drinking-water, paint, various foods, cosmetics, traditional medicines, newspaper and ceramics from locations throughout Cairo and analysed the samples to determine their lead content. The initial round of sampling was conducted in November/December 1996.

Additional sampling to confirm and expand the results was conducted in June 1997. Investigators then used data from the study and from previously reported research in a lead exposure model to estimate the distribution of blood lead levels in young children in Cairo and the relative contribution of various exposure pathways to the expected mean blood lead level. The analysis indicated that the blood lead levels of children in Cairo range from 14.4 µg/dl for children less than 1 year old to 10.8 µg/dl for those aged 5–6 years old. Results of modelling indicated that approximately 64% of the children in Cairo have blood lead levels above 10 µg/dl and approximately 14% have blood levels above 20 µg/dl. The study stated that levels as low as 10 µg/dl were associated with learning disabilities and lowered IQ [13].

Jordan

A team of investigators from the Ministry of Health, Ministry of Education and Department of Statistics in Jordan conducted a 1999 study, sponsored by WHO/CEHA, which aimed to assess the risk of lead exposure of children aged 6–14 years in high-risk areas in Amman [14]. The study involved sampling blood to determine lead concentration in schoolchildren living at downtown Amman and in Al-Shmaisani. Results of blood sampling were supported by the ambient air monitoring programme implemented by the Air Monitoring Division of the Environmental Health Directorate. The study indicated that emissions from vehicles operated with leaded gasoline are contributing to elevated lead levels in the blood of children living in downtown Amman in comparison to those living in Al-Shmaisani. Males were more affected than females. Average blood lead concentration in schoolboys was 5.66 µg/dl in downtown Amman, and 2.12 µg/dl in Al-Shmaisani. For schoolgirls, the values were 4.02 µg/dl and 2.05 µg/dl, respectively.

Kuwait

A study was conducted on 400 children (222 males and 178 females) between the ages of 1 month and 13 years with a history of convulsions, admitted during a 2-year period (1982–1983) to the Paediatric Department of Al-Jahra Hospital in Kuwait [15]. The largest group suffered febrile convulsions (77%), followed by afebrile convulsions and epilepsy (11.2%), hypocalcaemia with or without rickets (5.7%), central nervous system infections (4.4%) and lead intoxication (0.8%). In nearly 40% of the children the laboratory results were normal, while polymorphonuclear leucocytosis (37.5%) was the most common laboratory finding. Central nervous system infections were found in all age groups, and hypocalcaemia and lead intoxication were found to be significant causative factors for convulsions in children less than 2 years of age.

Oman

Childhood lead poisoning was studied by the measurement of 529 blood samples randomly selected from among children under 12 years, without clinical suspicion of lead poisoning. The samples were collected from four areas within Oman: the Royal Hospital, a tertiary referral centre in Muscat, and district hospitals in Nizwa, Sohar and Sur. In all areas, between 22% and 45% of children had higher than desirable blood lead levels according to CDC criteria. The highest blood lead levels were found in the Royal Hospital, Muscat and

occurred among children attending the paediatric oncology or thalassaemia clinics who were undergoing extensive investigations [16].

Pakistan

An investigation was conducted in 2001 to study whether blood lead concentrations in Karachi were as high as reported in 1989 and to identify which types of exposure to lead contribute most to elevated blood lead concentrations in children in Karachi [17]. A total of 430 children aged 36–60 months were selected through a geographically stratified design from the city centre, two suburbs, a rural community and an island in the harbour of Karachi. Blood samples were collected from children and a pre-tested questionnaire was filled out to assess the effect of various routes of exposure. Cooked food, drinking-water and house dust samples were collected from households. About 80% of children had blood lead concentrations of 10 µg/dl or more, with an overall mean of 15.6 µg/dl. The highest mean among the five localities investigated was that of the harbour island (21.6 µg/dl). As suggested by the study, this could be partially attributed to the high consumption of fish and seafood having high lead content. At the 5% level of significance, houses near to the main intersection in the city centre, application of kohl to children's eyes, father's exposure to lead at workplace, parental illiteracy and frequent hand-to-mouth activity in the child were among variables associated with elevated lead concentrations in blood. The investigators considered these findings a public health concern, as they reflected environmental lead levels likely to result in some degree of intellectual impairment among a large number of children in Karachi. The investigators concluded that there is sufficient evidence of negative effects of lead in gasoline to force the petroleum industry to take urgent action. The findings also point to the need for appropriate interventions to reduce lead exposure associated with other factors.

Copper, manganese and lead levels were studied in blood samples of 165 normal schoolchildren aged 5–14 years, belonging to the Bari Imam area of Islamabad [18]. The mean lead levels for boys ranged from 14.14 µg/dl to 35.4, while the mean levels for girls ranged from 15.00 µg/dl to 34.22 µg/dl.

Blood lead levels were estimated in 170 schoolchildren, aged 13–19 years, residing in Chakshahzad area of Islamabad [19]. The overall mean blood lead level was 2.38 µg/dl, ranging from 0.2 µg/dl to 8.6 µg/dl (3.22 µg/dl in boys and 1.49 µg/dl in girls). The highest mean levels for lead were found at the age of 13 years. Blood lead levels in adolescents reported in this study were relatively low. The levels reflect very little or no risk to the health of children in Chakshahzad and the study indicates that the area of Chakshahzad studied is relatively clear of lead pollution.

Blood lead levels were determined in preschool children residing in urban areas of Rawalpindi [20]. The study included 92 children (50 males and 42 females) aged 1–5 years. Blood lead levels were measured to fall in the range of 7 µg/dl to 34 µg/dl (mean 18.8 µg/dl). The mean lead levels were slightly higher in males (20.3 µg/dl) than in females (17.2 µg/dl) and over 90% of children had lead levels above the acceptable limit of 10 µg/dl. Leaded gasoline, leaded paint and use of contaminated kohl on children are common and can lead to increases in blood lead levels.

Five hundred students comprising males and females in the ratio of 3:1 with mean age of 14 years and 13.2 years, respectively, were selected from various schools in Peshawar and investigated for blood lead levels [21]. Mean blood lead levels of male and female students were found to be 21.2 $\mu\text{g}/\text{dl}$ and 16.8 $\mu\text{g}/\text{dl}$, respectively. 32.6% of the students had blood lead levels above 20 $\mu\text{g}/\text{dl}$. Mean blood lead levels of students who lived near main roads were significantly higher than those living at a distance of more than .5 km from a main road. Fully 13% of male students showed blood lead level in the range of 31–50 $\mu\text{g}/\text{dl}$, a level that puts them at risk of neurophysiological impairment. Investigators concluded that immediate measures need to be taken to reduce environmental pollution caused by leaded gasoline.

A study was conducted in the United States of America on the effects of imported eye cosmetics on Pakistani and Indian children using them. Children were evaluated for lead exposure in California through a state-mandated lead screening programme that began in November 1991 [22]. Charts of children at a county hospital clinic were reviewed for the period beginning October 1991 and ending February 1994. Lead exposure questionnaires were filled out by parents during clinic visits, and telephone interviews were conducted with parents or guardians of children from ethnic groups who use eye cosmetics. Lead level results were available for 175 children. The average lead level was 4.3 $\mu\text{g}/\text{dl}$ (0.21 $\mu\text{mol}/\text{L}$) for Pakistani and Indian children not using eye cosmetics and 12.9 $\mu\text{g}/\text{dl}$ (0.62 $\mu\text{mol}/\text{L}$) for those using the products. Chemical evaluation of some of the eye cosmetics used by the children revealed high lead content. The study showed that the use of eye cosmetics imported from Pakistan was strongly correlated with elevated blood lead levels. The study also stated that legislation has not been effective in protecting children from this source of lead exposure, and that education on lead toxicity and avoidance of substances containing lead is greatly needed, particularly for vulnerable groups.

Palestine

The re-emergence of lead poisoning from contaminated flour was reported in a West Bank village [23]. The authors described an outbreak of lead poisoning in a Palestinian family in the West Bank and drew attention to an unusual and important source of lead exposure. All 13 members of the family (2 children and 11 adults) were found to have lead poisoning following hospitalization for ‘gastroenteritis’, headache, joint pain, weight loss and vision difficulties. Seven females had low haemoglobin levels. Blood lead concentrations ranged from 42 $\mu\text{g}/\text{dl}$ to 48 $\mu\text{g}/\text{dl}$. Household flour samples originating from a stone mill, previously closed because of lead contamination, were found to contain 2000 ppm lead.

Qatar

Two hundred blood samples were collected from children under 15 years referred by paediatric clinics to determine their blood lead levels for diagnostic purposes [24]. Only 3 patients showed values exceeding the level of 25 $\mu\text{g}/\text{dl}$ used in Qatar as the maximum limit for normal blood lead. The highest level reached approximately 38 $\mu\text{g}/\text{dl}$ and was a single case. Compared to data collected in the 1980s and early 1990s, the results obtained from the study suggested that there have been significant reductions in lead levels in water and food and in the blood of children. The reductions were attributed to measures implemented in Qatar

over the past ten years to control the spread of lead contamination. These measures were successful mainly because of the availability of good analytical methods for lead measurement. The study recommended that a wider national survey be conducted to allow better assessment of the average lead intake and blood levels in children, pregnant women and nursing mothers. A new protocol to deal with high blood lead levels in children was also proposed to replace the current practice in Qatar. The proposed protocol introduced the new action levels of 10 µg/dl for children and pregnant women and 30 µg/dl for adults replacing the previous unified level of 25 µg/dl.

Saudi Arabia

Blood lead levels were measured in 538 girls aged 6–12 years who attended primary public schools in Riyadh, Saudi Arabia [25]. Of the 538 screened children, 24.4% had blood lead levels greater than or equal to 10 µg/dl, the level of concern identified by the Centers for Disease Control and Prevention (CDC), Atlanta, USA. Variations in the blood lead levels were investigated with respect to a number of risk factors, the most important being the location of the school. Students who attended schools located in the central region of Riyadh had significantly higher blood lead concentrations than those who attended schools in the peripheral areas (central, 10.6 µg/dl; eastern, 8.09 µg/dl; western, 7.76 µg/dl; northern, 5.64 µg/dl; and southern: 7 µg/dl). This is most likely the result of high levels of vehicle emissions in the central region. Other variables such as low family income and application of kohl to the child's eyes or umbilicus at birth were also identified as contributors to blood lead levels. These observations emphasized the importance of health education programmes to promote the reduction of lead exposure in the general population.

Relationships between blood lead concentrations in 1047 children aged 2 months to 16 years attending outpatient clinics at the King Faisal Specialist Hospital and Research Centre and age, sex and province (i.e. residence) were examined [26]. The study reported that mean blood lead concentrations increased during the first 5 years of life and then began to decrease, reaching a minimum at approximately 16 years of age. Boys who were more than 6 years of age had higher blood concentrations than similarly aged girls. Blood lead levels of children living in the Eastern province were higher on average (38.01 µg/dl, ranging from 26.13 µg/dl to 64.82 µg/dl) than those found in children from other provinces. Most of the children with elevated blood lead concentrations resided in small towns, such as Ehssa, Abqiq and Hofouf, rather than in cities such as Dammam and Dhahran. Investigators attributed high blood lead to factors such as socioeconomic status and cultural habits (e.g. diet, use of traditional remedies and cosmetics). It was also reported by the same authors that the percentage of children with blood lead levels exceeding 12.59 µg/dl was 20% and that of children with levels exceeding 25 µg/dl was 3.5% [27].

A Saudi Arabian infant (3 months) was admitted to Arar Central Hospital with a history of fever, weight loss, constipation, anorexia, pallor and microcytic anaemia. His condition continued to deteriorate, with convulsions and intracranial hypertension, until he received treatment for lead toxicity for about 2 months at Maternity and Children's Hospital in Riyadh. After investigation failed to determine the source of lead exposure, a two-stage survey was designed and implemented at Arar Central Hospital [27]. In the first stage, 108 children (50

males and 58 females) aged 1 month to 12 years attending a paediatric outpatient clinic of Arar Central Hospital were examined and their parents were asked to fill in a questionnaire. 14% of the children had blood lead levels exceeding 20 µg/dl. The mean blood lead concentration was 13.54 µg/dl (ranging from 67.8 µg/dl to 3.7 µg/dl). As a ratio of haemoglobin, 23% of the children had lead levels exceeding 1.5 µg Pb per gram of haemoglobin (Hb). Most of the high concentrations (92%) occurred in children under 5 years of age. 85.7% of families reported using kohl or other remedies. High lead concentrations were attributed to the use of traditional cosmetics and remedies and to socioeconomic and cultural factors (including children's playing and eating habits). In the second stage, 21 children with high blood lead levels were followed up, focusing on lead sources (e.g. water, dust, soil) and the conditions of the household (e.g. lead in paint, blood lead levels in relatives). No statistical association was found between blood lead levels and lead in soil, dust and water.

A study was conducted in Riyadh to investigate the effect of lead on haematological parameters in 538 schoolgirls in the first and second grades aged 6–12 years in 35 classes of 33 public schools [29]. The blood lead levels in students ranged from 2.3 µg/dl to 27.36 µg/dl. Results indicated that haematological parameters could occur at blood lead levels below the level of concern identified by CDC. The study reported that out of 108 children with lead levels greater than 10 µg/dl, 24 suffered from microcytic anaemia. A number of socioeconomic factors were also investigated in relation to lead levels; results showed that blood lead concentrations were negatively correlated with student weight, height and number of half-siblings.

Blood lead levels were measured in 202 Saudi male volunteers 16–57 years old. The influence of smoking on lead exposure was investigated by including smokers, previous smokers and non-smokers [30]. Blood lead was significantly higher in smokers than in non-smokers or previous smokers. The mean blood lead concentration in male smokers was 12.37 µg/dl, in previous smokers 11.4 µg/dl, and in non-smokers 8.92 µg/dl. Blood lead data distribution in the screened population showed that 73.3% of the participants had blood lead levels below 12 µg/dl (reference population); whereas 26.7% had blood lead levels between 12.1 µg/dl and 28.7 µg/dl (exposed population).

Twenty-two young children and infants aged 6 months to 13 years were admitted to King Fahd National Guard Hospital during the period 1984–1988 [31]. Ten of the children, aged 8–48 months, showed clinical and laboratory findings of lead encephalopathy. Each child suffered from one or more of the following signs and symptoms: seizures, coma, ataxia, bizarre behaviour, apathy, vomiting, loss of coordination, change in state of consciousness or loss of recently acquired skills. The mean blood lead level in this group of children was 6.2 µmol/L. All suffered from anaemia. Two of the 10 children died (blood lead levels of 13.2 and 6.9 µmol/L), one child was left with gross neurological disorder and the remaining child survived without evidence of mental damage. The study attributed the high blood lead levels to the use of traditional remedies and medicines, namely *farouk* and *bakhoor*. *Farouk*, an orange granular powder with lead content of 2310 ppm (µg/g), was used by the parents of 9 children to rub on the children's gums to enhance tooth eruption. One infant was intentionally exposed to fumes from *bakhoor*, a type of incense usually burned on charcoal, as a traditional

practice. The other 12 cases with subclinical lead poisoning were found while investigating the causes of hypochromic microcytic anaemia in 400 children.

Another study included 514 schoolchildren (383 in the exposed group and 131 in the control group) aged 6–14 years [32]. The children were selected from 4 primary schools in Riyadh; 3 of the schools represented urban, inner-city areas of high traffic density. The fourth represented a semi-rural area of low traffic density. Primary care physicians interviewed all of the children investigated, and a brief physical examination was conducted with special emphasis on the central nervous system. Results showed that 89.7% of the exposed group and 42.5% of the control group had blood lead levels greater than 10 µg/dl. The mean blood lead levels in schoolchildren at different schools were: 15.7 µg/dl (School 1); 13.8 µg/dl (School 2); 14.2 µg/dl (School 3); and 9.9 µg/dl (School 4). The mean atmospheric lead concentration in the vicinity of different schools was: 11.5 µg/m (School 1); 10.3 µg/m (School 2); 8.5 µg/m (School 3); and 1.2 µg/m (School 4). The investigators noted that the ambient airborne lead levels in the heavy traffic areas in Riyadh exceeded international air quality standards.

High lead concentration in breast milk is one of the first sources of lead exposure in neonates. A study was conducted on breast milk samples collected from 58 nursing mothers at King Khalid University Hospital [33]. Results showed that 47 mothers (81%) had detectable lead concentrations. The lead in breast milk samples from the 47 mothers varied from a low concentration of 0.32 µg/dl to a high of 2.5 µg/dl with an average of 0.77 ± 0.42 µg/dl. Lead concentration was found to be low in young mothers and higher in mothers aged 36 years or more with an average of 0.52 ± 0.14 µg/dl and 1.34 ± 0.65 µg/dl, respectively. The study showed that breast milk samples obtained from mothers residing near industrial areas or highways, using copper casserole dishes lined with white coating (rich in lead) and eating food preserved for long periods in metal containers had higher lead concentrations than samples from mothers living in remote areas with reduced exposure.

A survey was carried out among 124 pregnant women (and their respective 126 newborns) living in Riyadh to investigate the passage of lead from the pregnant mother to the unborn child [34]. The mean maternal blood lead level was 5.49 ± 2.6 µg/dl and the mean umbilical cord blood lead level was 4.14 ± 1.81 µg/dl. Lead levels were higher in maternal blood than in the umbilical cord blood. The study confirmed the transfer of lead from the mother to the fetus, as a high correlation between the maternal and cord blood lead levels was observed. A weak but significant relationship was found between maternal blood lead concentrations and birth weight of newborns. The investigators concluded that low levels of lead exposure in pregnant women may be considered hazardous. In addition, findings on low birth weight suggested further research on early lead exposure effects and the significance of other factors.

Another investigation was conducted on 226 blood samples from 113 mothers of 23 different nationalities [35]. Samples were collected from mothers before delivery, and from cord blood of the respective neonates. Mean maternal blood lead level was 0.72 µmol/L (14.9 µg/dl), range 0.32–1.34 µmol/L (6.6–27.8 µg/dl) and mean cord blood level was 0.64 µmol/L (range 0.29–1.46 µg/dl). It was found that 16% of the mothers and nearly 10 cord blood samples had blood lead levels greater than 0.97 µmol/L (20 µg/dl). Very high levels, in

excess of 1.21 $\mu\text{mol/L}$ (25 $\mu\text{g/dl}$), were detected in 3.5% of mothers as compared to 2.6% of cord blood samples. Out of 113 infants, 65 (58%) were males with a mean cord blood lead level of 0.63 $\mu\text{mol/L}$ and 48 (42%) were females with a mean level of 0.66 $\mu\text{mol/L}$. The lowest maternal blood lead level, 0.68 $\mu\text{mol/L}$, was observed among mothers aged 20–25 years, and lowest cord blood level, 0.58 $\mu\text{mol/L}$, was seen in neonates with mothers under 20 years old. The highest maternal and cord blood lead levels (0.82 and 0.75 $\mu\text{mol/L}$, respectively) were observed in maternal ages of greater than 35 years. The results showed a direct correlation between blood lead level in mothers and in umbilical cords, as shown by a linear regression distribution curve.

United Arab Emirates

Al-Khayat et al studied 19 infants with a mean age of 3.8 months who showed signs of acute lead encephalopathy following the use of traditional medicines [36]. All presented with convulsions; computed tomography (CT) scans of the brain on admission showed brain oedema in 4 infants, atrophy in 4 and normal findings in 11. Cerebrospinal fluid analysis in 9 patients showed pleocytosis in 6 infants and a high protein content in 8. The median lead level in these 19 infants with encephalopathy was 3.6 $\mu\text{mol/L}$ (74.5 $\mu\text{g/dl}$). Seven had a mean lead level of only 2.7 $\mu\text{mol/L}$ (56.9 $\mu\text{g/dl}$), which is well below the level set as the threshold for encephalopathy (70 $\mu\text{g/dl}$). During follow-up, 13 infants developed brain damage. The investigation showed that in very young infants, acute lead encephalopathy might occur at lead levels lower than previously reported.

3.2 Tooth lead concentration

Bahrain

A study was conducted to determine lead exposure among children in Bahrain [37]. A total of 280 shed deciduous whole teeth were collected from 269 children aged 5–15 years. The study period extended from July 1993 to April 1994. The study showed that the overall mean tooth lead level was 4.3 $\mu\text{g/g}$ dry weight with a range of 0.1–60.8 $\mu\text{g/g}$ dry weight. The cumulative frequency distribution revealed that 35% of the teeth had a lead concentration of more than 4 $\mu\text{g/g}$ dry weight. The tooth lead concentrations differed according to the tooth type and age. The child's sex, nationality, area of residence and socioeconomic status had no association with tooth lead level.

Pakistan

An investigation was carried out to evaluate chronic lead exposure in children by measuring lead levels in shed primary teeth collected from primary school children in Karachi [38]. A total of 309 teeth were collected from 9 schools and analysed for lead content by atomic absorption spectrophotometry with electrothermal atomization. The mean age of the subjects was 7.6 ± 1.2 years and the mean lead level was 5.78 μg per gram whole tooth (dry weight), ranging from 0.42 $\mu\text{g/g}$ to 39.75 $\mu\text{g/g}$. Incisor teeth had a significantly higher mean (SD) lead level, 6.42 (4.19) $\mu\text{g/g}$, than canines and molars, which contained 4.91 (5.12) μg and 4.50 (2.67) μg lead per gram whole tooth (dry weight), respectively. Significant

differences were observed between different schools. No difference was observed between boys and girls and the accumulation of lead in teeth was not correlated with chronological age.

3.3 Hair lead concentration

Saudi Arabia

The concentrations of lead in the scalp hair of 800 schoolchildren aged 6–8 years from four cities, Mecca, Jeddah, Riyadh and Tabuk, were measured [39]. Mean lead concentrations for these four locations were found to be 17.6 $\mu\text{g Pb/g hair}$ for Mecca, 23.3 $\mu\text{g Pb/g hair}$ for Jeddah, 5.1 $\mu\text{g Pb/g hair}$ for Riyadh and 10.9 $\mu\text{g Pb/g hair}$ for Tabuk. The mean values of Pb concentrations in hair for Jeddah, Mecca and Tabuk are on the high side of the acceptable “normal range”, indicating an increasing trend in environmental lead pollution.

3.4 Bone lead concentration

No literature is available on this issue.

4. COMMONLY MEASURED INDICATORS AND PARAMETERS

A summary of indicators and parameters measured and investigated in the reviewed literature is shown in Table 4.

Table 4. Commonly measured indicators and parameters of lead exposure

Commonly measured indicators and parameters	
Blood lead	Mean, average, maximum or minimum blood lead level or blood lead concentration ($\mu\text{g/dl}$ or $\mu\text{mol/L}$) in children, infants, mothers or umbilical cord Lead as a ratio of haemoglobin ($\mu\text{g Pb/g Hb}$), and % of children with Pb/Hb values exceeding 1.5 $\mu\text{g Pb/g Hb}$ % of children/infants within a certain age group in a specific locality having blood lead concentrations above a certain value (CDC or WHO criteria/threshold/danger point, 10 $\mu\text{g/dl}$, 20 $\mu\text{g/dl}$, 25 $\mu\text{g/dl}$) % of mothers having blood lead concentrations above a certain value (CDC or WHO criteria/threshold/danger point, 10 $\mu\text{g/dl}$, 20 $\mu\text{g/dl}$, 25 $\mu\text{g/dl}$)
Tooth lead	Mean, average, maximum, or minimum tooth lead level ($\mu\text{g/g dry weight}$) % of teeth with lead concentration exceeding 4 $\mu\text{g/g dry weight}$
Hair lead	Lead concentration in the scalp hair of children within a certain age group in a specific locality ($\mu\text{g Pb/g hair}$)

5. COMMONLY INVESTIGATED SOURCES OF LEAD EXPOSURE

The most common sources and causes of elevated lead levels in countries of the Region are summarized in Table 5. These sources may be categorized into those related to habitual

exposure (cosmetics and remedies such kohl, henna and *farouk*), general exposure (atmospheric emissions, paint and dietary intake) and occupational exposure.

Table 5. Commonly investigated sources and causes of lead exposure

Source/cause of lead exposure	Lead concentration in source	Country (reference study no.)*
Kohl on umbilical cord used by mother for 15–20 days after birth and in both eyes until admission to hospital	NA	Bahrain (267)
Foundry emissions	NA	Cyprus (316)
Occupational exposure (children and adolescents in battery workshops), urban industrialized cities	NA	Egypt (312)
Dietary uptake, soil and dust (air, water and paint did not contribute)	Initial food samples: 0.1–1755.4 mg/kg Exterior dust: 268 mg/kg Soil: 127.7 mg/kg Water: 1.69 mg/kg Exterior paint: 347.3 mg/kg Interior paint: 2151 mg/kg	Egypt (320)
Parent's high-risk occupations (solderers, plumbers, cable markers, automobile repair mechanics, ship repair workers, storage battery manufacturers, lead glaze blowers, pottery glaze makers, painters, varnish markers, welders, traffic police, taxi drivers, garage workers) Environmental factors: internal wall cover Proximity to workshops and factories Socioeconomic state (overcrowded areas and excessive automobile exhaust)	NA	Egypt (212, 214)
Children's habits: ingesting canned juice, playing with paper toys and ingesting sandwiches wrapped with newspaper or magazines Mothers' habits: using newspaper for absorption of fat and water, for storing food or for covering tables and using zinc utensils	NA	Egypt (213, 310, 214)
Lead in ambient air due to use of leaded gasoline	Amman/downtown: 0.161 $\mu\text{g}/\text{m}^3$ † Amman/Al-Shmaisani: 0.066 $\mu\text{g}/\text{m}^3$ †	Jordan (329)
Kohl as a cosmetic applied by mothers to themselves and their children	NA	Kuwait (202)
Traditional remedies	NA	Oman (311)
Kohl, occupational exposure, wind direction, child hand-to-mouth habits, living near city centre, food and drinking water, house dust, and leaded gasoline	Food: 1.33–.86 $\mu\text{g}/\text{g}$ Water: 1.85–8.19 $\mu\text{g}/\text{l}$ Dust: 2.84–96 $\mu\text{g}/\text{g}$	Pakistan (305)

Eye cosmetics	NA	Pakistan (125)
Leaded gasoline, kohl, leaded paint and pica	NA	Pakistan (227, 228)
Lead-contaminated flour from traditional stone mills (reinforced with lead joints)	2000 ppm	Palestine (331)
Water and food	Water: 0.0001–0.132 mg/l Milk (powder): 0.3174 mg/kg Milk (pasteurized liquid): 0.049 mg/L Yoghurt: 0.048 mg/kg Rice: 3.4722 mg/kg	Qatar (314)
Heavy vehicle emissions, kohl, low family income	NA	Saudi Arabia (321)
Socioeconomic status and cultural habits (diet, use of traditional remedies and cosmetics, and children's habits)	Water (from houses): 0.2–26.04 µg/l Dust (from houses): 13.49–175.41 µg/g Soil (from houses): 4.81–155.89 µg/g Air: 0.4–3.681 µg/m ³ Soil: 12.46–23.05 µg/g	Saudi Arabia (322, 324, 325)
Environmental and hygienic conditions (indoor and outdoor)		
Rapid modernization, environmental lead pollution, increased use of leaded gasoline	NA	Saudi Arabia (34, 322, 31)
Traditional remedies (including use of <i>farouk</i> and exposure to <i>bakhoor</i> fumes)	<i>Farouk</i> : 2310 ppm	Saudi Arabia (160)
Breast milk, living conditions and eating habits	NA	Saudi Arabia (333)

NA Not available

* Corresponds to Master File Number (MFN) in Annex 1

† Average for 6 years (1994–1999)

6. COMMONLY INVESTIGATED HEALTH OUTCOMES

Table 6 summarizes the symptoms and adverse health impacts commonly investigated and measured due to childhood lead exposure in countries of the Region.

Table 6. Commonly investigated symptoms and health outcomes of lead exposure

Commonly investigated symptoms and health outcomes	Associated lead level	Country (reference study number*)
5-day history of vomiting, irritability, constipation, and 2 episodes of generalized tonic-clonic convulsions in an infant, delayed speech in follow-up at the age of 2 years	109 µg/dl	Bahrain (267)
Low birth weight and high cancer rates	Greater than WHO and CDC danger point	Cyprus (316)
In children working in battery workshops, smoking and anaemia were found to be significantly associated with high risk of lead toxicity	25 µg/dl	Egypt (312)
Neurobehavioural symptoms such as irritability, mood instability, lack of school interest, decreased playing activities and easy fatigability	16.99–20.65 µg/dl	Egypt (214)
Gastrointestinal symptoms such as anorexia, abdominal colic, vomiting as well as bouts of diarrhoea alternating with constipation	18.94–19.67 µg/dl	Egypt (214)
History of convulsions: Central nervous system infections were found in all age groups, and hypocalcaemia and lead intoxication were found to be significant causative factors for convulsions in children under 2 years of age	> 2 mmol/L	Kuwait (202)
'Gastroenteritis', headache, joint pain, weight loss and vision difficulties; low haemoglobin levels	42–48 µg/dl	Palestine (331)
History of fever, weight loss, constipation, anorexia, pallor and microcytic anaemia in an infant, followed by convulsions and intracranial hypertension	NA	Saudi Arabia (325)
Height and weight negatively correlated with blood lead levels		Saudi Arabia (327, 321)
Microcytic anaemia; haematological abnormalities	10 µg/dl and less	Saudi Arabia (327)
Seizures, coma, ataxia, bizarre behaviour, apathy, vomiting, loss of coordination, and change in the state of consciousness or loss of recently acquired skills; anaemia	6.2 µmol/L	Saudi Arabia (160)
Two children of 10 died; one left with gross neurological disorder	13.2 and 6.9 µmol/L	Saudi Arabia (160)
Low birth weight	Maternal: 5.49 µg/dl Umbilical cord: 4.14 µg/dl	Saudi Arabia (328)
Neuropsychological and behavioural problems	9.02–27.36 µg/dl	Saudi Arabia (31)
Acute lead encephalopathy in 19 infants; 13 developed brain damage	74.5 µg/dl	United Arab Emirates (85)

NA Not available

*Corresponds to Master File Number (MFN) in Annex 1

7. PRIORITY INTERVENTIONS: PHASING OUT LEADED GASOLINE

Human exposure to lead represents a serious environmental health hazard. Leaded gasoline is identified as the major lead source, accounting for more than 90% of all atmospheric lead emissions in many urban areas [40]. As leaded gasoline is burned, lead compounds are released into the air in the form of fine particles that remain suspended for weeks. These particles eventually come to rest in soil and dust, or are inhaled into the lungs. Young children, who are the most vulnerable to lead hazards, ingest lead in dust and soil as a result of their normal hand-to-mouth habits. Clearly, phasing out leaded gasoline is an urgent international priority to ensure a cleaner, safer environment for future generations.

Although leaded gasoline has been completely phased out in almost all high-income countries and in some middle-income countries, most low-income countries still use gasoline with alarmingly high lead content and have not yet introduced unleaded gasoline [40,41]. In countries where leaded gasoline has been eliminated, significant benefits have resulted in both the health and economic sectors, including improved air quality, reduced health care costs and reduced vehicle maintenance costs. At the same time, learning ability has improved among children, and productivity has increased in society as a whole. Although experience in phasing out leaded gasoline proved its economic feasibility in both industrialized and developing countries, certain measures are needed in order to bring about a successful transition to unleaded gasoline [42].

Apart from technical issues, which are readily addressed, two elements play a decisive role in starting a phase-out programme: recognition of the lead problem, and political commitment to tackle the problem. High-level recognition and support by national authorities will enable sound government policies to be directed towards raising public awareness; building consensus; changing fuel specifications; setting price, tax, import and environmental policies; and ensuring necessary training [40].

Many countries in the Region are focusing on the potential risks associated with lead exposure. As seen, some countries have initiated research to investigate childhood lead exposure (extent, causes and health outcomes). However, leaded gasoline is still widely used throughout the Region, and only limited information is available on the establishment of proper measures or actions for phasing out lead in gasoline. Bahrain, Egypt, Jordan, Morocco, Oman, Pakistan, Saudi Arabia and United Arab Emirates have already taken action or are planning to join the global trend of phasing out lead additives in gasoline [43, 44].

In the United Arab Emirates, activities taken in this regard are part of the national strategy to reduce overall pollution in the environment. In 2003, the public and private sectors joined in launching a comprehensive public awareness campaign, the “UAE Goes Green campaign”, focusing on the many positive changes that use of unleaded gasoline create for the environment [45]. All petrol stations distributed pamphlets offering general guidelines for assisting motorists on the switchover and answered enquiries. A website was established and dedicated along with the toll-free line to provide information on technical issues and clarify any queries. Oil companies also introduced a number of new methods at refineries and service stations to facilitate a smooth transition.

8. CONCLUSIONS

- Exposure to lead in countries of the Region is as a serious environmental health hazard that should be tackled urgently. Its detrimental health effects, even at very low exposure dose, call for immediate action to phase out lead in gasoline as a first step to reducing the risk of exposure.
- Children are particularly vulnerable to the adverse health effects of lead, as they are more likely to be exposed to lead through their typical behaviour and as their bodies absorb a larger percentage of lead compared to those of adults.
- Information on childhood lead issues is lacking in the Region. More efforts are needed to coordinate data collection, indicator development, and intervention and monitoring among countries to assess the extent of the problem and to identify effective solutions.
- The identified studies on childhood lead were poorly distributed among countries of the Region. Around 75% of the studies were conducted in 3 countries (Egypt, Pakistan and Saudi Arabia); the remaining were conducted among another 8 countries (Bahrain, Cyprus, Jordan, Kuwait, Oman, Palestine, Qatar and United Arab Emirates).
- The main childhood lead exposure indicator commonly measured is blood lead level. One study measured hair lead content and two studies measured tooth lead levels. Future research should be oriented to the use of blood lead as an indicator, as it is recognized to be the most accurate matrix for assessing lead exposure.
- The main childhood lead issues investigated in countries of the Region include sources of lead exposure (traditional cosmetics and remedies, leaded gasoline, food), symptoms and health outcomes of lead exposure, and effect of factors such as location and condition of residence, sex, age, and cultural and socioeconomic status.
- Exposure to lead sources can be categorized into habitual exposure (use of cosmetics and remedies such as kohl, henna and *farouk*), general exposure (atmospheric emissions, paint and dietary intake) and occupational exposure. Leaded gasoline accounts for more than 90% of all atmospheric lead emissions in many urban areas.
- The main health impacts associated with lead exposure investigated in countries of the Region include neurobehavioural disorders and lead encephalopathy, reduced weight and height, haematological abnormalities and reduced learning abilities.
- Preventive measures such as phasing out leaded gasoline have already been initiated in some countries of the Region; however, a number of countries have not yet taken such steps. Other actions still need to be undertaken on a wider scale, such as raising awareness on the dangers of using lead-containing traditional cosmetics and medicines, desirable and undesirable habits and practices (in mothers and children) related to childhood lead exposure, and the effects of residence location and condition and occupation on childhood lead exposure.

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Annex 1

HEC DATABASE ON CHILDHOOD LEAD

Last updated: Apr.01 2003

MFN 0078

Subject LEAD

Country(ies)BAHRAIN

Title LEAD LEVELS IN DECIDUOUS TEETH OF CHILDREN IN BAHRAIN

Source, ANN-TROP-PAEDIATR. ANNALS-OF-TROPICAL-PAEDIATRICS. 17/2 (147-154)1997

Author(s)AL, MAHROOS, F; AL, SALEH, FS

Publication Year 1997

Key Words DECIDUOUS TOOTH; LEAD POISONING; ENVIRONMENTAL EXPOSURE; LEAD ENDOGENOUS COMPOUND

Abstract TO DETERMINE LEAD EXPOSURE AMONG CHILDREN IN BAHRAIN, A TOTAL OF 280 SHED DECIDUOUS WHOLE TEETH WERE COLLECTED FROM 269 CHILDREN. TEETH WERE ANALYZED FOR LEAD CONCENTRATIONS USING ATOMIC ABSORPTION SPECTROPHOTOMETRY WITH ELECTROTHERMAL ATOMIZATION.CHILDREN WERE BETWEEN 5 AND 15 YEARS OLD. THE STUDY PERIOD EXTENDED FROM JULY 1993 TO APRIL 1994. THE STUDY SHOWED THAT THE OVERALL MEAN TOOTH-LEAD LEVEL WAS 4.3 MU G/G DRY WEIGHT WITH A RANGE OF 0.1-60.8 MU G/G DRY WEIGHT. THE CUMULATIVE FREQUENCY DISTRIBUTION REVEALED THAT 35% OF THE TEETH HAD A LEAD CONCENTRATION OF MORE THAN 4 MU G/G DRY WEIGHT. THE TOOTH-LEAD CONCENTRATIONS DIFFERED ACCORDING TO THE TOOTH TYPE AND AGE. THE CHILD'S SEX, NATIONALITY, AREA OF RESIDENCE AND SOCIO-ECONOMIC STATUS HADNO IMPACT ON TOOTH-LEAD LEVEL. IN CONCLUSION, LEAD IS PRESENT IN TOXIC CONCENTRATIONS IN 35% OF THE TEETH OF THE CHILDREN STUDIED. URGENT MEASURES ARE NEEDED TO ELIMINATE LEAD FROM GASOLINE, PAINT AND OTHER SOURCES IN THE ENVIRONMENT.

MFN 0267

Subject LEAD POISONING

Country(ies)BAHRAIN

Title LEAD ENCEPHALOPATHY IN A BAHRAINI INFANT (CASE PRESENTATION)

Source BAHRAIN MED. BULL., VOL.15, NO. 3

Author(s)AL MAHROOS, FADHEELA

Publication Year 1993

Key Words ENVIRONMENTAL POLLUTION; LEAD

Abstract TO INCREASE AWARENESS ABOUT LEAD POISONING GENERALLY AND LEAD ENCEPHALOPATHY SPECIFICALLY, WE REPORT A CASE OF INFANTILE LEAD ENCEPHALOPATHY RESULTING FROM THE USE OF KOHL (SURMA)ON THE UMBILICAL CORD. THERE IS A NEED FOR PUBLIC EDUCATION ABOUT THE DANGER OF THIS PRACTICE. STRICT REGULATIONS ABOUT IMPORTATION AND DISTRIBUTION OF SUCH PRODUCTS ARE NEEDED.

Notes 19. FULL TEXT BECAME AVAILABLE

MFN 0316

Subject LEAD; HEAVY METALS

Country(ies)CYPRUS

Title NEWS: COMMITTEE TO REVIEW 'CLOSE THE FOUNDRY' ADVICE

Source CYPRUS MAIL, NOV. 16, 2000

Author(s)MILLER, ANTHONY

Publication Year 2000

Key Words LEAD POISONING; ENVIRONMENTAL HEALTH

Notes NEW: NEWS ABOUT A REPORT ON BLOOD-LEAD LEVELS IN CHILDREN (ALSO SEE 0317)

MFN 0310

Subject LEAD

Country(ies)EGYPT

Title TEETH AND BLOOD LEAD LEVELS IN EGYPTIAN SCHOOLCHILDREN:
RELATIONSHIP TO HEALTH EFFECTS

Source J APPL TOXICOL, VOL. 21, NO. 4. PP. 349-52, JULY-AUG. 2001

Author(s)OMAR, M.; IBRAHIM, M.; ASSEM, H.; MOUSTAFA, Y.; BATTAH, F.

Publication Year 2001

Key Words LEAD; SCHOOLCHILDREN

Abstract THE OBJECTIVE OF THIS WORK WAS TO STUDY TEETH AND BLOOD LEAD LEVELS IN EGYPTIAN SCHOOLCHILDREN AND TO RELATE LEAD LEVELS TO SOCIODEMOGRAPHIC AND ENVIRONMENTAL FACTORS, THE DEGREE OF URBANIZATION AND SUSPECTED MANIFESTATIONS OF POSSIBLE LEAD EXPOSURE. THE STUDY WAS CONDUCTED ON 60 CHILDREN AGED 6-12 YEARS: 30 CHILDREN LIVING IN AN URBAN AREA AT ALEXANDRIA CITY AND 30 CHILDREN LIVING IN A RURAL AREA AT KAFR EL-SHEIKH PROVINCE. BOTH GROUPS ARE MATCHED FOR AGE AND GENDER. EVERY CHILD WAS SUBJECTED TO HISTORY TAKING, CLINICAL EXAMINATION AND IQ MEASUREMENTS. LABORATORY INVESTIGATIONS INCLUDED MEASURING TEETH AND BLOOD LEAD LEVELS, HAEMOGLOBIN, SERUM IRON AND TOTAL IRON BINDING CAPACITY. THE RESULTS SHOWED THAT THE MEAN BLOOD LEAD LEVEL OF CHILDREN IN ALEXANDRIA WAS SIGNIFICANTLY HIGHER THAN THAT OF THE CHILDREN IN KAFR EL-SHEIKH; ALSO 56.7 AND 6.7 OF CHILDREN FROM ALEXANDRIA AND KAFR EL-SHEIKH HAD A BLOOD LEAD LEVEL OF 20 MICROG DL(-1), WITH THE MOST FREQUENT SYMPTOMS OF HEADACHE, ARTHRALGIA AND LACK OF SCHOOL INTEREST. THE CHILDREN IN ALEXANDRIA HAD SIGNIFICANTLY LOWER MEAN TEETH LEAD AND HAEMOGLOBIN LEVELS THAN THOSE OF THE KAFR EL-SHEIKH GROUP. A HISTORY OF WRAPPING SANDWICHES IN NEWSPAPERS, AGE AND DISTANCE BETWEEN THE HOME AND SCHOOL WERE SIGNIFICANT PREDICTORS OF LEAD EXPOSURE. THESE FINDINGS SUPPORT THE CONCEPT THAT TEETH LEAD CONCENTRATION MAY BE A VALID ADDITION TO THE INDICATORS USED FOR ASSESSMENT OF THE BODY BURDEN OF ENVIRONMENTAL LEAD. IN ADDITION, CHILDREN LIVING IN URBAN AREAS SUCH AS ALEXANDRIA NEED SPECIAL CONSIDERATION REGARDING PROTECTION FROM LEAD EXPOSURE, AS WELL AS TEETH AND BLOOD LEAD EVALUATION.

Notes NEW: ABSTRACT ONLY

MFN 0312

Subject LEAD

Country(ies)EGYPT

Title LEAD TOXICITY AMONG WORKING CHILDREN AND ADOLESCENTS IN
ALEXANDRIA, EGYPT

Source EASTERN MEDITERRANEAN HEALTH JOURNAL, VOLUME 4, ISSUE 3, PP. 520-529,
1998

Author(s)ZAKI, A.; EL-SHAZLY, M.; ABDEL-FATTAH, M.; EL-SAID, K.; CURTALE, F.

Publication Year 1998

Key Words LEAD TOXICITY; WORKING CHILDREN; URBAN CITIES

Abstract A SUBSTANTIAL NUMBER OF CHILDREN AND ADOLESCENTS WORK AND ARE EXPOSED TO DIFFERENT OCCUPATIONAL AND ENVIRONMENTAL HAZARDS. IN ORDER TO IDENTIFY THE PREVALENCE OF LEAD TOXICITY AND RELATED RISK FACTORS, A STUDY WAS CONDUCTED OF 408 WORKING CHILDREN AND ADOLESCENTS IN ALEXANDRIA. IN 20.1 OF THOSE SAMPLED, THE BLOOD LEAD LEVEL

WAS 25 MG/DL. FOR CHILDREN WORKING IN BATTERY WORKSHOPS IN EL-GOMROUK AND MINA EL-BASSAL DISTRICTS, ANAEMIA AND SMOKING WERE FOUND TO BE SIGNIFICANTLY ASSOCIATED WITH A HIGHER RISK OF LEAD TOXICITY. THUS, MORE ATTENTION SHOULD BE PAID TO THE PROBLEM OF LEAD TOXICITY IN WORKING CHILDREN, PARTICULARLY IN INDUSTRIALIZED URBAN CITIES WITH HEAVY TRAFFIC AND AN UNPROTECTED WORK ENVIRONMENT.

Notes NEW: FULL TEXT AVAILABLE (WHO)VERIFY

MFN 0320

Subject LEAD

Country(ies)EGYPT

Title LEAD EXPOSURE ABATEMENT PLAN FOR EGYPT: RESULTS OF ENVIRONMENTAL SAMPLING FOR LEAD (EHP-REPORT)

Source

Author(s)CHAPPELL, R.; BILLIG, P.; BRANTLY, E.; AULT, S.; EZZELDIN, H.

Corporate Author (s)

USAID MISSION TO EGYPT UNDER EHP ACTIVITY NO. 256-CC

Publication Year 1997

Key Words LEAD SAMPLING; LEAD ANALYSIS; FOOD; PAINT; COSMETICS; NEWSPAPER; ENVIRONMENTAL MEDIA

Abstract THE TEST IS TO SEE THE

Notes NEW: ENVIRONMENTAL HEALTH PROJECT ACTIVITY REPORT NO. 32

MFN 0318

Subject LEAD

Country(ies)EGYPT

Title LEAD EXPOSURE ABATEMENT PLAN FOR EGYPT: EHP-REPORT

Source

Author(s)O'TOOLE, L.; BRANTLY, E.; BILLIG, P.; PHOENIX, J.

Corporate Author (s)

USAID MISSION TO EGYPT UNDER EHP ACTIVITY NO. 355-CC

Publication Year 1997

Key Words LEAD SOURCES; EDUCATION; AWARENESS

Notes NEW: ENVIRONMENTAL HEALTH PROJECT ACTIVITY REPORT NO. 37

MFN 0212

Subject LEAD; ENVIRONMENTAL POLLUTION

Country(ies)EGYPT

Title ENVIRONMENTAL LEAD POLLUTION AND CHILDREN AT ALEXANDRIA PART I: DEMOGRAPHIC CHARACTERISTICS AND ENVIRONMENTAL CONDITIONS

Source ALEX. J. PEDIATR., 9

Author(s)EL ARABY, IBRAHIM I.; HAFEZ, BAHIGA; MOSTAFA, YEHIA; EL-DELGAWI, WAHID; BADR EL-DIN, OMNEYA; LOKA, MANAL

Publication Year 1995

Key Words ENVIRONMENTAL POLLUTION; ADVERSE EFFECTS; LEAD

Abstract THIS PART OF THE STUDY WAS CONDUCTED TO ASSESS BLOOD LEAD (PBB)OF INFANTS AND CHILDREN AT ALEXANDRIA AND TO REVEAL THE RELATION BETWEEN DEMOGRAPHIC CHARACTERISTICS AND SOME ENVIRONMENTAL FACTORS, AND PBB OF CHILDREN. STUDY POPULATION WAS COMPOSED OF 482 INFANTS AND CHILDREN AS AN EXPOSED GROUP AND 18 NEWBORNS AS A CONTROL GROUP. QUESTIONNAIRE ABOUT DEMOGRAPHIC CHARACTERISTICS AND ENVIRONMENTAL CONDITIONS WAS COMPLETED BY INTERVIEWING MOTHERS OF CHILDREN AND PBB WAS DETERMINED FOR ALL INFANTS AND CHILDREN. EXPOSED GROUP HAD SIGNIFICANTLY HIGHER PBB (15.64 ± 6.58 MICROGRAM/DL)THAN CONTROL GROUP (6.17 ± 4.21 MICROGRAM/DL). FEMALES HAD SIGNIFICANTLY HIGHER PBB THAN MALES.

EMPLOYMENT OF PARENTS IN HIGH RISK OCCUPATIONS REGARDING LEAD EXPOSURE LED TO SIGNIFICANT INCREASE OF PBB OF THEIR CHILDREN. AGE AND CROWDING INDEX WERE DIRECTLY CORRELATED WITH PBB. CHILDREN LIVING IN EL-GOMROK SHOWED SIGNIFICANTLY HIGHER PBB THAN THOSE IN OTHER DISTRICTS. PAINTING OIL AS WELL AS NEARBY WORKSHOPS AND FACTORIES SIGNIFICANTLY INCREASED PBB OF INFANTS AND CHILDREN.

Notes 20 (SEE: 213, 214) FULL TEXT BECAME AVAILABLE

MFN 0213

Subject LEAD; ENVIRONMENTAL POLLUTION

Country(ies) EGYPT

Title ENVIRONMENTAL LEAD POLLUTION AND CHILDREN AT ALEXANDRIA PART II: CHILDREN AND MOTHER'S HABITS

Source ALEX. J. PEDIATR., 9

Author(s) EL ARABY, IBRAHIM I.; HAFEZ, BAHIGA; MOSTAFA, YEHIA; EL-DELGAWI, WAHID; BADR EL-DIN, OMNEYA; LOKA, MANAL

Publication Year 1995

Key Words ENVIRONMENTAL POLLUTION; ADVERSE EFFECTS; MATERNAL BEHAVIOUR; ETHNOLOGY; CHILD BEHAVIOUR

Abstract THIS PART OF THE STUDY WAS CARRIED OUT TO REVEAL CHILDREN AND MOTHER'S HABITS THAT MAY INCREASE BLOOD LEAD OF INFANTS AND CHILDREN AT ALEXANDRIA. STUDY POPULATION WAS CHOSEN RANDOMLY FROM EL-SHATBY CHILDREN UNIVERSITY HOSPITAL (482 CHILDREN). QUESTIONNAIRE ABOUT CHILDREN MOTHERS HABITS WAS COMPLETED BY INTERVIEWING MOTHERS OF CHILDREN AND BLOOD LEAD (PBB) WAS DETERMINED FOR ALL CHILDREN. WRAPPING OF SANDWICHES BY NEWSPAPERS, INGESTION OF CANNED JUICE AND PLAYING WITH TOYS MADE OF PAPER LED TO SIGNIFICANT INCREASE OF CHILDREN PBB. REGARDING MOTHERS HABITS, USING ZINC UTENSILS AS WELL AS USING NEWSPAPERS AND/OR MAGAZINES FOR ABSORPTIONS OF EXCESS FAT OR WATER, STORING FOOD, AND COVERING TABLES SIGNIFICANTLY INCREASED PBB OF CHILDREN.

Notes 11 (SEE: 212, 214) FULL TEXT BECAME AVAILABLE

MFN 0214

Subject LEAD; ENVIRONMENTAL POLLUTION

Country(ies) EGYPT

Title ENVIRONMENTAL LEAD POLLUTION AND CHILDREN AT ALEXANDRIA PART III: SYMPTOMATOLOGY

Source ALEX. J. PEDIATR., 9

Author(s) EL ARABY, IBRAHIM I.; HAFEZ, BAHIGA; MOSTAFA, YEHIA; EL-DELGAWI, WAHID; BADR EL-DIN, OMNEYA; LOKA, MANAL

Publication Year 1995

Key Words ENVIRONMENTAL POLLUTION; ADVERSE EFFECTS; LEAD

Abstract THIS PART OF THE STUDY WAS PERFORMED TO REVEAL SYMPTOMS AMONG INFANTS AND CHILDREN IN RELATION TO BLOOD LEAD (PBB) AND TO TEST THE ASSOCIATION BETWEEN THE PRESENT SYMPTOMS AND FACTORS THAT CONTRIBUTE IN INCREASING PBB. STUDY POPULATION WAS CHOSEN RANDOMLY FROM EL-SHATBY CHILDREN UNIVERSITY HOSPITAL (482 CHILDREN). QUESTIONNAIRE ABOUT ENVIRONMENTAL CONDITIONS, CHILDREN'S AND MOTHER'S HABITS WAS COMPLETED BY INTERVIEWING MOTHERS OF CHILDREN AND PBB WAS DETERMINED FOR ALL CHILDREN. CHILDREN COMPLAINING OF NEUROBEHAVIOURAL SYMPTOMS SUCH AS IRRITABILITY, MOOD INSTABILITY, LACK OF SCHOOL INTEREST, DECREASED PLAYING ACTIVITIES AND EASY FATIGABILITY HAD SIGNIFICANTLY HIGHER PBB THAN SYMPTOMS-FREE CHILDREN. SIMILARLY, PBB OF CHILDREN COMPLAINING OF GIT RELATED SYMPTOMS SUCH AS ANOREXIA, ABDOMINAL COLIC,

VOMITING AS WELL AS BOUTS OF DIARRHOEA ALTERNATING WITH CONSTIPATION WAS SIGNIFICANTLY HIGHER THAN THAT OF SYMPTOMS-FREE CHILDREN. DECREASED PLAYING ACTIVITIES AND VOMITING WERE SIGNIFICANTLY ASSOCIATED WITH ALL 9 STUDIED ENVIRONMENTAL FACTORS AND HABITS. HOWEVER, IRRITABILITY AND ANOREXIA WERE SIGNIFICANTLY ASSOCIATED WITH 8 OF THESE FACTORS AND HABITS; EASY FATIGABILITY AND COLIC WERE ASSOCIATED WITH 7 AND 6 OF THEM, RESPECTIVELY.

Notes 17 (SEE 212, 213)FULL TEXT BECAME AVAILABLE

MFN 0329

Subject LEAD

Country(ies)JORDAN

Title STUDY ON LEAD EXPOSURE OF THE POPULATION OF HIGH RISK AREAS IN AMMAN WITH FOCUS ON CHILDHOOD EXPOSURE

Source

Corporate Author (s)

MINISTRY OF HEALTH/ENVIRONMENTAL HEALTH DIRECTORATE;WHO/CEHA

Publication Year 2000

Key Words LEAD EXPOSURE; LEADED GASOLINE; SCHOOL CHILDREN

Abstract THIS STUDY WAS CONDUCTED BY A TEAM OF INVESTIGATORS FROM THE MINISTRY OF HEALTH, MINISTRY OF EDUCATION AND DEPARTMENT OF STATISTICS, JORDAN. THE STUDY WAS SPONSORED BY THE WORLD HEALTH ORGANIZATION/REGIONAL CENTRE FOR ENVIRONMENTAL HEALTH ACTIVITIES (CEHA). THE STUDY AIMED TO ASSESS THE RISK OF LEAD EXPOSURE OF CHILDREN AT HIGH RISK AREAS IN AMMAN. THE STUDY COVERS SAMPLING OF BLOOD FOR LEAD CONCENTRATION DETERMINATION IN SCHOOL CHILDREN LIVING AT DOWNTOWN CITY OF AMMAN AND AT AL-SHAMASANI. RESULTS OF BLOOD SAMPLING WERE SUPPORTED BY RESULTS OF AMBIENT AIR MONITORING PROGRAM IMPLEMENTED BY AIR MONITORING DIVISION/ENVIRONMENTAL HEALTH DIRECTORATE. THE STUDY INDICATED THAT AIR POLLUTION BY LEAD EMITTED BY VEHICLES OPERATED WITH LEADED GASOLINE IS CONTRIBUTING IN ELEVATING LEAD CONCENTRATION IN THE BLOOD OF CHILDREN LIVING AT DOWNTOWN CITY OF AMMAN IN COMPARISON TO THOSE LIVING AT AL-SHMAISANI. MALES WERE MORE AFFECTED THAN FEMALES.

Notes NEW: FULL TEXT AVAILABLE

MFN 0202

Subject LEAD

Country(ies)KUWAIT

Title A STUDY OF CONVULSIONS IN CHILDHOOD

Source MED. PRINC. PRACT., 1

Author(s)MANANDHAR, D.S.; HUNT, M.C.; MOHAMED, M.I.

Publication Year 1989

Key Words CHILD HOSPITALIZATION; LEAD; POISONING; EPILEPSY; ETIOLOGY

Abstract THIS PROSPECTIVE STUDY WAS PERFORMED ON 400 CHILDREN, BETWEEN THE AGES OF 1 MONTH AND 13 YEARS WITH A HISTORY OF CONVULSIONS, ADMITTED DURING A 2-YEAR PERIOD. THERE WERE MORE MALES THAN FEMALES, WITH MORE CHILDREN ADMITTED IN THE WINTER SEASON THAN IN THE SUMMER. THE LARGEST GROUP SUFFERED FEBRILE CONVULSIONS (77 PERCENT), FOLLOWED BY AFEBRILE CONVULSIONS AND EPILEPSY (11.2 PERCENT), HYPOCALAEMIA WITH OR WITHOUT RICKETS (5.7 PERCENT), CENTRAL NERVOUS SYSTEM INFECTIONS (4.4 PERCENT)AND LEAD INTOXICATION (0.8 PERCENT). IN NEARLY 40 PERCENT OF THE CHILDREN, THE LABORATORY INVESTIGATIONS WERE NORMAL, WHILE POLYMORPHONUCLEAR LEUCOCYTOSIS (37.5 PERCENT)WAS THE MOST COMMON LABORATORY FINDING. CENTRAL NERVOUS SYSTEM INFECTIONS WERE FOUND IN ALL AGE GROUPS, AND

HYPOCALCAEMIA AND LEAD INTOXICATION WERE FOUND TO BE SIGNIFICANT CAUSATIVE FACTORS FOR CONVULSIONS IN CHILDREN UNDER 2 YEARS OF AGE.

Notes 11. FULL TEXT BECAME AVAILABLE

MFN 0311

Subject LEAD

Country(ies)OMAN

Title BRIEF REPORT. ALTERNATIVE MEDICINES ELEVATE BLOOD LEADS IN OMANI CHILDREN REFERRED FOR EXTENSIVE INVESTIGATION

Source JOURNAL OF TROPICAL PEDIATRICS, VOLUME 46, ISSUE 4, PP. 241-242

Author(s)TIMMS, PM.; BOLD, AM.

Key Words LEAD; MEDICINES

Abstract THE FREQUENCY OF ELEVATED BLOOD LEAD LEVELS IN OMANI CHILDREN REFERRED FOR ROUTINE INVESTIGATION WAS DETERMINED BY MEASUREMENT OF 529 BLOOD SAMPLES RANDOMLY SELECTED FROM CHILDREN LESS THAN 12 YEARS OLD, WITHOUT CLINICAL SUSPICION OF LEAD POISONING. THE BLOOD WAS COLLECTED FROM FOUR DISTINCT AREAS WITHIN THE SULTANATE OF OMAN: THE ROYAL HOSPITAL, A TERTIARY REFERRAL CENTRE IN THE CAPITAL MUSCAT; AND THE DISTRICT HOSPITALS NIZWA, SUR, AND SOHAR. IN ALL AREAS, BETWEEN 22 AND 45 PER CENT OF CHILDREN HAD HIGHER THAN DESIRABLE BLOOD LEAD LEVELS ACCORDING TO CDC CRITERIA. THE HIGHEST BLOOD LEAD LEVELS WERE FOUND IN THE ROYAL HOSPITAL, MUSCAT AND OCCURRED IN CHILDREN ATTENDING THE PAEDIATRIC ONCOLOGY OR THALASSAEMIC CLINICS WHO WERE UNDERGOING EXTENSIVE INVESTIGATIONS.

Notes NEW: ABSTRACT ONLY

MFN 0305

Subject LEAD

Country(ies)PAKISTAN

Title FACTORS ASSOCIATED WITH ELEVATED BLOOD LEAD CONCENTRATIONS IN CHILDREN IN KARACHI, PAKISTAN

Source BULLETIN OF THE WORLD HEALTH ORGANIZATION, VOL. 80, NO. 10, PP. 769-75, 2002

Author(s)RAHBAR, MH.; WHITE, F.; AGBOATWALLA, M.; HOZHABRI, S.; LUBY, S.

Publication Year 2002

Key Words LEAD/BLOOD; CHILD; PRESCHOOL; RISK FACTORS; ENVIRONMENTAL EXPOSURE; VEHICLE EMISSIONS; COSMETICS/CHEMISTRY; DUST/ANALYSIS; OCCUPATIONAL EXPOSURE; SOCIOECONOMIC FACTORS; CROSS SECTIONAL STUDIES

Abstract OBJECTIVES: TO CONFIRM WHETHER BLOOD LEAD CONCENTRATIONS IN KARACHI WERE AS HIGH AS REPORTED IN 1989 AND TO IDENTIFY WHICH TYPES OF EXPOSURE TO LEAD CONTRIBUTE MOST TO ELEVATED BLOOD LEAD CONCENTRATIONS IN CHILDREN IN KARACHI. METHODS: A TOTAL OF 430 CHILDREN AGED 36-60 MONTHS WERE SELECTED THROUGH A GEOGRAPHICALLY STRATIFIED DESIGN FROM THE CITY CENTRE, TWO SUBURBS, A RURAL COMMUNITY AND AN ISLAND SITUATED WITHIN THE HARBOUR AT KARACHI. BLOOD SAMPLES WERE COLLECTED FROM CHILDREN AND A PRETESTED QUESTIONNAIRE WAS ADMINISTERED TO ASSESS THE EFFECT OF VARIOUS TYPES OF EXPOSURE. COOKED FOOD, DRINKING-WATER AND HOUSE DUST SAMPLES WERE COLLECTED FROM HOUSEHOLDS. FINDINGS: ABOUT 80. OF CHILDREN HAD BLOOD LEAD CONCENTRATIONS 10 G/DL, WITH AN OVERALL MEAN OF 15.6 G/DL. AT THE 5 LEVEL OF SIGNIFICANCE, HOUSES NEARER TO THE MAIN INTERSECTION IN THE CITY CENTRE, APPLICATION OF SURMA TO CHILDREN'S EYES, FATHER'S EXPOSURE TO LEAD AT WORKPLACE, PARENTS' ILLITERACY AND CHILD'S HABIT OF HAND-TO-MOUTH ACTIVITY WERE AMONG VARIABLES ASSOCIATED WITH ELEVATED LEAD CONCENTRATIONS IN BLOOD. CONCLUSION: THESE FINDINGS ARE OF PUBLIC

HEALTH CONCERN, AS MOST CHILDREN IN KARACHI ARE LIKELY TO SUFFER SOME DEGREE OF INTELLECTUAL IMPAIRMENT AS A RESULT OF ENVIRONMENTAL LEAD EXPOSURE. WE BELIEVE THAT THERE IS ENOUGH EVIDENCE OF THE CONTINUING PROBLEM OF LEAD IN PETROL TO PROMPT THE PETROLEUM INDUSTRY TO TAKE ACTION. THE EVIDENCE ALSO SHOWS THE NEED FOR APPROPRIATE INTERVENTIONS IN REDUCING THE BURDEN DUE TO OTHER FACTORS ASSOCIATED WITH THIS TOXIC ELEMENT.

Notes NEW: FULL TEXT AVAILABLE SEE 313

MFN 0307

Subject LEAD

Country(ies)PAKISTAN

Title LEAD LEVELS IN PRIMARY TEETH OF CHILDREN IN KARACHI

Source ANN TROP PAEDIATR, VOL. 22, NO. 1, PP. 79-83, MAR.2002

Author(s)RAHMAN, A.; YOUSUF, FA.

Publication Year 2002

Key Words LEAD; PRIMARY SCHOOL

Abstract THE MAJORITY OF CHILDREN IN KARACHI HAVE BLOOD LEAD LEVELS ABOVE 10 MICROGRAMS/DL, THE UPPER SAFETY LIMIT SET BY THE UNITED STATES CENTERS FOR DISEASE CONTROL AND PREVENTION. A STUDY WAS UNDERTAKEN TO EVALUATE CHRONIC LEAD EXPOSURE IN CHILDREN BY MEASURING LEAD LEVELS IN SHED PRIMARY TEETH COLLECTED FROM PRIMARY SCHOOL CHILDREN IN KARACHI. A TOTAL OF 309 TEETH WERE COLLECTED FROM NINE DIFFERENT SCHOOLS, AND ANALYSED FOR LEAD CONTENT BY ATOMIC ABSORPTION SPECTROPHOTOMETRY WITH ELECTROTHERMAL ATOMIZATION. THE MEAN (SD)AGE OF THE SUBJECTS WAS 7.6 (1.2)YEARS AND THE MEAN LEAD LEVEL WAS 5.78 MICROGRAMS/G OF WHOLE TOOTH (DRY WEIGHT), RANGING FROM 0.42 TO 39.75 MICROGRAMS/G. INCISOR TEETH HAD A SIGNIFICANTLY HIGHER MEAN (SD)LEAD LEVEL, 6.42 (4.19)MICROGRAMS/G, THAN CANINES AND MOLARS WHICH CONTAINED 4.91 (5.12)MICROGRAMS AND 4.50 (2.67)MICROGRAMS LEAD WHOLE TOOTH (DRY WEIGHT), RESPECTIVELY. SIGNIFICANT DIFFERENCES WERE OBSERVED BETWEEN DIFFERENT SCHOOLS. NO DIFFERENCE WAS OBSERVED BETWEEN BOYS AND GIRLS AND THE ACCUMULATION OF LEAD IN TEETH WAS NOT CORRELATED WITH CHRONOLOGICAL AGE.

Notes NEW: ABSTRACT ONLY

MFN 0032

Subject LEAD; HEAVY METALS

Country(ies)PAKISTAN

Title THE COPPER, MANGANESE AND LEAD LEVELS IN CHILDREN OF A SCHOOL IN ISLAMABAD.

Source PAK. J. ZOOL., VOL. 24, NO. 3, PP. 227-229; 1992

Author(s)AHMED, S.; LUBNA, S.; SULTANA, K.

Publication Year 1992

Key Words COPPER; MANGANESE; LEAD; CHILDREN; HEAVY METALS

Abstract COPPER, MANGANESE AND LEAD LEVELS WERE STUDIED IN BLOOD SAMPLES OF 165 NORMAL SCHOOL CHILDREN AGED 5 TO 14 YEARS, BELONGING TO THE BARI IMAM AREA, ISLAMABAD. MEAN COPPER LEVELS RANGED FROM 40.91 MU G/DL TO 98.56 MU G/DL AMONG THE BOYS. THE VALUES RANGED FROM 56.88 MU G/DL TO 111.2 MU G/DL AMONG THE GIRLS. MEAN MANGANESE LEVELS RANGED FROM 0.605 TO 2.34 MU G/DL FOR BOYS AND THE VALUES DETERMINED FOR THE GIRLS RANGED FROM 0.365 TO 2.24 MU G/DL. THE MEAN LEAD LEVELS FOR BOYS RANGED FROM 14.14 TO 35.4 MU G/DL, WHILE THE MEAN LEVELS FOR GIRLS RANGED FROM 15.00 MU G/DL TO 34.22 MU G/DL.

MFN 0125

Subject LEAD

Country(ies)PAKISTAN

Title LEADED EYE COSMETICS: A CULTURAL CAUSE OF ELEVATED LEAD LEVELS IN CHILDREN

Source, J-FAM-PRACT. JOURNAL-OF-FAMILY-PRACTICE. 40/4 (358-362)1995

Author(s)SPRINKLE, RV

Publication Year 1995

Key Words LEAD POISONING DIAGNOSIS; LEAD POISONING ETIOLOGY; EYE; COSMETIC DRUG TOXICITY; LEAD DRUG TOXICITY

Abstract BACKGROUND. PREVENTING LEAD EXPOSURE IS OF PARAMOUNT IMPORTANCE BECAUSE LEAD IS SIGNIFICANTLY TOXIC AT SUBCLINICAL LEVELS, AND TREATING PATIENTS WITH ELEVATED BLOOD LEAD LEVELS IS DIFFICULT. CHILDREN WERE EVALUATED FOR LEAD EXPOSURE IN CALIFORNIA THROUGH A STATE-MANDATED LEAD SCREENING PROGRAM THAT WAS BEGUN IN NOVEMBER 1991. IMPORTED EYE COSMETICS WERE IDENTIFIED AS A SUSPECTED SOURCE OF LEAD EXPOSURE FOR PAKISTANI AND INDIAN CHILDREN WHO USED THESE PRODUCTS. METHODS. A RETROSPECTIVE CHART REVIEW OF CHILDREN AT A COUNTY HOSPITAL CLINIC WAS UNDERTAKEN FOR THE PERIOD BEGINNING OCTOBER 1991 AND ENDING FEBRUARY, 1994. LEAD EXPOSURE QUESTIONNAIRES WERE FILLED OUT AT CLINIC VISITS, AND TELEPHONE INTERVIEWS WERE CONDUCTED WITH PARENTS OR GUARDIANS OF CHILDREN FROM ETHNIC GROUPS WHO USE EYE COSMETICS. RESULTS. LEAD LEVEL RESULTS WERE AVAILABLE FOR 175 CHILDREN. THE AVERAGE LEAD LEVEL WAS 4.3 MU G/DL (0.21 MU MOL/L) FOR PAKISTANI/INDIAN CHILDREN NOT USING EYE COSMETICS AND 12.9 MU G/DL (0.62 MU MOL/L) (P=.03) FOR THOSE USING THE PRODUCTS. CHEMICAL EVALUATION OF SOME OF THE EYE COSMETICS USED BY THESE CHILDREN REVEALED HIGH LEAD CONTENT. CONCLUSIONS. USE OF EYE COSMETICS IMPORTED FROM PAKISTAN WAS FOUND TO BE STRONGLY CORRELATED WITH ELEVATED BLOOD LEAD LEVELS. ALTHOUGH IMPORTATION OF LOADED EYE COSMETICS IS PROHIBITED BY LAW, LEGISLATION HAS NOT BEEN EFFECTIVE IN PROTECTING CHILDREN FROM THIS SOURCE OF LEAD EXPOSURE. EDUCATION REGARDING LOW LEVEL LEAD TOXICITY AND AVOIDANCE OF SUBSTANCES CONTAINING LEAD IS NEEDED, PARTICULARLY FOR TARGETED SUBPOPULATIONS.

MFN 0223

Subject LEAD; TOXICITY

Country(ies)PAKISTAN

Title BLOOD LEAD LEVELS IN YOUNG CHILDREN IN CHAKSHAHZAD, ISLAMABAD

Source JPMA-PAK. MED. ASSOC., 45

Author(s)SADARUDDIN, AGHA; AGHA, F.; KHATOON, N.; SULTANA, KH.

Publication Year 1995

Key Words LEAD; BLOOD; ENVIRONMENTAL POLLUTION

Abstract BLOOD LEAD LEVELS WERE ESTIMATED IN ONE HUNDRED AND SEVENTY SCHOOL CHILDREN, AGED 13 TO 19 YEARS, RESIDING IN CHAKSHAHZAD AREA OF ISLAMABAD. THE OVERALL MEAN BLOOD LEAD LEVEL WAS 2.38 MICROGRAM/DL (RANGE 0.2 TO 8.6 MICROGRAM/DL), 3.22 MICROGRAM/DL IN BOYS AND 1.49 MICROGRAM/DL IN GIRLS. A SIGNIFICANT DIFFERENCE (P<0.01) WAS FOUND IN MEAN BLOOD LEAD CONCENTRATIONS BETWEEN THE TWO SEXES. THE HIGHEST MEAN LEVELS FOR LEAD WERE FOUND AT THE AGE OF 13 YEARS. BLOOD LEAD LEVELS IN ADOLESCENTS REPORTED HERE WERE RELATIVELY LOW. THEY REFLECT VERY LITTLE OR NO RISK TO THE HEALTH OF CHILDREN IN CHAKSHAHZAD AND IT ALSO INDICATED THAT AREA OF CHAKSHAHZAD IS RELATIVELY FREE FROM ANY LEAD POLLUTION (JPMA 45:215, 1995).

Notes 27. FULL TEXT BECAME AVAILABLE

MFN 0227

Subject LEAD

Country(ies)PAKISTAN

Title BLOOD LEAD LEVELS IN PRESCHOOL CHILDREN IN RAWALPINDI

Source JPMA-PAK. MED. ASSOC., 46

Author(s)HAFEZ, ASSAD; MALIK, QUDRAT U.

Publication Year 1996

Key Words LEADBEHAVIOR; OCCUPATIONAL HEALTH; ENVIRONMENTAL EXPOSURE

Abstract BLOOD LEAD LEVELS WERE DETERMINED IN PRESCHOOL CHILDREN RESIDING IN URBAN AREAS OF RAWAPINDI CITY. OF 92 (50 MALES AND 42 FEMALES)CHILDREN AGED ONE TO 5 YEARS WERE INCLUDED IN THE STUDY. BLOOD LEAD LEVELS RANGED FROM 7 MICROGRAM/DL TO 34 MICROGRAM/DL (MEAN 18.8 MICROGRAM/DL). THE MEAN LEAD LEVELS WERE SLIGHTLY HIGHER IN MALES (20.3 MICROGRAM/DL)THAN IN FEMALES (17.2 MICROGRAM/DL)AND OVER 90 PERCENT CHILDREN HAD LEAD LEVELS ABOVE THE ACCEPTABLE LIMIT OF 10 MICROGRAM/DL. USE OF LEADED PETROL, CONTAMINATED SURMA, LEADED PAINTS AND PICA IN CHILDREN ARE COMMON IN OUR COUNTRY AND MAY LEAD TO INCREASES LEAD LEVELS AND APPROPRIATE MEASURES SHOULD BE TAKEN TO CONTROL THIS TREND (JPMA 46:272, 1996).

Notes 15. FULL TEXT BECAME AVAILABLE

MFN 0228

Subject LEAD

Country(ies)PAKISTAN

Title BLOOD LEAD LEVELS IN SCHOOL CHILDREN OF PESHAWAR CITY

Source PAK. J. MED. RES., 33

Author(s)ZAHORULLAH; HAQ, T.; AKHTAR, T.; & AKHTAR, M.Publication Year 1994

Key Words ENVIRONMENTAL EXPOSURE; HEMATOLOGIC TESTS; METHODS; LEAD; BLOOD

Abstract FIVE HUNDRED SCHOOL CHILDREN COMPRISING MALES AND FEMALES IN THE RATIO OF 3:1 WITH MEAN AGE OF 14 AND 13.2 YEARS RESPECTIVELY WERE SELECTED FROM VARIOUS SCHOOLS OF PESHAWAR CITY AND INVESTIGATED FOR THEIR BLOOD LEAD LEVELS. MEAN BLOOD LEAD LEVELS OF MALE AND FEMALE STUDENTS HAVE BEEN FOUND TO BE 21.2 ± 8.15 AND 16.8 ± 4.81 MICROGRAM/DL RESPECTIVELY. 13 PERCENT OF MALE STUDENTS SHOWED BLOOD LEAD LEVEL IN THE RANGE OF 31–50 MICROGRAM/DL WITH NO FEMALE STUDENTS IN THIS RANGE. MEAN BLOOD LEAD LEVEL OF STUDENTS WHO LIVE NEAR MAIN ROADS WAS SIGNIFICANTLY HIGHER THAN THOSE LIVING AT A DISTANCE OF MORE THAN 1/2 KM FROM MAIN ROAD. IN CONTRAST TO KARACHI WHERE OVER 98 PERCENT OF CHILDREN HAD BLOOD LEAD LEVELS OVER 20 MICROGRAM/DL, IN PESHAWAR, 32.6 PERCENT HAD A LEVEL ABOVE THIS LIMIT. THE FINDING THAT 13 PERCENT OF MALE CHILDREN HAVING HIGH BLOOD LEVEL IN THE RANGE OF 31–50 MICROGRAM/DL AND WHO ARE AT RISK OF NEUROPHYSIOLOGIC IMPAIRMENT SHOULD BE A CAUSE FOR CONCERN AND IMMEDIATE MEASURES NEED TO BE TAKEN TO REDUCE ENVIRONMENTAL POLLUTION CAUSED BY LEADED PETROL.

Notes 12. FULL TEXT BECAME AVAILABLE

MFN 0331

Subject LEAD POISONING

Country(ies)PALESTINE

Title RE-EMERGENCE OF LEAD POISONING FROM CONTAMINATED FLOUR IN WEST BANK PALESTINIAN VILLAGE

Source INT-J-OCCUP-ENVIRON-HEALTH (INTERNATION-JOURNAL-OF-OCCUPATIONAL-AND-ENVIRONMENTAL-HEALTH), 6/3, PP. 183–186, 2000

Author(s)EL-SHARIF, N; FISCHBEIN, A; KONIJN, A; GORODETSKY, R; EL-SHARIF, H; KAUL, B; HERSHKO, C; GRAUER, F; FONER, H; AL-BABA, A; DWEIK, Z; LIHSOUNAT, M; RICHTER, ED

Publication Year 2000

Key Words LEAD POISONING; STONE MILLS; FLOUR; WEST BANK

Abstract ALTHOUGH CONTAMINATED FLOUR WAS FIRST DESCRIBED AS AN IMPORTANT SOURCE OF ENDEMIC LEAD POISONING IN THE MIDDLE EAST ALMOST 20 YEARS AGO, THE USE OF LEAD IN COMMUNITY FLOUR MILLS HAS NOT BEEN ELIMINATED AND CONTINUES TO REPRESENT A SIGNIFICANT ENVIRONMENTAL RISK. THE AUTHORS DESCRIBE AN OUTBREAK OF LEAD POISONING IN A WEST BANK PALESTINIAN FAMILY AND DRAW ATTENTION TO THIS UNUSUAL BUT IMPORTANT SOURCE OF LEAD EXPOSURE. ALL 13 MEMBERS OF THE FAMILY (2 CHILDREN 11 ADULTS), WERE FOUND TO HAVE LEAD POISONING FOLLOWING HOSPITALIZATION FOR 'GASTROENTERITIS', HEADACHE, JOINT PAIN, WEIGHT LOSS, AND VISION DIFFICULTIES. SEVEN FEMALES HAD LOW HEMOGLOBIN LEVELS. BLOOD LEAD CONCENTRATIONS RANGED FROM 42 TO 48 *GMG/DL. HOUSEHOLD FLOUR SAMPLES OBTAINED FROM A STONE MILL, PREVIOUSLY CLOSED BECAUSE OF LEAD CONTAMINATION, CONTAINED 2000 PPM LEAD. FLOUR FROM TRADITIONAL STONE MILLS REINFORCED WITH LEAD JOINTS REMAINS A POTENTIAL SOURCE FOR LEAD POISONING.

Notes NEW: ABSTRACT ONLY (FROM POLLUTION TOXICOLOGY)

MFN 0314

Subject LEAD POISONING

Country(ies)QATAR

Title LEAD POISONING: THE FORGOTTEN EPIDEMIC; PRELIMINARY STUDY IN QATAR

Source

Corporate Author (s)

WHO.EMRO.CEHA

Publication Year 1999

Key Words LEAD; LEAD SOURCES; WATER; CHILDREN'S FOOD; INFANT FOOD

Abstract A TOTAL OF 450 SAMPLES OF DRINKING WATER WERE ANALYZED FOR MEASUREMENT OF LEAD LEVELS. FROM 336 SAMPLES COLLECTED FROM VARIOUS LOCATIONS IN THE CITY OF DOHA AND ITS SUBURBS, 39 SAMPLES HAD A LEAD LEVEL EXCEEDING THE WHO GUIDELINE OF 0.01 MG/L. THE HIGHEST LEVEL REACHED IN THESE VIOLATIVE SAMPLES WAS 0.132 MG/L. SEVENTY-THREE SAMPLES OF BOTTLED WATER WERE COLLECTED REPRESENTING 21 BRANDS. ONLY 2 SAMPLES REACHED A LEVEL OF 0.012 MG/L, SLIGHTLY EXCEEDING THE WHO GUIDELINE VALUE. FROM A TOTAL OF 41 SAMPLES OF UNDERGROUND WATER REPRESENTING 12 DIFFERENT GEOGRAPHICAL LOCATIONS IN QATAR, ONLY 6 SAMPLES SLIGHTLY EXCEEDED THE WHO GUIDELINE VALUE AND THE HIGHEST LEVEL REACHED WAS 0.027MG/L. MORE THAN 200 SAMPLES OF PROCESSED FOODSTUFFS WERE ANALYZED, REPRESENTING SEVERAL FOOD GROUPS. GENERALLY, NO SERIOUS VIOLATIONS IN LEAD LEVELS WERE FOUND IN ANY SAMPLES ANALYZED. THESE INCLUDED INFANT FORMULAE (17 SAMPLES)AND COMMODITIES WIDELY USED BY CHILDREN (26 SAMPLES OF MILK AND DAIRY PRODUCTS, 34 SAMPLES OF FRUIT DRINK PRODUCTS AND SOFT DRINKS, AND 11 SAMPLES OF POTATO AND CORN BASED SNACK PRODUCTS). WITH THE EXCEPTION OF 3 SAMPLES OF MILK AND DAIRY PRODUCTS AND ONE SAMPLE OF RICE GRAINS, LEAD LEVELS WERE WELL BELOW THE MAXIMUM LIMITS RECOMMENDED BY THE FAO/WHO CODEX ALIMENTARIUS COMMISSION. TWO HUNDRED BLOOD SAMPLES WERE COLLECTED FROM CHILDREN (15 YEARS)REFERRED BY PEDIATRIC CLINICS TO DETERMINE THEIR BLOOD LEAD LEVELS FOR DIAGNOSTIC PURPOSES. ONLY 3 PATIENTS SHOWED VALUES EXCEEDING THE LEVEL OF 25 µG/DL USED IN QATAR AS THE MAXIMUM LIMIT FOR NORMAL

BLOOD LEAD. THE HIGHEST LEVEL REACHED APPROXIMATELY 38 µG/DL AND WAS A SINGLE CASE. COMPARED TO RESULTS COLLECTED IN THE EIGHTIES AND EARLY NINETIES THE PRESENT RESULTS SUGGEST THAT THERE HAVE BEEN SIGNIFICANT REDUCTIONS IN LEAD LEVELS IN WATER, FOOD, AND THE BLOOD OF CHILDREN. THIS IS DUE TO THE MEASURES IMPLEMENTED IN THE STATE OF QATAR OVER THE LAST TEN YEARS TO CONTROL THE SPREAD OF LEAD CONTAMINATION. THESE MEASURES WERE MAINLY SUCCESSFUL DUE TO THE AVAILABILITY OF GOOD ANALYTICAL METHODS FOR LEAD MEASUREMENT. IT IS RECOMMENDED THAT A WIDER NATIONAL SURVEY BE CONDUCTED TO ALLOW BETTER ASSESSMENT OF THE AVERAGE LEAD INTAKE AND BLOOD LEVELS IN CHILDREN, PREGNANT WOMEN AND NURSING MOTHERS. A NEW PROTOCOL TO DEAL WITH HIGH BLOOD LEAD LEVELS IN CHILDREN IS PROPOSED TO REPLACE THE PRESENT PRACTICE IN THE STATE OF QATAR. THE PROPOSED PROTOCOL INTRODUCES THE NEW ACTION LEVELS OF 10 µG/DL FOR CHILDREN AND PREGNANT WOMEN AND 30 µG/DL FOR ADULTS REPLACING THE PRESENT UNIFIED LEVEL OF 25 µG/DL.

Notes NEW: CEHA SPECIAL STUDIES; SS-9

MFN 0308

Subject LEAD

Country(ies)SAUDI ARABIA

Title RELATIONSHIPS BETWEEN BLOOD LEAD CONCENTRATIONS, INTELLIGENCE, AND ACADEMIC ACHIEVEMENT OF SAUDI ARABIAN SCHOOLGIRLS.

Source INT J HYG ENVIRON HEALTH, VOL. 204, NO. 2-3, PP. 165-74, NOV. 2001

Author(s)AL-SALEH, I.; NESTER, M.; DEVOL, E.; SHINWARI, N.; MUNCHARI, L.; AL-SHAHRIA, S.

Publication Year 2001

Key Words LEAD; PRIMARY SCHOOLGIRLS; NEUROPSYCHOLOGICAL IMPAIRMENT; BEHAVIOURAL IMPAIRMENT

Abstract THIS CROSS-SECTIONAL STUDY EXAMINED THE ASSOCIATION BETWEEN BLOOD LEAD LEVELS AND NEUROPSYCHOLOGICAL AND BEHAVIOURAL PROBLEMS OF 533 SCHOOLGIRLS (6-12 YEARS OF AGE)WHO ATTENDED PUBLIC SCHOOLS IN RIYADH, CAPITAL OF SAUDI ARABIA. REGRESSION MODELS WERE USED TO DETERMINE THE BEST PREDICTORS OF BEERY VMI SAUDI-BASED STANDARD SCORES, TONI SAUDI-BASED SCORES AND RANK PERCENTILE. THE MEAN BLOOD LEAD LEVEL WAS 8.11 +/-3.50 MICROGRAMS/DL IN THE RANGE OF 2.3 TO 27.36 MICROGRAMS/DL. SIGNIFICANT NEGATIVE ASSOCIATIONS WERE NOTED BETWEEN BLOOD LEAD LEVELS AND BEERY VMI SAUDI-BASED STANDARD SCORES AS WELL AS RANK PERCENTILE. LEAD HAD NO EFFECT ON TONI SAUDI-BASED STANDARD SCORES. BEERY VMI SAUDI-BASED STANDARD SCORES, TONI SAUDI-BASED STANDARD SCORES AND RANK PERCENTILES WERE INVERSELY RELATED TO PUPILS WITH BLOOD LEAD LEVELS 9 MICROGRAMS/DL. THESE FINDINGS ATTEST AN ASSOCIATION BETWEEN NEUROPSYCHOLOGICAL AND BEHAVIOURAL IMPAIRMENT AND LEAD EXPOSURE AT BLOOD LEAD LEVELS IN THE RANGE OF 9.02 TO 27.36 MICROGRAMS/DL. THE RESULTS OF THIS STUDY SHOULD BE SERIOUSLY CONSIDERED BY PUBLIC HEALTH AUTHORITIES TO GIVE MORE ATTENTION TO THIS PEDIATRIC HEALTH PROBLEM.

Notes NEW: ABSTRACT ONLY

MFN 0321

Subject LEAD

Country(ies)SAUDI ARABIA

Title DETERMINANTS OF BLOOD LEAD LEVELS IN SAUDI ARABIAN SCHOOLGIRLS

Source INT J OCCUP ENVIRON HEALTH, VOL. 5, NO. 2, PP. 107-114, 1999

Author(s)AL-SALEH, IMAN; NESTER, MISHAEL; DEVOL, EDWARD; SHINWARI, NEPTUNE; AL-SHAHRIA, SULIMAN

Publication Year 1999

Key Words BLOOD/LEAD; SCHOOLCHILDREN; KOHL

Abstract BLOOD LEAD LEVELS WERE MEASURED IN 538 GIRLS AGED 6–12 YEARS WHO ATTENDED PRIMARY PUBLIC SCHOOLS IN RIYADH, SAUDI ARABIA. OF THE 538 SCREENED CHILDREN, 24.4 PERCENT HAD BLOOD LEAD LEVELS OR = 10 MICROGRAM/DL, THE CENTERS FOR DISEASE CONTROL'S LEVEL OF CONCERN. VARIATIONS IN THE BLOOD LEAD LEVELS WAS INVESTIGATED WITH RESPECT TO A NUMBER OF RISK FACTORS. THE MAIN DETERMINANT OF BLOOD LEAD LEVELS WAS THE REGIONAL LOCATION OF THE SCHOOL. PUPILS WHO ATTENDED SCHOOLS LOCATED IN THE CENTRAL REGION OF RIYADH HAD SIGNIFICANTLY HIGHER BLOOD LEAD CONCENTRATIONS THAN DID PUPILS WHO ATTENDED SCHOOLS IN THE PERIPHERAL AREAS. THIS IS MOST LIKELY TO BE DUE TO THE HEAVY VEHICULAR EMISSIONS IN THE CENTRAL REGION. OTHER VARIABLES SUCH AS LOW FAMILY INCOME, GRADE AND APPLICATION OF KOHL TO THE CHILD'S EYES AND/OR UMBILICUS AT BIRTH WERE ALSO CONTRIBUTORS TO THE BLOOD LEAD LEVELS. THESE OBSERVATIONS EMPHASIZE THE IMPORTANCE OF HEALTH EDUCATION PROGRAMS TO PROMOTE THE REDUCTION OF LEAD EXPOSURE IN THE GENERAL POPULATION.

Notes NEW: FULL TEXT AVAILABLE

MFN 0322

Subject LEAD

Country(ies)SAUDI ARABIA

Title DISTRIBUTION OF BLOOD LEAD LEVELS IN 1047 SAUDI ARABIAN CHILDREN WITH RESPECT TO PROVINCE, SEX, AND AGE

Source ARCHIVES OF ENVIRONMENTAL HEALTH, VOL. 49, NO. 6, PP. 471–476, 1994

Author(s)AL-SALEH, IMAN; DEVOL, EDWARD; TAYLOR, ANDREW

Publication Year 1994

Key Words BLOOD/LEAD; CHILDREN; COSMETICS; GEOGRAPHICAL DISTRIBUTION

Abstract RELATIONSHIPS BETWEEN BLOOD LEAD CONCENTRATIONS IN 1047 CHILDREN AGED 2 MO TO 16 Y AND AGE, SEX, AND PROVINCE (I.E., RESIDENCE) WERE EXAMINED. THE RELATIONSHIPS WERE CONSISTENT WITH OTHER STUDIES, IN WHICH MEAN BLOOD LEAD CONCENTRATIONS REPORTEDLY INCREASED DURING THE FIRST 5 Y OF LIFE, AFTER WHICH BEGAN TO DECREASE, REACHING A MINIMUM AT APPROXIMATELY 16 Y OF AGE. HOWEVER, BOYS WHO WERE MORE THAN 6 Y OF AGE HAD HIGHER BLOOD CONCENTRATIONS THAN SIMILARLY AGED GIRLS. BLOOD LEAD LEVELS OF CHILDREN LIVING IN THE EASTERN PROVINCE WERE HIGHER THAN LEVELS FOUND IN CHILDREN FROM OTHER PROVINCES. MOST OF THE CHILDREN IN THIS STUDY WHO HAD ELEVATED BLOOD LEAD CONCENTRATIONS RESIDED IN SMALL TOWNS, E.G., EHSSA, ABQIQ, HOFUOF, RATHER THAN IN CITIES SUCH AS DAMMAM AND DAHRAN. FACTORS, SUCH AS SOCIOECONOMIC STATUS AND CULTURAL HABITS (E.G., DIET, USE OF TRADITIONAL REMEDIES AND COSMETICS), MAY HAVE CONTRIBUTED TO THIS RESULT.

Notes NEW: FULL TEXT AVAILABLE

MFN 0323

Subject IRON DEFICIENCY

Country(ies)SAUDI ARABIA

Title THE USEFULNESS OF ZINC PROTOPORPHYRIN AS IRON DEFICIENCY SCREENING TOOL FOR SAUDI CHILDREN

Source INTERNATIONAL JOURNAL OF ENVIRONMENTAL HEALTH RESEARCH, 7, PP. 55–61, 1997

Author(s)AL-SALEH, IMAN; SHINWARI, NEPTUNE

Publication Year 1997

Key Words ZINC PROTOPORPHYRIN; IRON DEFICIENCY; LEAD EXPOSURE; CHILDREN

Abstract BLOOD SAMPLES FROM 240 SAUDI CHILDREN AGED 1 DAY-72 MONTHS OLD WERE ANALYSED FOR ZINC PROTOPORPHYRIN (ZPP), LEAD (PB) AND HEMATOLOGICAL PARAMETERS. ELEVATED BLOOD ZINC PROTOPORPHYRIN CONCENTRATIONS (3.3 MICROGRAM/G HB) WERE FOUND IN 50.8 PERCENT. THESE CHILDREN HAD A MEAN BLOOD ZPP CONCENTRATION OF 6.857 ± 4.925 MICROGRAM/G (3.35–43.7 MICROGRAM/G). BLOOD LEAD LEVEL 10 MICROGRAM/DL WERE FOUND IN 8 CHILDREN IN THE RANGE OF 10.45–61.08 MICROGRAM/DL. ON THE OTHER HAND, HB LESS THAN 11 G/DL WERE FOUND IN 51.6 PERCENT. THE CORRELATION COEFFICIENT BETWEEN THE CONCENTRATION OF ZPP AND THE HEMATOLOGICAL PARAMETERS AND AGE WERE TESTED. SIGNIFICANT NEGATIVE CORRELATION WAS FOUND BETWEEN ZPP CONCENTRATIONS AND HB, HCT, RBC AND AGE. WE CONCLUDE THAT THE USE OF HEMATOFUOROMETER TO MEASURE ZPP PROVED TO BE AN EFFECTIVE AND INEXPENSIVE SCREENING TOOL FOR IRON DEFICIENCY IN CHILDREN ESPECIALLY IN COMMUNITIES WHERE THE PREVALENCE OF IRON DEFICIENCY IS HIGH.

Notes NEW: FULL TEXT AVAILABLE

MFN 0324

Subject LEAD

Country(ies) SAUDI ARABIA

Title A CHARACTERIZATION OF THE BLOOD LEAD CONCENTRATION IN SAUDI ARABIAN CHILDREN

Source ANNALS OF CLINICAL BIOCHEMISTRY, VOL. 31, PP. 469–472, 1994

Author(s) AL-SALEH, IMAN; DE VOL, EDWARD; TAYLOR, ANDREW

Publication Year 1994

Key Words BLOOD/LEAD; CHILDREN; NON-LINEAR MATHEMATICAL MODEL; CUMULATIVE DISTRIBUTION

Abstract THE RESULTS PRESENTED IN THIS PAPER ARE THOSE DERIVED FROM AN EXTENSIVE ANALYSIS OF LEAD IN 1047 CHILDREN AGED 2 MONTHS TO 16 YEARS ATTENDING AS OUTPATIENTS AT A REFERENCE HOSPITAL, TAKING CASES FROM ALL PARTS OF THE KINGDOM OF SAUDI ARABIA. SINCE THE DISTRIBUTION OF BLOOD LEAD DATA IN THE SAMPLE SUGGESTED THE EXISTENCE OF TWO MIXED SUB GROUPS AMONG THE STUDIED CHILDREN, A NON-LINEAR MATHEMATICAL MODEL WAS USED FIT TO THE DATA. MORE THAN 20 PERCENT OF THE CHILDREN HAD BLOOD LEAD CONCENTRATIONS ABOVE 0.608 MICROMOLE/L (12.59 MICROGRAM/DL).

Notes NEW: FULL TEXT AVAILABLE

MFN 0325

Subject LEAD

Country(ies) SAUDI ARABIA

Title LEAD EXPOSURE IN THE CITY OF ARAR, SAUDI ARABIA

Source ARCHIVES OF ENVIRONMENTAL HEALTH, VOL. 51, NO. 1, PP. 73–, 1996

Author(s) AL-SALEH, IMAN; MUSTAFA, ALI; DUFOUR, LAILA; TAYLOR, ANDREW; HITON, RICHARD

Publication Year 1996

Key Words LEAD POISONING; COSMETICS; SOCIOECONOMIC FACTORS

Abstract IN FOLLOW-UP TO A CASE OF LEAD ENCEPHALOPATHY, HIGH PREVALENCES OF LEAD EXPOSURE (23 PERCENT) AND IRON DEFICIENCY (60 PERCENT) WERE FOUND IN CHILDREN WHO LIVED IN ARAR, SAUDI ARABIA. ENVIRONMENTAL FACTORS HAD MINOR EFFECTS ON THE BLOOD LEAD CONCENTRATIONS OF THESE CHILDREN. WE CONCLUDED THAT TRADITIONAL COSMETICS AND REMEDIES WERE THE MAJOR SOURCES OF LEAD EXPOSURE IN THIS ARAR POPULATION.

Notes NEW: FULL TEXT AVAILABLE

MFN 0326

Subject LEAD

Country(ies)SAUDI ARABIA

Title USEFULNESS OF ERYTHROCYTE PROTOPORPHYRIN AS A PRIMARY SCREENING TEST FOR LEAD EXPOSURE IN CHILDREN

Source INTERNATIONAL JOURNAL OF ENVIRONMENTAL HEALTH RESEARCH, 2, PP. 184–191, 1992

Author(s)AL-SALEH, IMAN; TAYLOR, ANDREW; HINTON, RICHARD

Publication Year 1992

Key Words ERYTHROCYTE PROTOPORPHYRIN; LEAD EXPOSURE; CHILDREN

Abstract ERYTHROCYTE PROTOPORPHYRIN AND BLOOD LEAD CONCENTRATIONS WERE MEASURED IN SAMPLES FROM 583 SAUDI CHILDREN ATTENDING THE OUTPATIENT CLINICS. ERYTHROCYTE PROTOPORPHYRIN CONCENTRATIONS SHOWED POOR CORRELATION WITH BLOOD LEAD CONCENTRATIONS OF 25 UG PER DL AND BELOW. MEASUREMENT OF ERYTHROCYTE PROTOPORPHYRIN AS A PRIMARY TEST FOR LEAD EXPOSURE IS NOT RECOMMENDED.

Notes NEW: FULL TEXT AVAILABLE

MFN 0327

Subject LEAD

Country(ies)SAUDI ARABIA

Title BLOOD LEAD LEVEL AND HAEMATOLOGICAL PARAMETERS IN SAUDI ARABIAN FEMALE SCHOOL CHILDREN

Source JOURNAL OF ENVIRONMENTAL MEDICINE, 1: PP. 141–146, 1999

Author(s)AL-SALEH, IMAN; NESTER, M; DEVOL, E; SHINWARI, N; AL-SHAHRIA, S

Publication Year 1999

Key Words LEAD; SCHOOL CHILDREN; HAEM-SYNTHESIS; HAEMATOLOGICAL PARAMETERS

Abstract THE PRESENT STUDY AFFORDED THE OPPORTUNITY TO STUDY THE EFFECT OF LEAD ON HAEMATOLOGICAL PARAMETERS OF 538 SAUDI FEMALE PUPILS AGED 6 TO 12 YEARS LIVING IN RIYADH CITY. BLOOD LEAD LEVELS RANGED FROM 2.3 TO 27.362 MICROGRAM PER DL. BASED ON MENTZER'S FORMULA, 42 PUPILS WERE EXCLUDED DUE TO THALASSAEMIA. MULTIPLE REGRESSION ANALYSES WERE CONDUCTED TO STUDY THE EFFECT OF LEAD ON HAEMATOLOGICAL PARAMETERS SUCH AS HGB, HCT, MCV AND MCH AFTER ADJUSTING FOR SERUM FE AND A NUMBER OF OTHER VARIABLES. THE RESULTS SHOWED THAT MCV WAS SIGNIFICANTLY ASSOCIATED WITH BLOOD LEAD LEVELS. MICROCYTIC ANAEMIA IN 108 PUPILS WITH BLOOD LEAD LEVELS 10 MICROGRAM PER DL WAS ALSO INVESTIGATED. OF THE 108 PUPILS, 24 HAD MICROCYTIC ANAEMIA AS DEFINED BY MCV 80FL AND HCT 0.36. THE RESULTS OF THIS STUDY INDICATE THAT HAEMATOLOGICAL ABNORMALITIES CAN BE SEEN AT BLOOD LEAD LEVELS LESS THAN THE CURRENT CDC ACCEPTABLE LIMIT FOR LEAD.

Notes NEW: FULL TEXT AVAILABLE

MFN 0328

Subject LEAD

Country(ies)SAUDI ARABIA

Title LEAD, ERYTHROCYTE PROTOPORPHYRIN, AND HEMATOLOGICAL PARAMETERS IN NORMAL MATERNAL AND UMBILICAL CORD BLOOD FROM SUBJECTS OF THE RIYADH REGION, SAUDI ARABIA

Source ARCHIVES OF ENVIRONMENTAL HEALTH, VOL. 50, NO. 1, PP. 66–73, 1995

Author(s)AL-SALEH, IMAN; KHALIL, MOHAMMED ABDULKARIM; TAYLOR, ANDREW

Publication Year 1995

Key Words LEAD EXPOSURE; HAEMATOLOGICAL PARAMETERS; PREGNANT WOMEN; NEWBORNS

Abstract A SURVEY WAS UNDERTAKEN AMONG 124 PREGNANT WOMEN LIVING IN RIYADH CITY TO INVESTIGATE THE PASSAGE OF LEAD FROM THE PREGNANT MOTHER TO THE UNBORN CHILD. THE MEAN MATERNAL BLOOD LEAD LEVEL WAS 5.49 ± 2.6 MICROGRAM PER DL AND FOR THE UMBILICAL CORD WAS 4.14 ± 1.81 MICROGRAM PER DL. LEAD LEVELS WERE HIGHER IN MATERNAL THAN IN THE UMBILICAL CORD BLOOD. THE RESULTS ARE IN AGREEMENT WITH OTHER STUDIES. IN THIS STUDY, AN EXCELLENT CORRELATION BETWEEN THE MATERNAL AND CORD BLOOD LEAD LEVELS ($R=.83$, $P.0001$) CONFIRMS THE TRANSFER OF LEAD FROM THE MOTHER TO THE FETUS. A WEAK BUT SIGNIFICANT RELATIONSHIP WAS FOUND BETWEEN MATERNAL BLOOD LEAD CONCENTRATIONS AND BIRTH WEIGHT OF NEWBORNS (R

Notes NEW: FULL TEXT AVAILABLE

MFN 0330

Subject LEAD

Country(ies) SAUDI ARABIA

Title LEAD EXPOSURE IN SAUDI ARABIA AND ITS RELATIONSHIP TO SMOKING

Source BIOMETALS, VOL. 8, PP. 243-245, 1995

Author(s) AL-SALEH, IMAN

Publication Year 1995

Key Words LEAD; SMOKING

Abstract LEAD WAS DETERMINED IN WHOLE BLOOD SAMPLES OBTAINED FROM 202 SAUDI MALE VOLUNTEERS. THE INFLUENCE OF SMOKING ON LEAD EXPOSURE WAS INVESTIGATED. BLOOD LEAD WAS SIGNIFICANTLY HIGHER IN CURRENT SMOKERS THAN IN NON-SMOKERS AND PREVIOUS SMOKERS ($P0.05$). THE DISTRIBUTION OF BLOOD LEAD DATA IN THE SCREENED SUBJECTS SUGGESTED THE EXISTENCE OF TWO MIXED POPULATIONS AND A CUT-OFF OF 12 MICROGRAM/DL WAS FOUND WHERE THE TWO POPULATIONS SEPARATE. OF THE EXPOSED POPULATION, 80 PERCENT WITH BLOOD LEAD CONCENTRATIONS ABOVE 12 MICROGRAM/DL WERE SMOKERS.

Notes NEW: FULL TEXT AVAILABLE

MFN 0034

Subject LEAD

Country(ies) SAUDI ARABIA

Title MEASUREMENTS OF HAIR LEAD CONCENTRATIONS IN CHILDREN OF FOUR CITIES IN SAUDI ARABIA.

Source ENVIRON. INT., VOL. 14, NO. 3, PP. 237-242; 1988

Author(s) AHMAD, P.; KUTBI, I.I.; ABULFARAJ, W.H.; AHMED, M.

Publication Year 1988

Key Words LEAD; HAIR; CHILDREN

Abstract THE CONCENTRATIONS OF LEAD IN THE SCALP HAIR OF 800 SCHOOL CHILDREN, AGED 6-8 YEARS, FROM FOUR CITIES: MAKAKH, JEDDAH, RIYADH AND TABUK IN SAUDI ARABIA, WERE MEASURED BY ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY. MEAN LEAD CONCENTRATIONS FOR THESE FOUR LOCATIONS WERE FOUND TO BE 17.6 MU G PB/G HAIR FOR MAKKAH, 23.3 MU G PB/G HAIR FOR JEDDAH, 5.1 MU G PB/G HAIR FOR RIYADH AND 10.9 MU G PB/G HAIR FOR TABUK. THE MEAN VALUES OF PB CONCENTRATIONS IN HAIR FOR JEDDAH, MAKKAH AND TABUK CITIES ARE ON THE HIGH SIDE OF THE ACCEPTABLE "NORMAL RANGE", INDICATING AN INCREASING TREND IN ENVIRONMENTAL LEAD POLLUTION. RIYADH APPEARS TO BE RELATIVELY "CLEAN" IN THIS RESPECT. RAPID MODERNIZATION WITH INCREASED USE OF LEADED GASOLINE FOR TRANSPORTATION MAY ALREADY BE CAUSING A STRESS ON THE ENVIRONMENT OF SAUDI ARABIA.

MFN 0065

Subject LEAD

Country(ies)SAUDI ARABIA

Title CORRELATION BETWEEN MATERNAL AND CORD BLOOD LEAD LEVELS

Source, INT-J-ENVIRON-HEALTH-RES. INTERNATIONAL-JOURNAL-OF-ENVIRONMENTAL-HEALTH-RESEARCH. 1997; 7/4 (323-328)

Author(s)AL, KHAYAT, A; HABIBULLAH, J; KOUTOUBY, A; RIDHA, A; ALMEHDI, AM

Publication Year 1997

Key Words LEAD BLOOD LEVEL

Abstract WHOLE BLOOD LEAD LEVELS WERE ESTIMATED BY ATOMIC ABSORPTION ANALYSIS IN 226 BLOOD SAMPLES FROM 113 MOTHERS OF 23 DIFFERENT NATIONALITIES. SAMPLES WERE COLLECTED BEFORE DELIVERY, AND FROM CORD BLOOD FROM THEIR RESPECTIVE NEONATES. THE CONCENTRATIONS OF BLOOD LEAD WERE WITHIN THE EXPECTED RANGE OF OCCUPATIONALLY UNEXPOSED POPULATIONS. MEAN MATERNAL BLOOD LEAD LEVELS WERE 0.72 ± 0.10 MU MOL/L (14.9 ± 2.14 MU G/DL), RANGE 0.32-1.34 MU MOL/L (6.6-27.8 MU G/DL) AND MEAN CORD BLOOD LEVELS WERE 0.64 ± 0.12 MU MOL/L (RANGE 0.29-1.46 MU MOL/L). SIXTEEN PERCENT OF THE MOTHERS AND NEARLY 10 CORD BLOOD SAMPLES WERE FOUND TO HAVE BLOOD LEAD LEVEL GREATER THAN 0.97 MU MOL/L (20 MU G/DL). VERY HIGH LEVELS, IN EXCESS OF 1.21 MU MOL/L (25 MU G/DL), WERE DETECTED IN 3.5 OF MOTHERS AS COMPARED TO 2.6 OF CORD BLOOD SAMPLES. OUT OF 113 INFANTS, 65 (58) WERE MALES WITH A MEAN CORD BLOOD LEAD LEVEL OF 0.63 MU MOL/L AND 48 (42) WERE FEMALES WITH A MEAN LEVEL OF 0.66 MU OL/L. THE LOWEST MATERNAL BLOOD LEAD LEVELS 0.68 MU MOL/L WERE OBSERVED IN AGES 20 TO 25 YEARS OLD, AND LOWEST CORD BLOOD LEVELS 0.58 MU MOL/L WERE SEEN IN MATERNAL AGE OF LESS THAN 20 YEARS OLD. ON THE OTHER HAND, THE HIGHEST MATERNAL AND CORD BLOOD LEAD LEVELS (0.82 AND 0.75 MU MOL/L RESPECTIVELY) WERE OBSERVED IN MATERNAL AGES OF GREATER THAN 35 YEARS OLD. THE RESULTS SHOW A DIRECT CORRELATION OF BLOOD LEAD LEVEL BETWEEN MOTHERS AND UMBILICAL CORD AS SEEN IN THE LINEAR REGRESSION DISTRIBUTION CURVE.

MFN 0160

Subject LEAD

Country(ies)SAUDI ARABIA

Title LEAD POISONING AMONG SAUDI CHILDREN

Source, ANN-SAUDI-MED. 13/5 (395-401)1993

Author(s)YAISH, HM; NIAZI, GA; AL, SOBY, A

Publication Year 1993

Key Words LEAD POISONING DIAGNOSIS; LEAD POISONING ETIOLOGY; LEAD POISONING DRUG THERAPY; LEAD POISONING EPIDEMIOLOGY; ANEMIA DIAGNOSIS; ANEMIA ETIOLOGY; ENVIRONMENTAL EXPOSURE; EDETIC ACID DRUG THERAPY; DIAZEPAM DRUG THERAPY

Abstract TEN SAUDI CHILDREN WITH CLINICAL AND LABORATORY FINDINGS RELATED TO LEAD INTOXICATION WERE SEEN AT THE KING FAHAD NATIONAL GUARD HOSPITAL FROM 1984 TO 1988. A PRESUMPTIVE DIAGNOSIS OF CHRONIC LEAD POISONING WAS MADE RETROSPECTIVELY ON 12 OTHER CHILDREN WITH HYPOCHROMIC AND MICROCYTIC ANEMIA WHOSE OTHER LABORATORY DATA WERE CONSISTENT WITH LEAD POISONING. THE AGES OF THE CHILDREN RANGED FROM SIX MONTHS TO 13 YEARS. AFTER THE FIRST CHILD WITH LEAD ENCEPHALOPATHY WAS DIAGNOSED, A HIGH INDEX OF SUSPICION WAS MAINTAINED, THUS ENABLING US TO ESTABLISH AN EARLY DIAGNOSIS OF LEAD ENCEPHALOPATHY. THE FINDINGS OF THIS STUDY SUGGEST THAT EXCESSIVE LEAD EXPOSURE MAY STILL POSE A SERIOUS PUBLIC HEALTH HAZARD IN SAUDI ARABIA TODAY WHICH NEEDS TO BE ADDRESSED.

MFN 0207

Subject LEAD POISONING

Country(ies)SAUDI ARABIA

Title LEAD POISONING AMONG SAUDI CHILDREN

Source ANN. SAUDI MED., 13

Author(s)YAISH, HASSAN.M.; NAIZI, GULZAR.A.; AL SOBY.ABDULLAH.

Publication Year 1993

Key Words LEAD; BLOOD

Abstract TEN SAUDI CHILDREN WITH CLINICAL AND LABORATORY FINDINGS RELATED TO LEAD INTOXICATION WERE SEEN AT THE KING FAHAD NATIONAL GUARD HOSPITAL FROM 1984 TO 1988. A PRESUMPTIVE DIAGNOSIS OF CHRONIC LEAD POISONING WAS MADE RETROSPECTIVELY ON 12 OTHER CHILDREN WITH HYPOCHROMIC AND MICROCYTIC ANEMIA WHOSE OTHER LABORATORY DATA WERE CONSISTENT WITH LEAD POISONING. THE AGES OF THE CHILDREN RANGED FROM SIX MONTHS TO 13 YEARS. AFTER THE FIRST CHILD WITH LEAD ENCEPHALOPATHY WAS DIAGNOSED, A HIGH INDEX OF SUSPICION WAS MAINTAINED, THUS ENABLING US TO ESTABLISH AN EARLY DIAGNOSIS OF LEAD ENCEPHALOPATHY. THE FINDINGS OF THIS STUDY SUGGEST THAT EXCESSIVE LEAD EXPOSURE MAY STILL POSE A SERIOUS PUBLIC HEALTH HAZARD IN SAUDI ARABIA TODAY WHICH NEEDS TO BE ADDRESSED.

Notes 27. FULL TEXT BECAME AVAILABLE.DUPLICATE/160

MFN 0031

Subject LEAD

Country(ies)SAUDI ARABIA

Title LEAD EXPOSURE AMONG SCHOOL CHILDREN IN RIYADH, SAUDI ARABIA: A CASE-CONTROL STUDY.

Source BULL. ENVIRON. CONTAM. TOXICOL., VOL. 50, NO. 5, PP. 0007-4861; 1993

Author(s)JARALLAH, J.S.; NOWEIR, K.M.; AL-SHAMMARI, S.A.; AL-SALEH, I.A.; AL-ZAHRANI, M.A.; AL-AYED, M.H.

Publication Year 1993

Key Words LEAD; CHILDREN; ENVIRONMENTAL HEALTH; BLOOD ANALYSIS; EXHAUST EMISSIONS; TRANSPORTATION; HAZARDS

Abstract IN THE KINGDOM OF SAUDI ARABIA THE CITY ROADS AND HIGHWAYS HAVE WITNESSED A PHENOMENAL RISE IN VEHICULAR TRAFFIC IN THE LAST 20 YEARS. THE ATMOSPHERIC LEAD CONCENTRATION IN JEDDAH CITY WAS FOUND TO BE 3.38 MU G/M OF AIR IN CERTAIN HEAVY TRAFFIC AREAS, AND THIS IS HIGHER THAN THE AIR QUALITY GUIDELINE 0.5-1.0 MU G/M FOR EUROPE. THE PRESENT STUDY WAS UNDERTAKEN TO EVALUATE THE HEALTH HAZARDS RELATED TO LEAD IN SCHOOL CHILDREN IN DIFFERENT AREAS IN RIYADH CITY. THE STUDY IS ESSENTIALLY AN ENVIRONMENTAL AS WELL AS A BIOLOGICAL ONE.

Notes FULL TEXT BECAME AVAILABLE

MFN 0333

Subject LEAD POISONING

Country(ies)SAUDI ARABIA

Title LEAD CONCENTRATION IN BREAST MILK OF NURSING MOTHERS LIVING IN RIYADH

Source ANNALS OF SAUDI MEDICINE (ANN SAUDI MED), MAY 1995

Author(s)YOUNES, BASSAM; AL-MESHARI, ABDUL AZIZ; AL-HAKEEM, AMAL; AL-SALEH, SAAD

Publication Year 1995

Key Words LEAD POISONING; BREAST MILK; MILK SAMPLES

Abstract LEAD POISONING HAS PROVEN TO BE OF THE MOST DIFFICULT ENVIRONMENTAL HEALTH PROBLEMS. PART OF THIS DIFFICULTY IS BASED ON THE LACK OF DISTINCTIVE MANIFESTATIONS AT AN EARLY PHASE IN THE PROCESS.

BREAST MILK FEEDING WITH HIGH LEAD CONCENTRATION IS ONE OF THE FIRST SOURCES OF LEAD EXPOSURE IN NEONATES. THIS STUDY REPORTED THAT THE LEAD IN BREAST MILK SAMPLES FROM 81 PERCENT OF NURSING MOTHERS VARIED FROM A LOW CONCENTRATION OF 0.318 MICROGRAM/DL TO A HIGH OF 2.5 MICROGRAM/DL WITH AN AVERAGE OF 0.768 ± 0.42 MICROGRAM/DL. LEAD CONCENTRATION WAS FOUND TO BE LOW IN YOUNG MOTHERS AND HIGHER IN MOTHERS AGE 36 YEARS OR MORE WITH AN AVERAGE OF 0.515 ± 0.14 AND 1.344 ± 0.65 MICROGRAM/DL, RESPECTIVELY. THERE WERE NO SIGNIFICANT DIFFERENCES BETWEEN LEAD CONCENTRATION IN SAMPLES OBTAINED FROM RIGHT OR LEFT BREASTS AND SIMILARLY, NO SIGNIFICANT DIFFERENCES IN LEAD CONCENTRATIONS IN MILK SAMPLES IN RELATION TO THE LENGTH OF PERIOD OF LACTATION. BREAST MILK SAMPLES OBTAINED FROM MOTHERS RESIDING NEAR INDUSTRIAL AREAS OR HIGHWAYS, USING COPPER CASSEROLE COATED WITH WHITE (RICH IN LEAD) INNER COAT AND EATING FOOD MATERIAL PRESERVED FOR LONG PERIODS IN METAL CONTAINERS SHOWED HIGHER LEAD CONCENTRATION THAN FROM THOSE LIVING IN REMOTE AREAS WITH REDUCED EXPOSURE. THE DIAGNOSIS OF LEAD POISONING REQUIRED A CONSTANT AWARENESS OF ITS PREVALENCE.

Notes NEW: FULL TEXT AVAILABLE

MFN 0085

Subject LEAD

Country(ies) UNITED ARAB EMIRATES

Title ACUTE LEAD ENCEPHALOPATHY IN EARLY INFANCY-CLINICAL PRESENTATION AND OUTCOME

Source, ANN-TROP-PAEDIATR. ANNALS-OF-TROPICAL-PAEDIATRICS. 17/1 (39-44)1997

Author(s) AL, KHAYAT, A; MENON, NS; ALIDINA, MR

Publication Year 1997

Key Words BRAIN DISEASE ETIOLOGY; LEAD POISONING DIAGNOSIS; LEAD POISONING ETIOLOGY; TRADITIONAL MEDICINE; NEUROTOXICITY ETIOLOGY

Abstract WE STUDIED 19 INFANTS WITH A MEAN AGE OF 3.8 MONTHS WHO PRESENTED WITH FEATURES CONSISTENT WITH ACUTE LEAD ENCEPHALOPATHY FOLLOWING THE USE OF TRADITIONAL MEDICINES. ALL PRESENTED WITH CONVULSIONS; CT SCANS OF THE BRAIN ON ADMISSION SHOWED BRAIN OEDEMA IN FOUR, ATROPHY IN FOUR AND NORMAL FINDINGS IN 11. CEREBROSPINAL FLUID ANALYSIS IN NINE PATIENTS SHOWED PLEOCYTOSIS IN SIX AND A HIGH PROTEIN CONTENT IN EIGHT. THE MEDIAN LEAD LEVEL IN THESE 19 INFANTS WITH ENCEPHALOPATHY WAS 3.6 MU MOL/L (74.5 MU G/DL). SEVEN HAD A MEAN LEAD LEVEL OF ONLY 2.7 MU MOL/L (56.9 MU G/DL) WHICH IS MUCH BELOW 70 MU G/DL, THE LEVEL USUALLY PROPOSED AS THE THRESHOLD FOR ENCEPHALOPATHY. THIRTEEN INFANTS DEVELOPED BRAIN DAMAGE DURING FOLLOW-UP; STATISTICAL ANALYSIS CORRELATED THE LEAD LEVEL AT 2 MONTHS POST CHELATION WITH AN ABNORMAL NEUROLOGICAL OUTCOME. OUR FINDINGS INDICATE THAT IN VERY YOUNG INFANTS ACUTE LEAD ENCEPHALOPATHY MAY OCCUR AT LEAD LEVELS LOWER THAN PREVIOUSLY REPORTED.
