

Annual Elevated Lead Report. 2024

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Executive Summary

This report summarises findings from the surveillance of cases of elevated blood lead in children (aged 0 to 17 years) and adults over the age of 65 in Wales from 1 January to 31 December 2024. Results are compared with the years 2018 to 2023. This analysis is produced annually by Environmental Public Health (EPH), Public Health Wales, who support clinicians with managing cases of elevated blood lead. This report outlines 2024 case data and updates on surveillance activities. Finally, it includes recommendations for next steps.

Results

More children were tested in 2024 compared with previous years (n=683 in 2024 v 558 in 2023), and subsequently more cases of elevated blood lead were identified. In 2024, 27 children were newly diagnosed with elevated blood lead, compared with 19 in 2023. This is 4.0% of 683 blood lead tests conducted meeting the public health action level, compared with 3.4% in 2023, although this difference is not statistically significant.

More tests were conducted in Betsi Cadwaladr Health Board than any other Health Board, and the fewest were conducted in Powys. Positive test rates were highest in Swansea Bay and lowest in Powys. Most of the tests were for boys (n = 470, 68.8% of all tests), and the largest number of cases were in the four-to-five-year age group (n = 11, 40.7% of all cases). Children from the most deprived 20% of areas in Wales were over-represented among both test (n = 202, 29.6% of all tests) and cases (n = 9, 33.3% of all cases). Testing of adults over the age of 65 in 2024 was higher than previous years (n=49 in 2024 v n=35 in 2023). Unlike children, more tests were conducted for individuals from WIMD 5 (least deprived) than WIMD one (most deprived).

Conclusions and Recommendations

This is the second summary of the findings of blood lead testing in children and older adults in Wales. These data show that exposure to lead continues to affect children across Wales. There are issues that EPH can investigate further, as well as work with other partners on to encourage action.

Recommendations for Environmental Public Health include:

- 1) Continue to engage with clinical staff across Wales, particularly paediatric teams, to encourage testing for lead across all local health boards
- 2) Work in partnership with clinicians and other care providers to provide advice to families and carers, with particular consideration for the high proportion of children affected who live in the most deprived areas.

- 3) Publish a more detailed analysis of cases managed by EPH, establishing the most common likely sources of lead, with the aim of producing targeted proactive messaging to make parents and caregivers aware of these sources.
- 4) Continue to advocate for more detail to be provided in the blood lead test data set, including NHS number and ethnicity.
- 5) Continue to consider approaches to developing understanding of “baseline” lead data in healthy people of all ages.

Background

Lead is a naturally occurring toxic metal, ubiquitous within the Earth's crust (WHO, 2023). Due to its historic use, lead is still present in the environment, posing a risk to the health of the people of Wales. The World Health Organization (WHO) estimated that approximately two million lives were lost globally in 2019 due to lead exposure (WHO, 2021).

Health harms

In the UK, lead related deaths are, thankfully, rare, if they occur at all. However, elevated blood lead levels can cause significant health harms. Lead exposure can result in severe toxic effects to the gastrointestinal system, nervous system, renal system, and haematopoietic system (Public Health England, 2017). Children are more vulnerable to lead poisoning than adults as they absorb four to five times as much ingested lead from a given source (WHO, 2023).

There is no safe level of lead, and health harms occur even at very low concentrations. Low level exposures to lead ($\leq 10\mu\text{g}/\text{dL}$ in blood) can result in neuro-behavioural effects in both adults and children, including reduced cognitive function such as impaired attention, learning ability and memory (United States Department of Health and Human Services Agency for Toxic Substances and Disease Registry, 2020).

Sources of lead

Exposure to lead and lead in the environment has been reduced by successful primary prevention measures to reduce lead in fuel and paints, replace lead water pipes, control of emissions from industrial sites and reduce lead in soil (UKHSA, 2023). Following the removal of lead from petrol, ingestion of lead, as opposed to inhalation, has become the most common exposure source in high income countries, primarily from lead paint dust and flakes in older houses (WHO, 2010).

In Wales, one of the two drinking water providers, Dwr Cymru Welsh Water (DCWW) is seeking to remove lead from the water supply and reduce reliance on phosphate dosing to support this. As part of the work towards a "lead-free Wales" DCWW aim to replace at least half of lead pipes and fittings they are aware of by 2050 (DCWW, 2023).

Lead exposure and health harms in Wales

Lead exposure is determined by a blood test to measure blood lead concentration. Individuals may be asymptomatic until higher levels of exposure and, even then, symptoms of lead exposure are not specific and include abdominal pain, loss of appetite, vomiting, fatigue, developmental delay and learning difficulties (NHS Inform, 2023). Therefore, it may be difficult for patients and their clinicians to identify the need for a test for lead exposure. As a result, the number of children and adults who have both a blood test taken and a result showing an elevated, or positive, blood lead level is likely to represent a significant underestimate of the size of the population exposed to lead in Wales.

In Wales, Public Health Wales has established surveillance to annually, retrospectively, analyse all NHS blood tests taken for lead in Wales. There is no routine population surveillance of blood lead levels of healthy people in Wales. The latest UK National Screening Committee (NSC) review concluded that screening the population is **not recommended** as the number of children affected is not known, the test is not reliable enough, and treatments in children with mild symptoms of lead exposure have not been proven and may be harmful (UK NSC, 2018).

This report aims to describe the epidemiology of blood lead test results, and cases of elevated blood lead, in Wales, to inform our understanding of the population exposed to lead and to target future public health actions. We characterize trends in the incidence of elevated blood lead cases in terms of age, sex, geographical distribution, and deprivation. This report is a baseline for future surveillance of elevated blood lead.

Statement of inequalities assessment

We have considered how this surveillance will affect inequalities, both in terms of describing and addressing them.

Lead exposure is particularly harmful to children and may need public health intervention and clinical management. Interventions and awareness raising around the dangers of lead should be for children and their parents or carers. In line with the Well-being of Future Generations Act (WFGA) we need to keep in mind not just actual exposure to children but the potential for other children to be exposed in the future.

In addition, engagement and preventative work should focus on children with Pica, autism spectrum disorder and other learning difficulties. Collecting “population” data on testing and cases of elevated blood lead or children with pica, autism and other additional needs would be invaluable but is not currently supported by the data that we have available to us.

It has been established that exposure to lead is more likely to occur in poorly maintained properties. People living in poorly maintained properties are more likely to be from more deprived areas. As part of our analysis, we have assessed tests and cases by WIMD quintile.

We have also assessed the data by sex to ensure there are no disparities between males and females. Unfortunately, due to lack of data, we have been unable to assess tests and cases by ethnicity. This is something we hope to include in future reporting.

We have analysed data for children and adults over the age of 65 only. Working age adults are excluded because exposures in this group tend to be occupational and tests may be carried out through the workplace or via the NHS. Actions to address these exposures therefore sit with employers and their regulators and obtaining a true picture of exposure is not possible. Including adults over the age of 65 is intended to identify situations where hobbies are leading to exposures.

Methods

The data summarised here are maintained by Digital Health and Care Wales (DHCW). They collate laboratory reports from across Wales.

Case definition

Children:

A confirmed elevated blood lead case was an individual aged 0 to 17 with a blood lead concentration $\geq 0.24\mu\text{mol/L}$ (or $5\mu\text{g/dL}$), as detected in a laboratory. The case must also be a resident of Wales.

Adults:

A confirmed elevated blood lead case was an individual aged 65 or over with a blood lead concentration $\geq 0.48\mu\text{mol/L}$ (or $10\mu\text{g/dL}$), as detected in a laboratory. The case must also be a resident of Wales.

Study population

Individuals were included in the study population where their Lower-layer Super Output Area (LSOA) of residence was in Wales. An individual's blood test must have been conducted between 1st January 2018 and 31st December 2024. Only initial blood tests were considered; repeat test results were excluded. A long-term average was calculated for 1st January 2018 to 31st December 2023 and compared with 1st January to 31st December 2024.

Other Data Sources

Crude test rates for each sex, and age group, by calendar year were calculated using the mid-year population estimates for Wales for the year 2023 produced by StatsWales. Mid-year population estimates for 2024 were unavailable for analysis.

Crude test rates by Welsh Local Authority (LA) and Health Board (HB) were calculated using the mid-year population estimates (MYE) produced by StatsWales. As the MYE for 2024 was not available, the estimates for 2023 were used.

Deprivation was assessed by the Welsh Index of Multiple Deprivation (WIMD) which scores the 1909 Welsh Lower-layer Super Output Areas (LSOAs) by different types of deprivation. These were then ranked from 1 (most deprived) to 1,909 (least deprived) and assigned to a fifth, 1 being most deprived and 5 least deprived; it is these fifths we analysed. The 2020-mid year population size for each LSOA was obtained from StatsWales. More recent population estimates are currently unavailable.

The crude test rates by urban/rural divide were calculated by using ONS LSOA designations (C1/C2= urban, D1/D2 and E1/E2 = rural).

Analysis

All data cleaning and analysis (descriptive and statistical) were performed in R 4.1.3.

Long-term averages were calculated as the average number of tests for each month for which data were available, so, for example, the average for all January tests from 2018 to 2023. 95% confidence intervals were calculated.

Data are correct as of the 20th October 2025.

Surveillance Findings

Children

Number and rate of initial tests

In 2024, 683 blood tests of children were submitted for initial lead testing; an increase of 125 tests compared to 2023 and the highest annual number of tests for the period for which we have data. The testing rate for 2024 was 21.6/100,000 (figure 1).

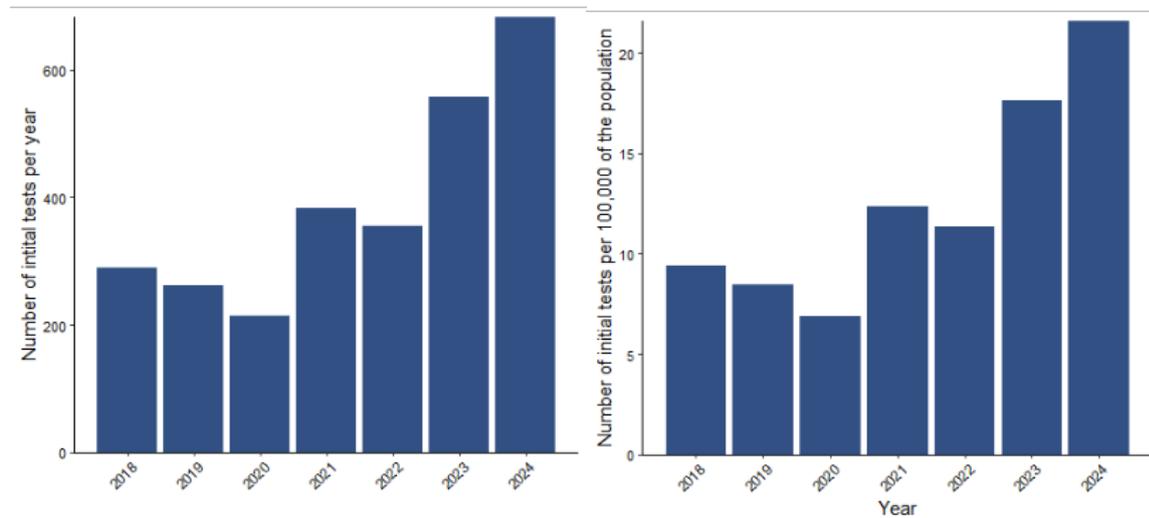


Figure 1: Number and rate of initial blood tests taken for lead, per year in children. 2018 -2024.

During 2024, the number of tests each month exceeded the monthly average for 2018 to 2023 (figure 2) particularly from January to October, with peak testing in July.

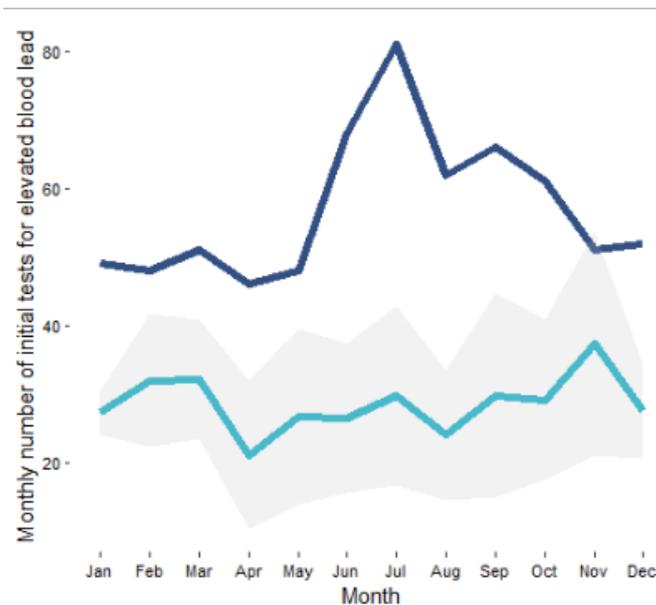


Figure 2: Monthly number of tests of children for blood lead in Wales in 2024 (dark blue line) relative to the long-term average (2018 – 2023, light blue line) ± 95% CIs (grey shading).

In 2024, there were 27 new children with elevated blood lead, compared with 19 in 2023. In 2024, 3.9% of tests met the public health action level (figure 3), compared with 3.4% in 2023 (difference not significant).

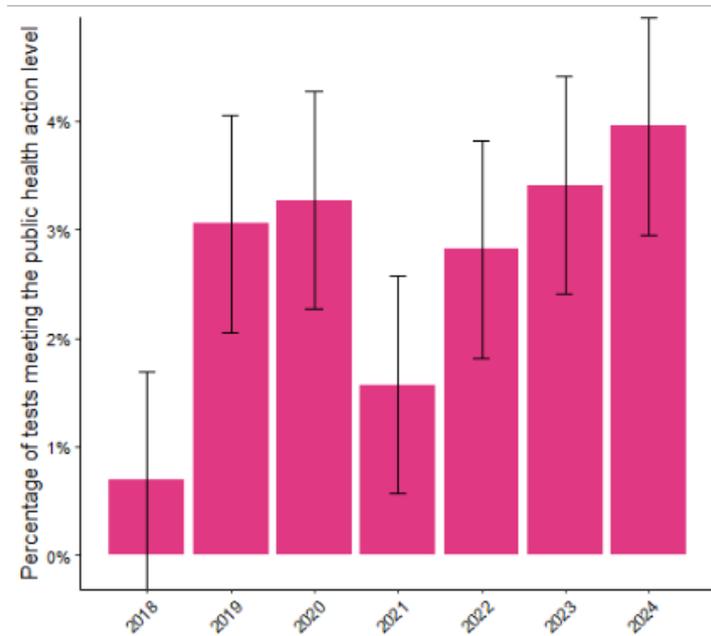


Figure 3: Percentage of tests meeting the public health action level per 100,000 of the population meeting or exceeding the threshold for elevated blood lead in children at the threshold of 0.24umol/L in Wales. 2018 - 2024.

Age and sex of children tested

Most blood lead tests in 2024 were for boys (n = 470, 68.9% of all tests). Most tests were for two-to-five-year-olds (n = 416, 61% of all tests, figure 4).

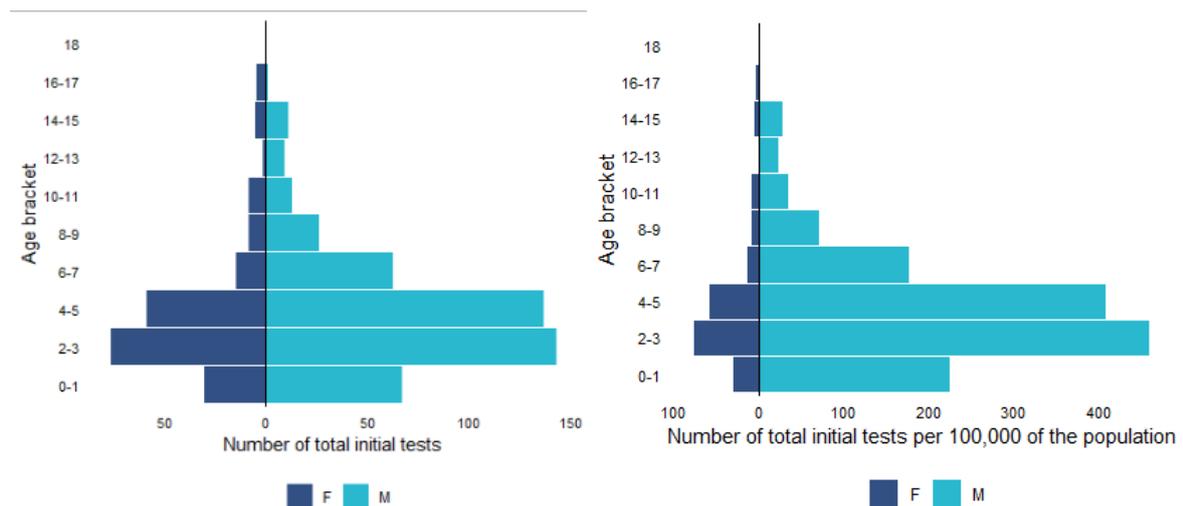


Figure 4: Number and rate of initial blood tests taken for lead by age and sex of child

Most children with an initial elevated blood lead test were boys (n = 22, 81% of all cases). Most children with an elevated blood lead test were in the two- to seven-year-old age group (n = 25, 93% of all cases). Test positivity was highest among male 6- to 7-year-olds (7.9% of males tested aged 6-7 years old, figure 5).

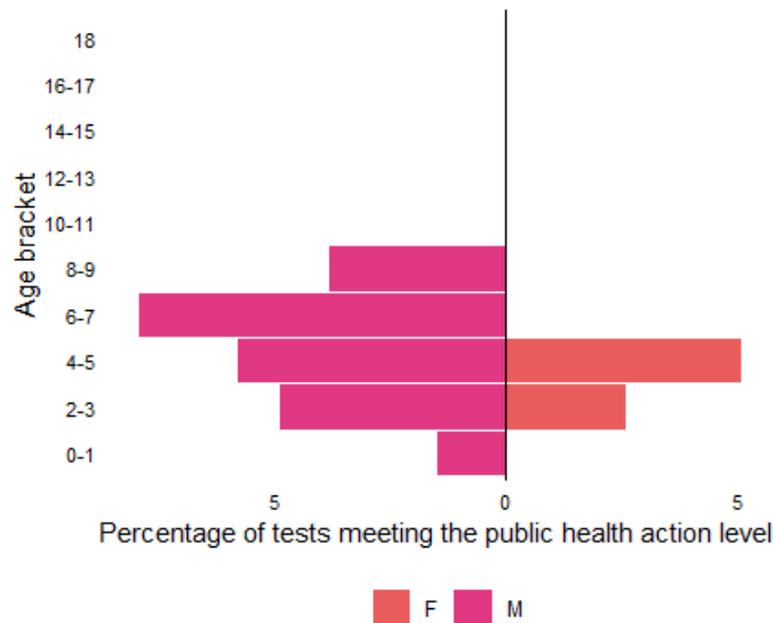


Figure 5: Proportion of tests per age and sex of the population meeting or exceeding the threshold for elevated blood lead in children at the threshold of 0.24umol/L in Wales in 2024.

Health board trends

In 2024, the test rate per head of population was highest in Betsi Cadwaladr University HB (BCUHB; 30.3/100,000) and lowest in Powys THB (PTHB; 4.5/100,000; figure 6).

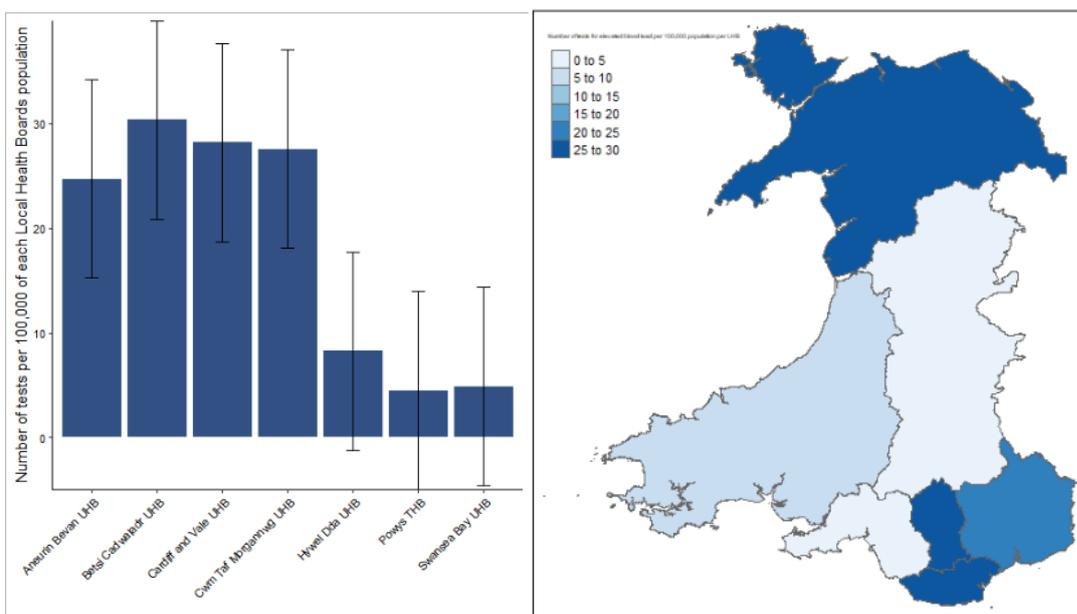


Figure 6: Initial blood lead test rate per 100,000 population by HB.

BCUHB had the highest incidence of initial blood lead tests meeting the public health action level per head of population (1.3/100,000, figure 7). In terms of positivity, however, the highest percentage of positive tests among people tested was in Swansea Bay UHB (SBUHB; figure 8).



Figure 7: Rate of cases of elevated blood lead per 100,000 population by HB.

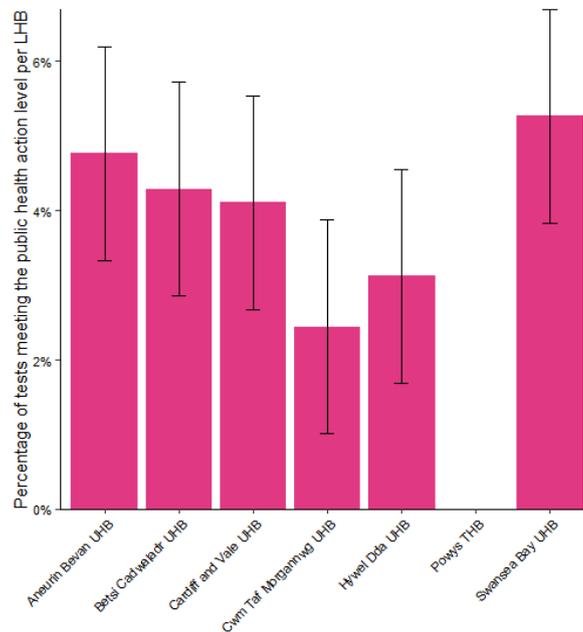


Figure 8: Percentage of tests conducted per HB meeting the public health action level.

Local authority trends

The highest rate of testing in 2024 was in Denbighshire (64.8/100,000 of the population), which was significantly higher than all other LAs, the lowest testing rate was in Pembrokeshire (3.2/100,000; figure 9).

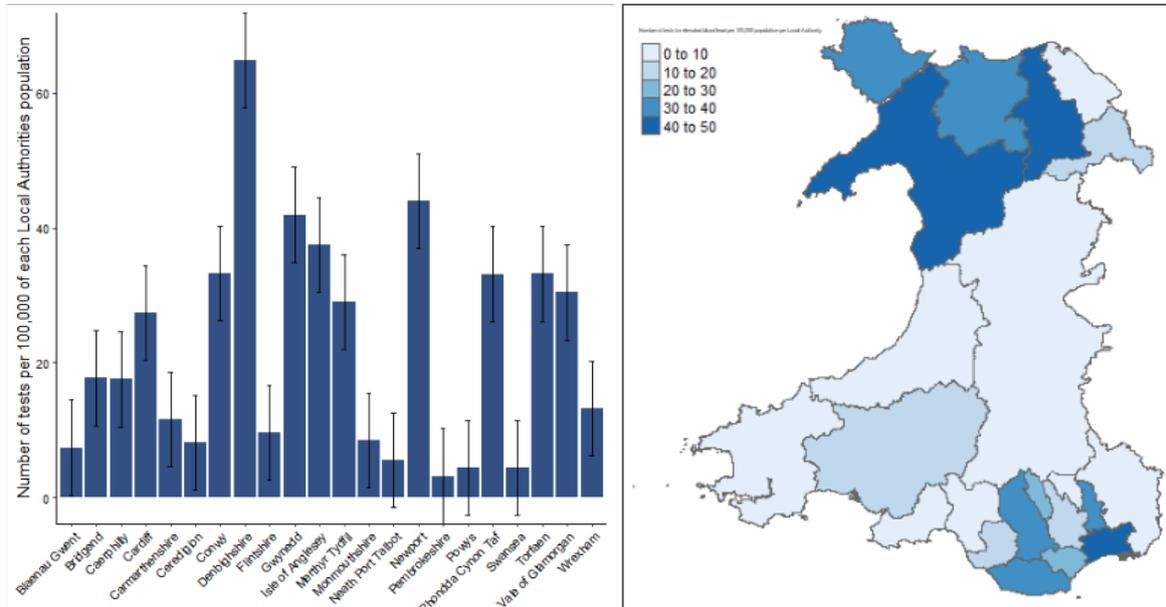


Figure 9: Rate of tests for elevated blood lead in children per 100,000 population by LA

The highest incidence of newly elevated blood lead was also in Denbighshire (5.1/100,000 population), significantly higher than all other LAs in Wales and likely a reflection of their higher rate of testing. In several LAs no children were newly diagnosed with elevated blood lead in 2024 (figure 10).



Figure 10: Rate of children with elevated initial blood lead tests per 100,000 population by LA

Test positivity was highest in Flintshire (figure 11).

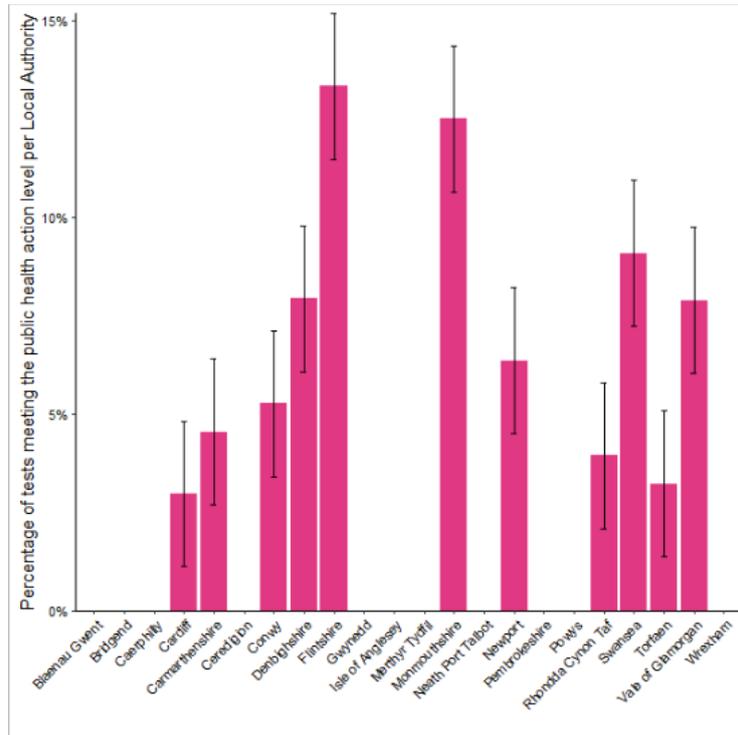


Figure 11: Percentage of tests conducted by LA meeting the public health action level

Deprivation based trends

In 2024, over a third of children with an initial blood lead test were in WIMD fifth 1, the most deprived group (n = 236, 34.6%; figure 12).

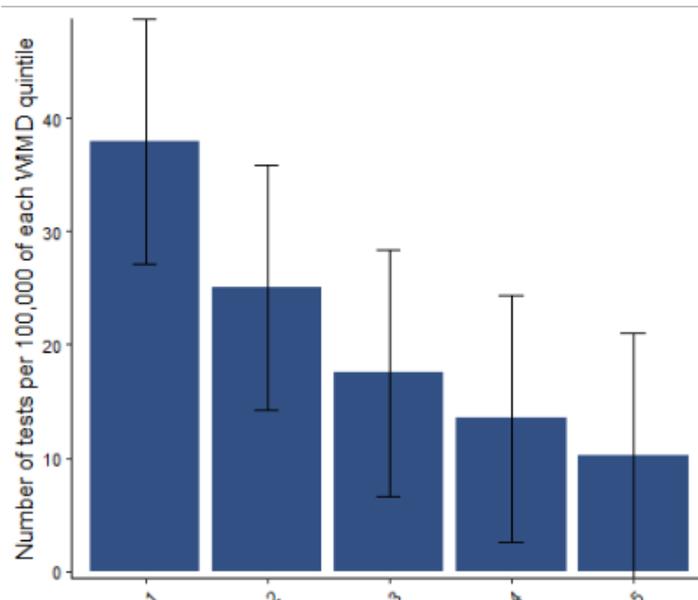


Figure 12: Rate of tests for elevated blood lead in children per 100,000 population per WIMD quintile.

The rate of elevated blood lead was also highest in children living in WIMD one, the most deprived group (n= 10, 37.0%, 1.6/100,000; figure 13).

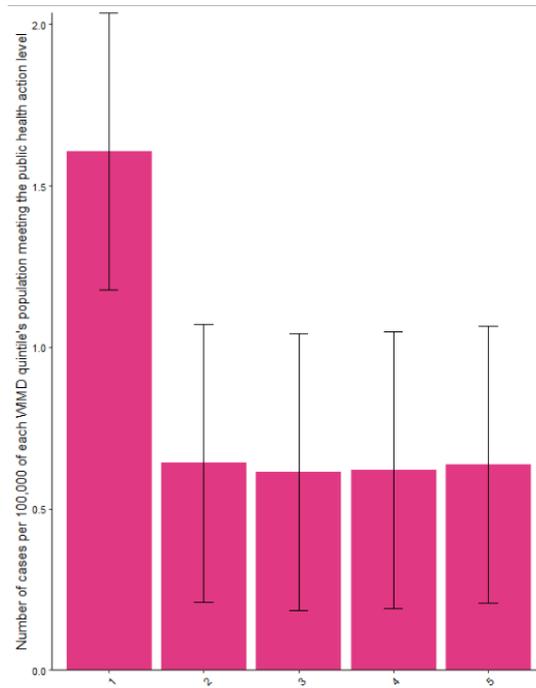


Figure 13: Rate of cases of elevated blood lead in children per 100,000 population per WIMD quintile.

Urban: rural analysis

Most children tested in 2024 live in urban areas (n=551, 81%; figure 14).

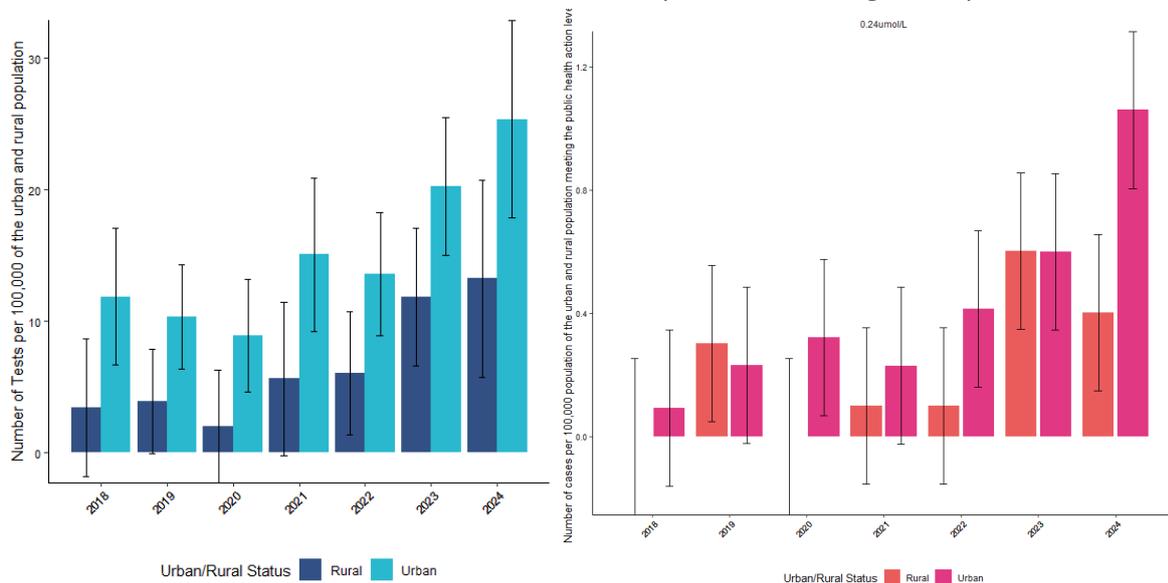


Figure 14: Tests and rates of elevated blood lead in children per 100,000 Urban/Rural population.

Most likely as a result of the majority of children being tested residing in urban areas, more children from urban areas were found to have an elevated blood lead level (figure 15).

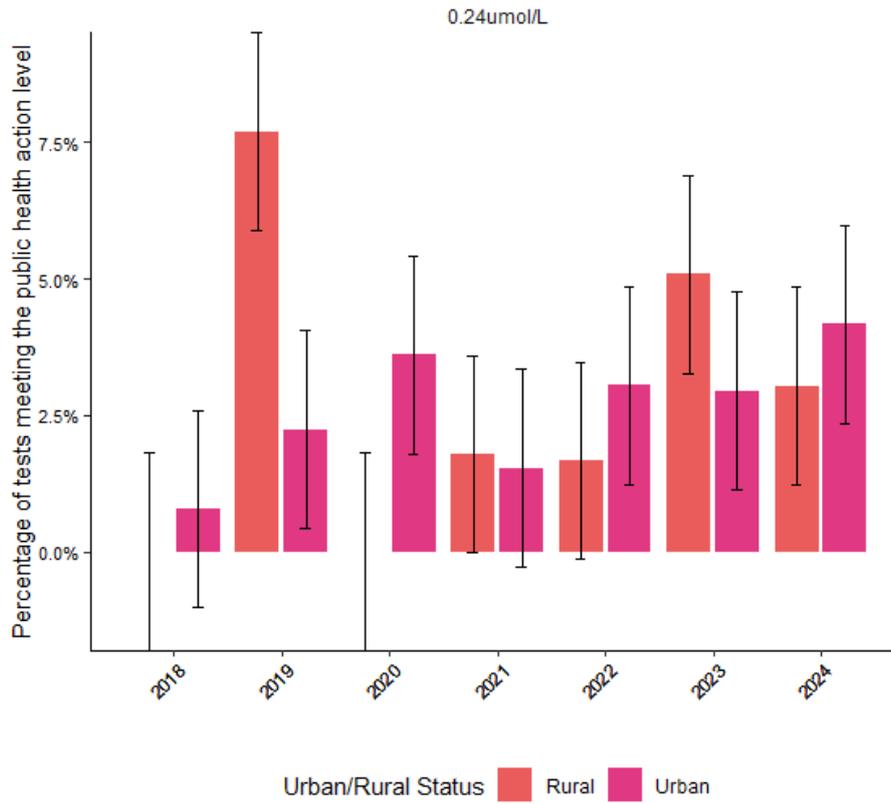


Figure 15: Percentage of tests meeting the public health action level by Urban Rural status.

Section two: Adults over the age of 65

Number of initial tests

For 2024, 49 tests of adults over the age of 65 were submitted for initial testing (figure 16), compared with 35 in 2023.

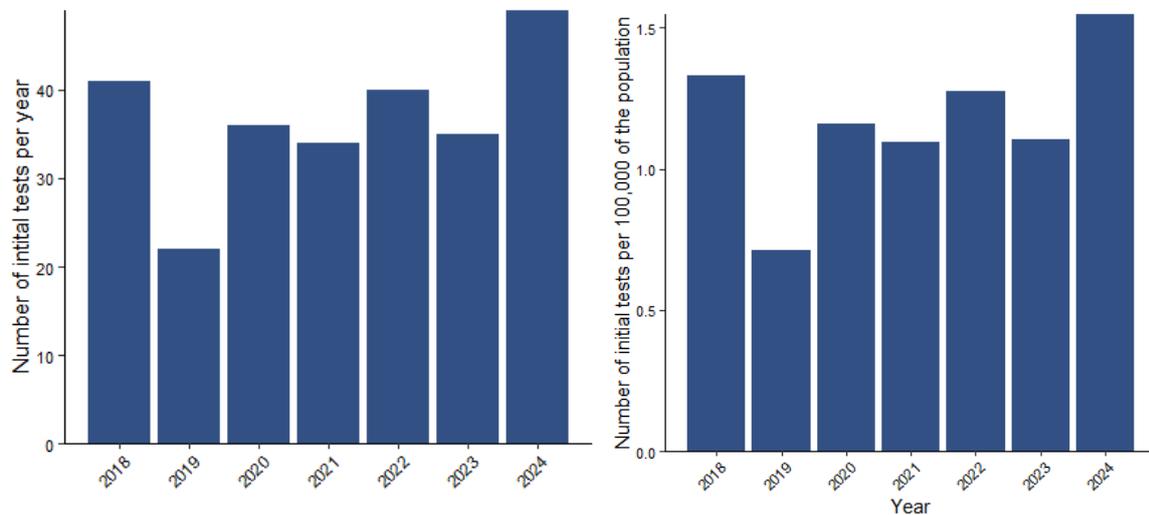


Figure 16: Number and rate of initial blood tests taken for lead, per year in adults over the age of 65. 2018 – 2024.

Age and sex of adults tested

In 2024, more men aged 65 and over were tested than women (n = 31, 63%).

Health board trends

In 2024, the test rate was highest for adults aged 65 and over in HDUHB (2.6/100,000, figure 17).

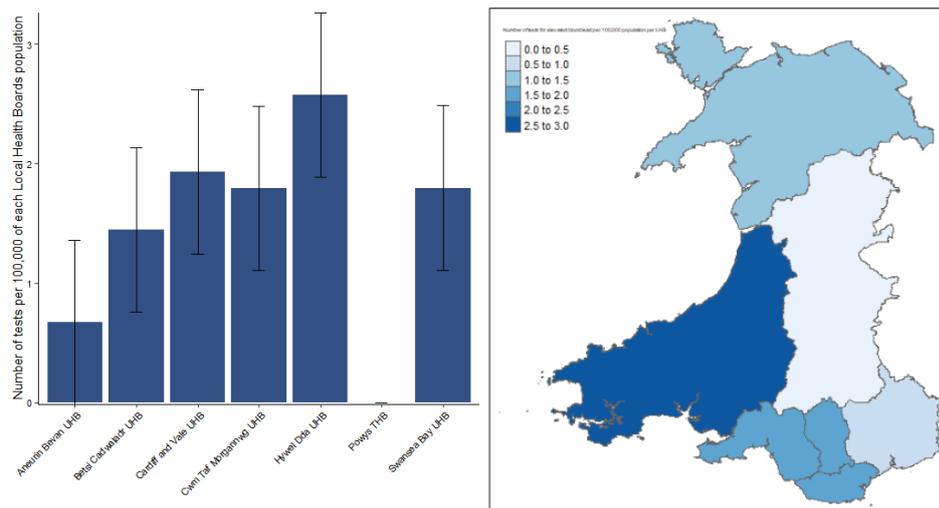


Figure 17: Initial blood lead test rate per 100,000 population by health board.

Local Authority trends

The highest rate of testing in 2023 was in Vale of Glamorgan (5.2/100,000, figure 18).

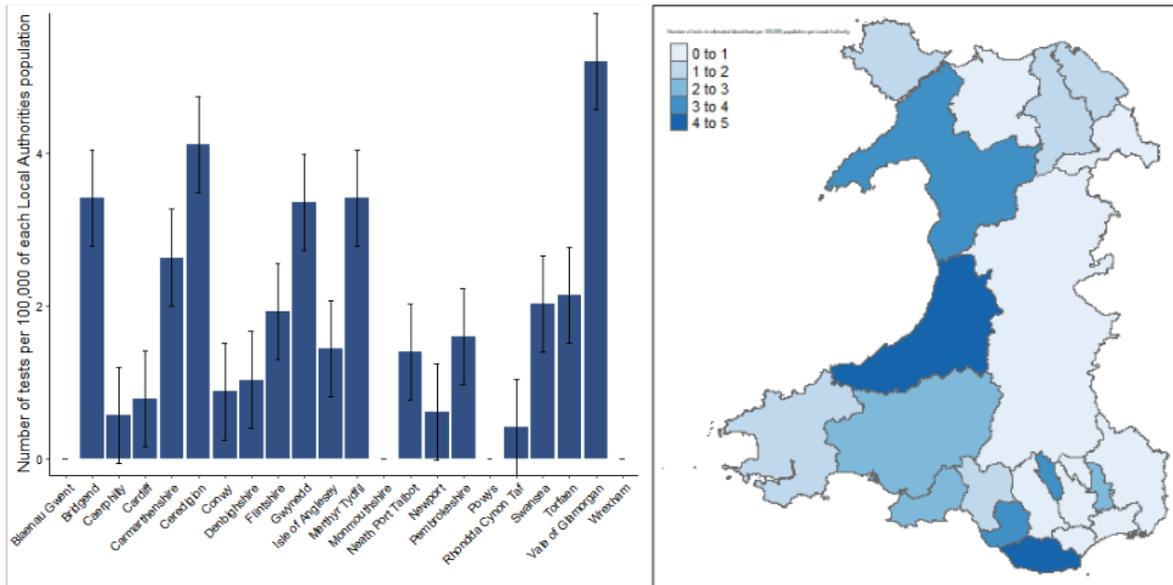


Figure 18: Test rate in adults aged 65 and over per 100,000 population by LA.

Testing for elevated blood lead by WIMD quintile

In 2024, in contrast with children, the least number of tests were conducted for retired adults living in WIMD quintile 1, the most deprived quintile (n = <5, figure 19).

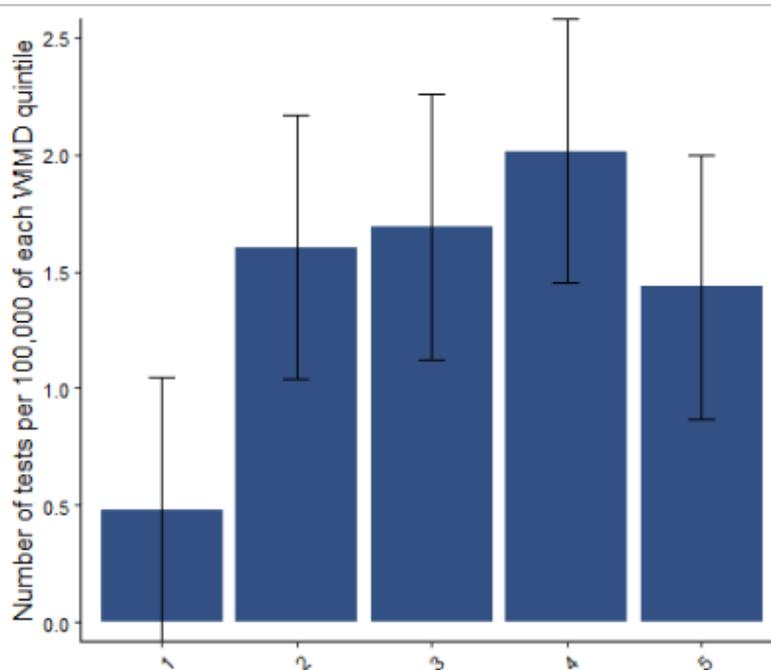


Figure 19: The number of tests for elevated blood lead in adults aged over 65 per 100,000 population per WIMD quintile.

Urban: rural analysis

Most adults aged over 65 tested live in rural areas (n = 25, 51% of all adults tested in 2024; figure 20).

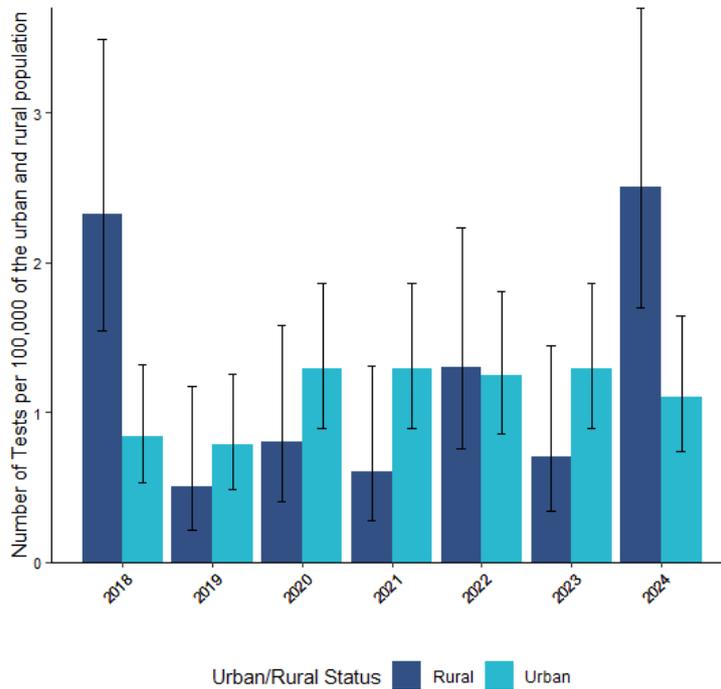


Figure 20: Rate in adults aged 65 and over per 100,000 Urban/Rural population.

Fewer than five older adults had elevated blood lead in 2024. No further analysis of these data is possible.

Limitations

These analyses are based on testing data gathered from people who clinicians suspect to have an illness that may, or may not, be caused by an environmental source. There is no routine population level testing of blood for lead levels in Wales. Therefore, these people are already unwell, or have conditions meaning they may be more likely to be exposed to lead due to their behaviours. The population profiles presented here may be reflective of illness profiles in the population, rather than elevated blood lead concentrations in the population.

We used the aggregate WIMD deprivation score to create fifths and then compared outcomes between these fifths. WIMD does, of course, also include a health indicator, risking circularity between “explainer” and outcome. However, it is not currently clear to us whether another of the WIMD components could be an appropriate proxy in the way that, for example, income is used for deprivation when studying air pollution. Previous studies in the UK have established that children from Asian ethnic backgrounds have higher blood lead concentrations than children with European ethnicity (Kolev *et al.* 1996). The dataset does not contain any ethnicity data and therefore it is not possible to make any conclusions regarding ethnicity.

Conclusions and Recommendations

This is the second summary of the findings of blood lead testing in children and older adults in Wales. These data show that exposure to lead is still causing significant health harms to children across Wales. There are issues that EPH can investigate further, as well as work with other partners on to encourage action.

This report has highlighted several characteristics of people diagnosed with elevated blood lead that may allow targeted approaches to reducing lead exposure. Males of all ages are more likely to be tested and reach the public health action level for elevated blood lead. This finding closely aligns with findings observed in England (UK Health Security Agency. 2023).

Child cases were more likely to live in the most deprived areas of Wales. Deprived areas are more likely to have older properties that are poorly maintained; subsequently increasing the risk of exposure to lead via both paint and lead pipes. It is important that in future data are collected and analysed regarding potential exposure sources.

The data contained in this report likely represents a significant underestimation of the true incidence. Elevated blood lead can present insidiously with non-specific symptoms, making diagnosis difficult for clinicians (BMJ Best Practice. 2022). At present, not all health boards are testing to the same extent.

Recommendations for Environmental Public Health include:

1. Continue to engage with clinical staff across Wales, particularly paediatric teams, to encourage testing for lead across all local health boards
2. Work in partnership with clinicians and other care providers to provide advice to families and carers, with particular consideration for the high proportion of children affected who live in the most deprived areas.
3. Publish a more detailed analysis of cases managed by EPH, establishing the most common likely sources of lead, with the aim of producing targeted proactive messaging to make parents and caregivers aware of these sources.
4. Continue to advocate for more detail to be provided in the blood lead test data set, including NHS number and ethnicity.
5. Continue to consider approaches to developing understanding of “baseline” lead data in healthy people of all ages.

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