

MOROCCO

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A. Regulation on sources

Source of lead	Relevant legislation/regulation	Government agencies	Data source
1. Lead in paint	<ol style="list-style-type: none"> 1. As of 2020, Morocco has draft lead paint laws. 2. At the international level, Morocco ratified the 13th convention of the ILO. The agreement bans the use of lead carbonate, which is used in white paints. 3. Decree 2-12-431, November 2013: Enforces regulations of lead usage in the industrial sector. It aims to protect workers through banning the use of lead in paints and limiting the element's usage in other fields. 	<ol style="list-style-type: none"> a. Government of Morocco 	<ol style="list-style-type: none"> 1. Overview of Lead Paint Laws in Africa, EPA 2. Lead poisoning can cause cognitive impairment for children, such as memory loss and an IQ decrease
2. Lead in toys	<ol style="list-style-type: none"> 1. Law 24-09: Relating to the safety of products regulates the use of lead in children's toys, pencils and marker pens, as well as textile and clothing products. 	<ol style="list-style-type: none"> a. Government of Morocco 	<ol style="list-style-type: none"> 1. Lead poisoning can cause cognitive impairment for children, such as memory loss and an IQ decrease
	No other standards found at this time for lead.		

B. International Agreements

Agreement	Year Ratified
1. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	1995 (a) ¹
2. Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade	2011
3. Minamata Convention on Mercury	2015 (signature)
4. Stockholm Convention on Persistent Organic Pollutants	2004

C. Blood lead-level monitoring programs

Details	Data source
1. No details of a national or regional level structured program for blood lead level testing found. However, published studies point to some presence of testing programs at the local level.	1. Refer to section E on scientific papers that perform blood lead-level sampling

D. Inventory of toxic sites (Toxic Sites Identification Program (TSIP), Pure Earth)

No toxic sites yet identified at this time.

¹ Accession (a)

E. Scientific papers on lead exposure (Please contact info@gahp.net for information on studies not in the public domain)

Topic	Authors	Year	Title	Abstract/ description
Blood-lead levels	Laamech, Jawhar; Bernard, Alfred; Dumont, Xavier; Benazzouz, Bouchra; Lyoussi, Badiaa	2014	Blood lead, cadmium and mercury among children from urban, industrial and rural areas of Fez Boulemane Region (Morocco): Relevant factors and early renal effects	<p>Objectives: To describe blood lead (Pb-B), cadmium (Cd-B) and mercury (Hg-B) levels in children living in urban, industrial and rural areas in Fez city (north of Morocco) and to identify the determinants and some renal effects of exposure.</p> <p>Material and Methods: The study was conducted from June 2007 to January 2008 in 209 school children (113 girls, 96 boys), aged 6–12 years, from urban, industrial and rural areas in Fez city. Interview and questionnaires data were obtained. Blood and urinary samples were analyzed.</p> <p>Results: The mean of blood lead levels (Pb-B) in our population was 55.53 µg/l (range: 7.5–231.1 µg/l). Children from the urban area had higher blood lead levels (BLLs) mean (82.36 µg/l) than children from industrial and rural areas (48.23 and 35.99 µg/l, respectively); with no significant difference between boys and girls. BLLs were associated with traffic intensity, passive smoking and infancy in the urban area. The mean of blood cadmium levels (BCLs) was 0.22 µg/l (range: 0.06–0.68 µg/l), with no difference between various areas. Rural boys had higher BCLs mean than rural girls, but no gender influence was noticed in the other areas. BCLs were associated with the number of cigarettes smoked at children’s homes. The blood mercury levels (BMLs) mean was 0.49 µg/l (range: 0.01–5.31 µg/l). The BMLs mean was higher in urban and industrial areas than in the rural area with no gender-related difference. BMLs were associated with amalgam fillings and infancy in the urban area. About 8% of the children had BLLs ≥ 100 µg/l particularly in the urban area, microalbuminuria and a decrease in height were noticed in girls from the inner city of Fez and that can be related to high BLLs (89.45 µg/l).</p> <p>Conclusions: There is a need to control and regulate potential sources of contamination by these trace elements in children; particularly for lead.</p>

Topic	Authors	Year	Title	Abstract/ description
	Pawlas, Natalia; Stromberg, Ulf; Bergdahl, Ingvar	2013	Cadmium, mercury and lead in the blood of urban women in Croatia, the Czech Republic, Poland, Slovakia, Slovenia, Sweden, China, Ecuador and Morocco	<p>Objectives: The aim of the study was to make an international comparison of blood levels of cadmium (B-Cd), lead (B-Pb) and mercury (B-Hg) of women in seven European, and three non-European cities, and to identify determinants.</p> <p>Materials and Methods: About 50 women (age: 46–62) from each city were recruited (totally 480) in 2006–2009. Interview and questionnaire data were obtained. Blood samples were analysed in one laboratory to avoid interlaboratory variation.</p> <p>Results: Between the European cities, the B-Pb and B-Cd results vary little (range of geometric means: 13.5–27.0 µg/l and 0.25–0.65 µg/l, respectively); the variation of B-Hg was larger (0.40–1.38 µg/l). Between the non-European cities the results for B-Pb, B-Cd and B-Hg were 19.2–68.0, 0.39–0.99 and 1.01–2.73 µg/l, respectively. Smoking was a statistically significant determinant for B-Cd, while fish and shellfish intakes contributed to B-Hg and B-Pb, amalgam fillings also contributed to B-Hg.</p> <p>Conclusions: The present results confirm the previous results from children; the exposure to lead and cadmium varies only little between different European cities suggesting that other factors than the living area are more important. The study also confirms the previous findings of higher cadmium and lead levels in some non-European cities. The geographical variation for mercury is significant.</p>
	Hruba, Frantiska; Stromberg, Ulf; Cerna, Milena; Chen, Chunying; Harrari, Florencia, et al.	2012	Blood cadmium, mercury, and lead in children: An international comparison of cities in six European countries, and China, Ecuador, and Morocco	<p>Abstract: Children’s blood-lead concentration (B-Pb) is well studied, but little is known about cadmium (B-Cd) and mercury (B-Hg), in particular for central Europe. Such information is necessary for risk assessment and management. Therefore, we here describe and compare B-Pb, B-Cd and B-Hg in children in six European, and three non-European cities, and identify determinants of these exposures. About 50 school children (7–14 years) from each city were recruited (totally 433) in 2007–2008. Interview and questionnaire data were obtained. A blood sample was analyzed: only two laboratories with strict quality control were used. The European cities showed only minor differences for B-Cd (geometric means 0.11–0.17 µg/L) and B-Pb (14–20 µg/L), but larger for B-Hg (0.12–0.94 µg/L). Corresponding</p>

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				means for the non-European countries were 0.21–0.26, 32–71, and 0.3–3.2 µg/L, respectively. For B-Cd in European samples, traffic intensity close to home was a statistically significant determinant, for B-Hg fish consumption and amalgam fillings, and for B-Pb sex (boys higher). This study shows that European city children's B-Cd and B-Pb vary only little between countries; B-Hg differs considerably, due to varying tooth restoration practices and fish intake. Traffic intensity seemed to be a determinant for B-Cd. The metal concentrations were low from a risk perspective, but the chosen non-European cities showed higher concentrations than the cities in Europe.
Lead exposure	Lekouch, N; Sedki, A; Bouhouch, S; Nejmeddine, A; Pineau, A; Pihan, J.C.	1999	Trace elements in children's hair, as related exposure in wastewater spreading field of Marrakesh (Morocco)	Abstract: Lead and cadmium concentration was determined in the hair of 327 school children living in a wastewater spreading field of Marrakesh (Morocco). The influence of age, sex, food habits and family occupation on the children's hair Pb and Cd concentration was also evaluated. Girls had more metal in their hair than boys (16.5±5.4 µg/g and 12.5±3.5 µg/g, respectively). However, for Cd the boys had more metal (2.9±0.6 and 2.2±0.4, respectively) but the difference was not statistically significant and metal levels decreased with age. Family occupation, direct contact with wastewater, customs and food habits were the most significant factors influencing the metal content of children's hair. The average Pb and Cd content were higher in the exposed children (14.8±4.5 µg/g and 2.5±0.5 µg/g, respectively) than in the non-exposed children (4.6±2.2 µg/g and 0.6±0.2, respectively), but the difference was not statistically significant. This study shows that in this area all the population (especially children) was extremely exposed to the danger caused by potentially toxic metals.
Lead in food	Mahjoub, Mohammed; Fadlaoui, Soufiane; El Maadoudi, Mohammed; Smiri, Youseff	2021	Mercury, Lead, and Cadmium in the Muscles of Five Fish Species from the Mechraâ-Hammadi Dam in Morocco and Health Risks for Their Consumers	Abstract: This study aims to assess the degree of metal contamination (mercury (Hg), cadmium (Cd), and lead (Pb)) in the muscles of five species of fish <i>Esox lucius</i> , <i>Sander lucioperca</i> , <i>Micropterus salmoides</i> , <i>Lepomis macrochirus</i> , and <i>Scardinius erythrophthalmus</i> , from the Mechraâ-Hammadi Dam between July 2017 and May 2018, and to conduct a risk assessment for human consumers. Trace metals were determined by Graphite Furnace Atomic Absorption Spectrometry for the Pb and the Cd and by Cold Vapor Atomic Absorption Spectrometry for the Hg. The results gotten from the study of the muscles of the different fish species show that the higher mean amounts of Cd and Hg were determined in <i>E. lucius</i> , and

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				<p>the maximum mean levels of Pb were detected in <i>S. erythrophthalmus</i>. Results suggested that demersal fishes inhabiting near the sediments and piscivorous fishes with higher trophic level were likely to accumulate higher trace metal concentrations. The general order of bioaccumulation of the trace metals measured in the muscles of the fish species is as follows: Hg > Pb > Cd. Therefore, the bioaccumulation of Hg in fish studied is more important than that of Cd and Pb. Furthermore, these concentrations are higher in summer than in winter for all trace metals. All the values of the trace metals in the muscle tissues are below the maximum limits recommended by the European Community (EC) N° 1881/2006. However, estimation of noncarcinogenic health risks by the target hazard quotient indicated no obvious noncarcinogenic risks to humans that consume those fishes (THQ < 1). Results of THQ and maximum safe consumption indicated that Hg may cause more harm to human by fish consumption especially for <i>E. lucius</i> and <i>S. lucioperca</i>. Therefore, reduced intake of carnivorous fishes should be promoted as part of a healthier diet.</p>
	Chahid, Adil; Hilali, Mustapha; Benlhachimi, Abdeljalil; Bouزيد, Taoufiq	2014	Contents of cadmium, mercury and lead in fish from the Atlantic sea (Morocco) determined by atomic absorption spectrometry	<p>Abstract: As a part of a specific monitoring program, lead (Pb) cadmium (Cd) and mercury (Hg) concentrations in important species of fish from various fishing ports of the southern Kingdom of Morocco (<i>Sardina pilchardus</i>, <i>Scomber scombrus</i>, <i>Plectorhinchus mediterraneus</i>, <i>Trachurus trachurus</i>, <i>Octopus vulgaris</i>, <i>Boops boops</i>, <i>Sarda sarda</i>, <i>Trisopterus capelanus</i>, and <i>Conger conger</i>) were investigated by the Moroccan Reference Laboratory (NRL) for trace elements in foodstuffs of animal origin. The samples were analysed for lead and cadmium by a graphite furnace atomic absorption spectrometry (GFAAS); and for mercury by cold vapour atomic absorption spectrometry (CVAAS). The results were expressed as µg/g of wet weight (w/w). The levels of Cd, Pb and Hg in muscles of fish were 0.009–0.036, 0.013–0.114 and 0.049–0.194 µg/g, respectively. The present study showed that different metals were present in the sample at different levels but within the maximum residual levels prescribed by the EU for the fish and shellfish from these areas, in general, should cause no health problems for consumers.</p>

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	Voegborlo, R; Methnani, A; Abedin, M	1999	Mercury, cadmium and lead content of canned tuna fish	Abstract: Mercury levels in canned tuna fish were determined by cold vapour atomic absorption spectrophotometry while cadmium and lead levels were determined by flame atomic absorption spectrophotometry. The metal contents in the samples, expressed in $\mu\text{g g}^{-1}$ wet weight, varied from 0.20 to 0.66 with an average value of 0.29 for mercury, from 0.09 to 0.32 with an average value of 0.18 for cadmium and from 0.18 to 0.40 with an average value of 0.28 for lead. The results of this study indicate that tuna fish from the Mediterranean coast of Libya have concentrations well below the permissible levels for these toxic metals. Their contribution to the body burden can therefore be considered negligible.
Lead in make-up	Gouita, H; Bellaouchou, A; Fekhaoui, M; Abidi, A; Mahnine, N; Aakame, B.	2016	Assessment of lead levels in traditional eye cosmetic “kohl” frequently used in Morocco and Health hazard	Abstract: This study aims to investigate the content of lead in most frequently used brands of cosmetics products in Morocco. 100 samples of kohl (kohl powder, galena, eye pencils and paste) were selected taken from large cosmetic stores in Morocco. And lead of them is analyzed using a Fast Sequential Atomic Absorption Spectrometer (SAAFS 240). The results showed that the concentrations of lead in kohl samples were within the range of 0.01 mg/g and 973.8 mg/g. There were significant differences between the averages of lead content in different brands of the kohl samples. Thus the continuous use of these cosmetics can increase the absorption of heavy metals especially lead into the human body.
Lead in mines	Lamin, H; Alami, S; Bouhnik, O; Bennis, M; Benkritly, S; Abdelmoumen, H; Bedmar, E; Missbah, M	2020	Identification of the endosymbionts from <i>Sulla spinosissima</i> growing in a lead mine tailing in Eastern Morocco as <i>Mesorhizobium camelthorni</i> sv. <i>aridi</i>	Aims: To identify the bacteria nodulating <i>Sulla spinosissima</i> growing profusely in a lead and zinc mine tailings in Eastern Morocco. Methods and Results: In all, 32 rhizobial cultures, isolated from root nodules of <i>S. spinosissima</i> growing in soils of the mining site, were tolerant to different heavy metals. The ERIC-polymerase chain reaction (PCR) fingerprinting analysis clustered the isolates into seven different groups, and the analysis of the 16S rRNA sequences of four selected representative strains, showed they were related to different species of the genus <i>Mesorhizobium</i> . The <i>atpD</i> , <i>glnII</i> and <i>recA</i> housekeeping genes analysis confirmed the affiliation of the four representative strains to <i>Mesorhizobium camelthorni</i> CCNWXJ40-4T, with similarity percentages varying from 96.30 to 98.30%. The sequences of the <i>nifH</i> gene had 97.33–97.78% similarities with that of <i>M. camelthorni</i> CCNWXJ40-4T; however, the

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				<p>nodC phylogeny of the four strains diverged from the type and other reference strains of <i>M. camelthorni</i> and formed a separated cluster. The four strains nodulate also <i>Astragalus gombiformis</i> and <i>A. armatus</i> but did not nodulate <i>A. boeticus</i>, <i>Vachellia gummifera</i>, <i>Prosopis chilensis</i>, <i>Cicer arietinum</i>, <i>Lens culinaris</i>, <i>Medicago truncatula</i>, <i>Lupinus luteus</i> or <i>Phaseolus vulgaris</i>.</p> <p>Conclusions: Based on similarities of the nodC symbiotic gene and differences in the host range, the strains isolated from <i>S. spinosissima</i> growing in soils of the Sidi Boubker mining site may form a different symbiovar within <i>Mesorhizobium</i> for which the name <i>aridi</i> is proposed.</p>
	Lamin, Hanane; Alami, Soufiane; Bouhnik, Omar; ElFaik, Salma; Abdelmoumen, Hanaa; Bedmar, Eulogio; Idrissi Mustapha	2019	Nodulation of Retama monosperma by Ensifer aridi in an Abandoned Lead Mine Soils in Eastern Morocco	<p>Abstract: Millions tons of lead and zinc wastes from the abandoned Touissit mine are stored in the open air as dikes in the vicinity of the villages in Eastern Morocco and pose a real danger to both the environment and local populations. To prevent the movement of minerals to the nearby villages and limit the damages to the environment and health, we proposed the nitrogen-fixing leguminous shrub <i>Retama monosperma</i>, as a model plant to use for phytostabilization experimentations. This plant species is known by its ability to grow in hard climatic conditions and in heavy metals contaminated soils. The isolation of bacterial strains nodulating <i>R. monosperma</i> in the abandoned mine soils will permit the selection of rhizobia to inoculate young plant seedlings before their use for the phytostabilization of the mine tailings. In this work, 44 bacteria were isolated from the root nodules of <i>R. Monosperma</i> grown in the Touissit abandoned mine. Twenty-four isolates were considered as true rhizobia as they possess a copy of the nodC symbiotic gene and were able to renodulate their original host. The phenotypic characterization showed that all the strains are tolerant in vitro to different concentrations of heavy metals. The analysis of the 16S rRNA sequences of two selected representative strains showed they were related to different strains of <i>Ensifer aridi</i> isolated from different legumes in three continents deserts. The <i>glnII</i>, <i>recA</i>, and <i>gyrB</i> housekeeping genes analysis confirmed the affiliation of the strains to <i>E. aridi</i>. Moreover, the phylogenic analysis of <i>nodA</i>, <i>nodC</i>, and <i>nifH</i> symbiotic genes showed that the strains are more related to <i>E. aridi</i> JNVUTP6 species isolated from <i>Tephrosia purpurea</i> root nodules in the Thar Desert in India.</p>

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				To our knowledge, this is the first report about the isolation of <i>E. aridi</i> from <i>R. monosperma</i> root nodules.
	Iavazzo, Pietro; Adamo, Paola; Boni, Maria; Hillier, Stephen; Zampella, Mariavittoria	2012	Mineralogy and chemical forms of lead and zinc in abandoned mine wastes and soils: An example from Morocco	Abstract: Chemical extractions coupled with quantitative X-ray powder diffraction (XRPD) were used to define the chemical and mineralogical forms of Pb and Zn in abandoned wastes and soils from the Upper Moulouya mining district (Morocco). The aim was to provide baseline data required to assess metal mobility and bioavailability. Wastes and soils were sampled inside the mine sites of Zeïda, Mibladen and Aouli, both in exploitation and processing areas. Additional potentially unaffected soil samples were taken outside the Mibladen site. pH of wastes and soils is alkaline as a consequence of carbonate abundance (on average 36%). Total Pb and Zn concentrations have a wide spread of values (Pb: 0.041–17.25 g kg ⁻¹ ; Zn: 0.051–276.5 g kg ⁻¹), with tailings from all mines and soils from Mibladen processing area exhibiting the highest concentrations. Very low or no detectable contamination characterizes the soils from exploitation areas and those collected outside Mibladen. Zinc contamination is mainly restricted to Mibladen processing area, where Zn ores from other Moroccan mines were possibly processed. The sequential extraction procedure for metal fractionation indicates that in contaminated samples Pb and Zn are mainly present in the acetic acid extractable fraction, likely as carbonates, (Pb up to 80%; Zn up to 52%), while in less or not contaminated soils both metals are mostly associated with the reducible fraction, presumably as iron oxides (Pb up to 68%; Zn up to 80%). Eight minerals containing Pb and Zn were identified: cerussite, anglesite, galena, hydrozincite, smithsonite, sphalerite, willemite and hemimorphite. Cerussite is the most important Pb-host. Hemimorphite and smithsonite account for most Zn. According to the alkaline conditions and to the low solubility of Pb and Zn mineral phases, it can be suggested that within the studied environment mobilization into solution in aqueous systems and bioavailability of Pb and Zn have a low

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				potential. Nevertheless, given aridity and strong winds, inhalation of airborne particulates may be a concern.
	Iavazzo, Pietro; Ducci, Daniela; Adamo, Paola; Trifuoggi, Marco; Migliozzi, Antonello; Boni, Maria	2011	Impact of Past Mining Activity on the Quality of Water and Soil in the High Moulouya Valley (Morocco)	Abstract: Physical and chemical properties and the total content of potentially toxic metals (PTMs) in waters and soils were studied from the High Moulouya Valley (Morocco) in order to assess the impact of the past mining activity on their quality and to lay the foundations of a potential reclamation of the area. Surface water and groundwater samples were collected from the Moulouya River and mine pit lakes; tailings and soils were sampled inside and outside the mine sites of Zeïda, Mibladen, and Aouli. Both waters and soils were alkaline, due to the limestone environment, and contained Pb and Zn as main metallic contaminants. Pollution levels were highest within the Mibladen mining site, and soil pollution was mainly restricted to the areas where activities of metal concentration were carried out. Tailings and soils from these areas besides Pb and Zn were also polluted by As, Cd, and Cu showing clay fraction highly enriched in metal contaminants. At the time of study, all soils and wastes (including the highly polluted tailings) were in advanced stage of spontaneous herbaceous and arbustive revegetation. It is concluded that, in the High Moulouya Valley, the processes governing PTM transfer from the element-rich sites to the nearby environment are strongly influenced by pH, carbonate content, and semi-arid climate reducing metal mobility from the mining waste impoundments by dissolution. The transfer by wind and water erosion of metal-enriched fine waste particles is likely to be a much more important vector for metal dispersion. In this perspective, among a range of land remediation techniques available, natural and oriented revegetation could represent a low-cost and possible permanent solution.

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Lead poisoning	Bouftini, S; Bahhou, J; Lelievre, B; Barca, J; Turcant, A; Diquet, B; Abourazzak, S; Chaouki, S; Hida, M; Khattabi, A; Nejjari, C; Amarti, A; Achour, S	2014	Screening for Childhood Lead Poisoning in the Industrial Region of Fez, Morocco	Abstract: The study objectives were to estimate lead poisoning prevalence among children living next to an industrial area, to compare it to that in a control population, and to establish clinical and biological follow-up of the poisoned children. This is a descriptive cross-sectional study including 150 children (exposed and unexposed) performed between January 2012 and April 2013. It was meant to determine blood lead levels (BLLs) in children considered to be an exposed population (EP N 90), living in the industrial area Ain Nokb Fez compared with BLLs of children of other areas belonging to the same city supposed to be unexposed [UP (N = 60)]. A sociodemographic questionnaire was obtained, and a blood lead analysis was performed. Clinical and biological follow-up has been performed of poisoned children. The sample consisted of 90 EP children with an average age of 6.82 ± 3.32 years and male-to-female sex ratio (SR) of 1.5 and 60 UP children with an average age of 6.45 ± 3.29 years and an SR of 1.2. Among the 150 children recruited, the average of BLLs was 58.21 ± 36 $\mu\text{g/L}$ (18–202.3 $\mu\text{g/L}$). The average of BLLs in EP children (71 ± 40 $\mu\text{g/L}$) was statistically greater ($p < 0.0001$) than that registered in UP children (38 ± 13 $\mu\text{g/L}$). All poisoned children belonged to the EP group at a prevalence of 21.1 %. The clinical and biological examinations of poisoned children showed a few perturbations such as anemia, hypocalcaemia, and deficiencies in magnesium and iron. No renal disease or objective neurological disorders were observed. In the follow-up of the children with $\text{BLL} \geq 100$ $\mu\text{g/L}$ (19 cases). BLL monitoring showed a significant decrease in average of blood concentration ranging from 136.75 ± 32.59 to 104.58 ± 32.73 $\mu\text{g/L}$ ($p < 0.0001$) and in lead poisoning prevalence ($p < 0.001$), which decreased to 7.8 % from 21.1. Our study showed a high prevalence of lead poisoning (21.1 %) in EP children. The relocation of the industrial site associated with corrective and preventive measures has contributed to a decrease of exposure and lead poisoning prevalence in the aforementioned population.

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Lead pollution	Monna, Fabrice; Bouchaou, Lhoussaine; Rambeau, Claire; Losno, Remi; Bruguier, Oliver; Dongarra, Gaetano; Black, Stuart; Chateau, Carmela	2011	Lichens Used as Monitors of Atmospheric Pollution Around Agadir (Southwestern Morocco)—A Case Study Predating Lead-Free Gasoline	Abstract: More than 30 epiphytic lichens, collected in Agadir (Morocco) and along a 150-km transect from the Atlantic Ocean eastward, were analyzed for their metal content and lead isotopic composition. This dataset was used to evaluate atmospheric metal contamination and the impact of the city on the surrounding area. The concentrations of Cu, Pb, and Zn (average \pm 1 SD) were $20.9 \pm 15.2 \mu\text{g g}^{-1}$, $13.8 \pm 9.0 \mu\text{g g}^{-1}$, and $56.6 \pm 26.6 \mu\text{g g}^{-1}$, respectively, with the highest values observed in lichens collected within the urban area. The $^{206}\text{Pb}/^{207}\text{Pb}$ and $^{208}\text{Pb}/^{207}\text{Pb}$ ratios in the lichens varied from 1.146 to 1.186 and from 2.423 to 2.460, respectively. Alkyllead-gasoline sold in Morocco by the major petrol companies gave isotopic ratios of $^{206}\text{Pb}/^{207}\text{Pb} = 1.076\text{--}1.081$ and $^{208}\text{Pb}/^{207}\text{Pb} = 2.348\text{--}2.360$. These new, homogeneous values for gasoline-derived lead improve and update the scarce isotopic database of potential lead sources in Morocco and may be of great value to future environmental surveys on the presence of lead in natural reservoirs, where it persists over time (e.g., soils and sediments). The interest of normalizing metal concentrations in lichens to concentrations of a lithogenic element is demonstrated by the consistency of the results thus obtained with lead isotopic ratios. Leaded gasoline contributed less than 50% of the total amount of lead accumulated in lichens, even in areas subject to high vehicular traffic. This strongly suggests that the recent banishment of leaded gasoline in Morocco will not trigger a drastic improvement in air quality, at least in Agadir.
	El Abidi, A; Idrissi, L; Taleb, H; Azizi, A; Mameli, O; Melis, P	2000	The impact of lead pollution on the environment of Rabat-Sale' (Morocco)	Abstract: There are numerous possible vectors of industrial lead poisoning in unprotected work environments and the areas surrounding industrial sites. In the Rabat-Salé region, ceramics is the industry which uses most lead. Galena (PbS) is used in the fabrication of some types of pottery, and other lead-based compounds are used as glaze. A second source of lead pollution is the production of some fuels, in which lead is used as an anti detonator. In order to evaluate the impact of lead contamination on the environment, our investigation is focused on the lead concentration in the atmosphere, soil and vegetation at five stations in the Rabat-Salé region. We found concentrations of lead higher than those published for any other country in the atmosphere and vegetation near the ceramics factories of Rabat-Salé. These concentrations decreased significantly as we moved away from urban areas.

F. Blood testing in National Health Surveys

National Health Survey	Non-Communicable Diseases Risk-Factors Surveillance	Source
Purpose	Collect the data necessary to calculate demographic indicators, in particular fertility rates and the various components of infant and child mortality at the national level and by place of residence; collect data on maternal mortality at the national level and by place of residence; collect data on vaccination coverage, prevalence, and treatment of certain diseases in children under five years old; collect data on contraceptive prevalence, preferences, family planning, and reproductive health; evaluate the nutritional status of children under years old; collect data on maternal care; collect data on domestic violence; assess the state of health of people aged 60 and over, and identify their needs in terms of health and social services; and collect data on basic medical coverage in Morocco.	Morocco National Survey on Population and Family Health , 2018, Ministry of Health
Sample size	Children of 5 years or less; single women aged 15-49 years old; people aged 60+ years.	
Blood sample testing	General blood testing.	
Latest round	2018	
Next round	2021	