UK Health Security Agency

Lead Exposure in Children Surveillance System (LEICSS) annual report 2022

Summary of 2021 data

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Contents

Executive summary

This report summarises the surveillance of cases of lead exposure in children in England from 1 January to 31 December 2021. We last published an annual surveillance report in October 2021 detailing 2020 case data. This report outlines 2021 case data and gives an update of the surveillance activities.

Following a review of the evidence of the harm of lead exposure in children (1, 2), a UKHSA task and finish group recommended the lowering of the blood lead public health intervention level for England. Since 5 July 2021, the case definition for surveillance changed to half the original concentration, from 0.48 µmol/L (equivalent to ≥10µg/dl) to 0.24µmol/L (equivalent to ≥5µg/dl). As expected, this led to a steep increase in the number of cases being reported to LEICSS. We summarise cases both before and after this change.

For the purposes of surveillance from 2015 to 4 July 2021, a case was defined as a child:

- with a blood lead concentration ≥0.48µmol/L (equivalent to ≥10µg/dl), as detected in a UK Accreditation Service (UKAS) accredited biochemistry or toxicology laboratory
- reported to UKHSA for public health intervention
- aged under 16 years at the time of first elevated blood lead concentration
- resident in England

Since 5 July 2021, a case is defined as:

- with a blood lead concentration ≥0.24µmol/L (equivalent to ≥5µg/dl), as detected in a UK Accreditation Service (UKAS) accredited biochemistry or toxicology laboratory
- reported to UKHSA for public health intervention
- aged under 16 years at the time of first elevated blood lead concentration
- resident in England

Main points

Main findings of this report are that:

- 121 cases of lead exposure in children that met the case definition were notified to UKHSA in 2021, 31 of these were pre-case definition change and 90 were post-case definition change
- most cases (86, 72%) were directly notified to LEICSS by participating laboratories; just over a quarter of cases (34, 28%) were notified through other routes, substantially less than in 2020 (40%) but similar to previous years proportion (21%)
- the median delay between a specimen being drawn and a case being processed by surveillance was 11 (IQR 8-15) days; in 2020 this delay was 18 days. This shorter

delay suggests that much of the extended delay in 2020 is thought to be due to pressures on the health system from the coronavirus (COVID-19) pandemic
- the number of cases detected was very much lower than the expected incidence of lead exposure based on international population survey data (3 to 5)
- the average detection rate for England between 2015 and 2021 was 7 cases per million children aged 0 to 15 years, although there was large regional variation
- cases were typically 1 to 4 years of age, male, and resident in more deprived areas
- the median blood lead concentration of cases was 0.38µmol/L (7.87 µg/dL) in 2021, compared to 0.71µmol/L (14.69 µg/dL) in 2020, reflecting the change in case definition

Main messages and recommendations

Lead is a persistent environmental contaminant that can have toxic effect even at low blood lead concentrations. There is no known safe threshold for lead exposure.

Children exhibiting pica[1] or hand to mouth behaviour in environments with lead hazards are likely to be at the highest risk of exposure.

Clinicians should be aware of the risk of lead exposure for children, the main sources of lead exposure, children most at risk, presenting symptoms and signs of exposure.

The UK Health Security Agency (UKHSA) lowered the public health intervention concentration for lead from ≥10µg/dL (≥0.48µmol/L) to ≥5µg/dL (≥0.24µmol/L) for children under 16 years and for pregnant women, with effect from 5 July 2021. UKHSA worked with stakeholders to support this change and produced updated guidance and advice to support including a series of stakeholder events. The background to the change is described in the report 'Evaluation of whether to lower the public health intervention concentration for lead exposure in children' (2).

UKHSA also launched a free online training course, 'Tackling lead poisoning in public health', in July 2021, designed for professionals involved in responding to lead incidents to develop their understanding of lead poisoning and public health policy. A webinar on the importance of lead exposure was held by the Royal College of Paediatrics and Child Health (RCPCH) for training of physicians and paediatrics, which is available on YouTube: 'Lead Toxicity in Children – a continuing problem'.

Cases who fit the latest case definition, with a blood lead concentration above 5µg/dL (0.24µmols/L), should be notified to UKHSA health protection teams for public health case management.

[1] The persistent ingestion of non-nutritive substances at an age where this is developmentally inappropriate.

UKHSA’s major efforts in health protection during 2020 and 2021 were focused on responding to the COVID-19 global pandemic. We have continued to respond to cases reported to UKHSA, but developments in surveillance functions have been delayed as a result. Impacts of the pandemic can be seen in the surveillance indicator data for 2020 to 2021 with delays in notification and processing. Longer term effects of the pandemic on health systems and LEICSS cases are yet to be seen.

Background

Exposure to lead can result in severe multi-system toxicity (1). How this toxicity manifests depends on both the blood lead concentration (BLC), and how rapidly BLC rises. Overt manifestations of toxicity (that is, lead poisoning), such as anaemia or abdominal pain, accompany higher lead concentrations, for example, BLC>1.93µmol/L (>30µg/dl)[2] (2, 6). Lead exposures resulting in a lower BLC may not cause such apparent symptoms, but still cause harm, particularly to the central nervous system. Decreased intellectual function and possibly other neuro-behavioural problems such as shortening of attention span and disruptive behaviour are associated with BLCs even below 0.48µmol/L (10µg/dl) (4, 6). Timely removal or abatement of the exposure source is the mainstay of case management, but symptomatic children, and children with blood lead concentration greater than 1.93µmol/L may also require chelation therapy (6).

Successful primary prevention efforts – targeted at reducing the use of lead in paints and fuels, regulation of lead concentrations in drinking water, water supply pipes, remediation of lead in soil and control of industry emissions – have been successful in reducing lead in the environment and exposures to lead, and BLC in children, as has been demonstrated in the USA (4). However, lead is a persistent contaminant, therefore children can still be exposed to lead already in the environment. Since the removal of lead from petrol, ingestion rather than inhalation has been the most common route of exposure in high income countries, particularly from dusts and flakes of leaded paint (6). Leaded paint had wide domestic use in the UK before gradual withdrawal from the 1960s onwards (7) and lead carbonates and sulphates were eventually banned for sale in 1992.

Children with developmental disorders have been found to have higher blood lead concentrations than other children (8); such children are at higher risk of exposure due to increased mouthing (or ‘pica’) behaviour (9), leading to increased ingestion of lead from paint flakes, lead in soil, and so on. Iron deficiency may further increase susceptibility to lead toxicity and can also cause pica, a high-risk behaviour (10). Other important potential routes of exposure in children are ingestion of lead-contaminated water, contaminated soil or dust, herbal medicine preparations, contaminated food and spices, consumer products not meeting regulatory standards (for example, paint on toys, make-up, lead crystal glassware, jewellery) or inhalation from lead-containing fuel emissions or secondary exposure from parental hobbies or occupations (for example, resulting in children being exposed to lead dust on work-clothing) (6).

Around 1 in 3 children (up to 800 million globally) have blood lead concentrations at or above 5µg/dL, the concentration at which clinical and public health action is advised in many countries (5). There are no recent comprehensive survey data estimating how many children in England

[2] Both µmol/L and µg/dL units are commonly used internationally to express blood lead concentrations, where 1 µg/dl = 0.0483µmol/L. Divide the concentration in µg/dl by 20.7 to obtain the concentration in µmol/L.

are exposed to lead. International population survey data may be used for estimates; a survey conducted in France in 2008 to 2009[3] (3), estimated 0.09% of 1 to 6 year-olds had a BLC ≥0.48µmol/L (≥10µg/dl), and 1.5% a BLC ≥0.24µmol/L (≥5µg/dl). A survey in the USA in 2013 to 2014 (11) estimated 0.5% of 1 to 5 year olds had a BLC ≥0.24µmol/L (≥5µg/dl). Applying the USA estimate to the UK population of 1 to 4 year olds in England and Wales in 2021 (taken from ONS 2021 Census data) suggests that as many as 3.2 million children in the UK have BLCs above the intervention concentration. However, recent estimations by the Institute of Health Metrics (12), using the Global Burden of Disease tools suggest that for the UK in 2019 there were 213,702 (95% CI 186,117 to 281,542) children aged 0 to 19 years with a BLC of ≥0.24µmol/L (≥5µg/dl), and 29,036 (95% CI 25,099 to 42,470) children with BLC ≥0.48µmol/L (≥10µg/dl). However, comparison with historic data suggests a substantial fall in average BLCs over time (11). Moreover, population lead exposure is strongly influenced by setting, so these findings give only a broad indication of the potential situation in England.

Lead exposure is diagnosed by a blood test to measure the blood lead concentration. As signs and symptoms of lead exposure are non-specific, it is easily missed and misdiagnosed in clinical settings. An evidence review for the need for population screening was carried out by the UK National Screening Committee in 2018. A systematic population screening programme was not recommended (13), because of concerns about testing and treatment and the lack of up to date population prevalence data (alongside evidence of a steady decline in lead exposure over time). Case detection therefore depends on clinicians having a high clinical suspicion, for example due to the home circumstances of the child increasing the risk of lead exposure, and subsequently ordering a blood test. Surveillance of cases identified by clinicians offers a means of gathering intelligence to guide public health action to prevent further cases of exposure.

[3] France restricted white lead-based interior paint in 1909 (earlier than England); thus exposures from this source would be expected to be lower than in the UK.

The Lead Exposure in Children Surveillance System (LEICSS)

UKHSA coordinates LEICSS, a national surveillance system for children residing in England. Formal surveillance of lead exposure in children in England was initiated in 2010 by the Surveillance of elevated blood Lead in Children (SLiC) study, a joint research project between the British Paediatric Surveillance Unit and the Health Protection Agency (the forebear to Public Health England (PHE), now UKHSA). The SLiC study authors recommended implementation of a laboratory-based surveillance system in order to facilitate timely public health management of cases of lead poisoning in children (14). A pilot system, the Lead Poisoning in Children (LPIC) surveillance system, was therefore instigated in 2014. LPIC was then permanently implemented in 2016 following successful evaluation of the pilot, and its name changed to LEICSS to recognise broader aims of prevention of lead exposure in children, in addition to the rapid recognition of cases of lead poisoning.

A UKHSA working group oversees LEICSS management, and a steering group with additional representatives from participating laboratories, academia, NHS clinical toxicology and patient representative groups (for example Lead Exposure and Poisoning Prevention (LEAPP) Alliance) oversee system aims and development (see Steering and Working Group Members below). The data collected from LEICSS feeds into the Environmental Public Health Surveillance System (EPHSS) for England operated by UKHSA as part of Environmental Public Health Tracking programme, and the steering group and working group report to the UKHSA Environmental Public Health Tracking Board.

LEICSS aims are:

- to facilitate timely public health action for individual cases, as the mainstay of treatment for cases of lead exposure is rapid removal of the putative source of exposure
- the system should also meet population level surveillance objectives, to inform public health action to reduce the incidence of lead exposure in children in England, such as by identifying at risk geographic areas or populations, and identification of current and emerging sources of exposure

Case reporting to LEICSS

LEICSS is a passive surveillance system that integrates reports of incident (newly detected) cases of lead exposure in children from 2 sources:

- cases reported to UKHSA directly from a UK Accreditation Service (UKAS) accredited testing biochemistry or toxicology laboratory, or

- searching HPZone[4] for cases first reported from a non-UKHSA source (for example, the managing clinician or an environmental health officer) to a local UKHSA Health Protection Team (HPT)[5], or from other UKHSA departments (for example, UKHSA Radiation, Chemicals and Environmental Hazards Directorate) and not reported to LEICSS by laboratories participating in surveillance

Case notification to UKHSA is voluntary but encouraged for case management and surveillance purposes.

Case reports from biochemistry and toxicology laboratories

Reports of cases meeting the following case definition are referred to as 'laboratory-detected' cases.

For the purposes of surveillance from 2015 to 4 July 2021, a case was defined as a child:

- with a blood lead concentration ≥0.48µmol/L (equivalent to ≥10µg/dl), as detected in a UK Accreditation Service (UKAS) accredited biochemistry or toxicology laboratory
- reported to UKHSA for public health intervention
- aged under 16 years at the time of first elevated blood lead concentration
- resident in England

Since 5 July 2021, a case is defined as:

- with a blood lead concentration ≥0.24µmol/L (equivalent to ≥5µg/dl), as detected in a UKAS accredited biochemistry or toxicology laboratory
- reported to UKHSA for public health intervention
- aged under 16 years at the time of first elevated blood lead concentration
- resident in England

LEICSS surveillance staff enter case details onto a case management system called HPZone following notification. The relevant local HPT is then alerted to investigate and manage the case. This route of notification to the investigating HPT has been found to be timelier than waiting for notification from other sources involved in treating the case, for example, the managing clinician (15).

[4] HPZone is the public health case management system used in England by UKHSA Health Protection Teams when investigating and managing public health threats to their local populations.
[5] HPTs are frontline units responsible for investigating and managing public health threats to their populations.

‘HPZone-detected’ cases

HPZone-detected cases are those that are or were:

- notified directly to a health protection team in England for public health management and classified on HPZone as ‘toxic exposure to lead’
- aged under 16 years at the time of notification to the health protection team
- resident in England
- not initially notified to LEICSS by a participating biochemistry or toxicology laboratory

Blood lead concentration data is not routinely recorded on HPZone in a way that makes them available for analyses by LEICSS for these cases. Thus an HPZone detected case may have a BLC <5µg/dL (0.24 µmols/L).

The Supra-regional Assay Service (SAS) Trace Elements laboratories network, and other reporting laboratories

A group of highly specialised diagnostic laboratories, the SAS, provide a referral network for specialised laboratory investigations in the UK. Blood lead concentration is measured in 6 SAS Trace Elements laboratories in England, and it is estimated they perform the vast majority of such tests nationally. All 6 SAS laboratories participate in LEICSS, and a partnership between the SAS-associate laboratory in Wales (Cardiff Toxicology Laboratory) has been developed to alert LEICSS of England residents whose blood lead concentration may be determined in Cardiff. Other, non-SAS but UKAS accredited laboratories have also agreed to report cases to LEICSS; these are typically located in larger NHS Trusts or are private laboratories. All contributing laboratories are named in the acknowledgements of this report.

Public health management of cases

Following a review of the evidence of the harm of lead exposure in children (2), a UKHSA task and finish group recommended the lowering of the blood lead public health intervention concentration. Since 5 July 2021 the case definition for surveillance changed to half the original concentration, from 0.48 µmol/L (equivalent to ≥10µg/dl) to 0.24µmol/L (equivalent to ≥5µg/dl). A BLC of ≥0.24µmol/L (or ≥5µg/dl) is the current threshold (‘public health intervention concentration’) for public health case management in England for children and pregnant women as it indicates a specific source is present. HPTs will take steps to systematically identify and remove the potential source(s) of lead exposure in cases, following guidance in a HPT Standard Operating Procedure (SOP, aka ‘Lead Action Card’) (16). This involves liaison and involvement with other UKHSA stakeholders, such as the Environmental Hazards and Emergencies department, and non-UKHSA stakeholders, such as the responsible clinician and local authority where the case resides. General information on lead and incident management can be found on the UKHSA web page Lead: health effects, incident management and toxicology.

Purpose of this report

This report provides a summary of data extracted from the national LEICSS data set for cases of child lead exposure in residents of England reported to health Protection Teams during 1 January to 31 December 2021. As the case definition changed during the year, we have accounted for this in the descriptive analysis. The data on cases both before and after the change in case definition have been compared. Moreover, the 2021 metrics were compared to the previous 2015 to 2020 5-year average, where relevant, using data from cases with report dates between 1 January to 31 December for each of these years.

Figures are correct at the time of publication and may be subject to change as new information about cases becomes available.

This report, and previous years' annual reports, and other surveillance reports, are available at Lead exposure in children: surveillance reports.

Surveillance data indicators

Number of unique cases

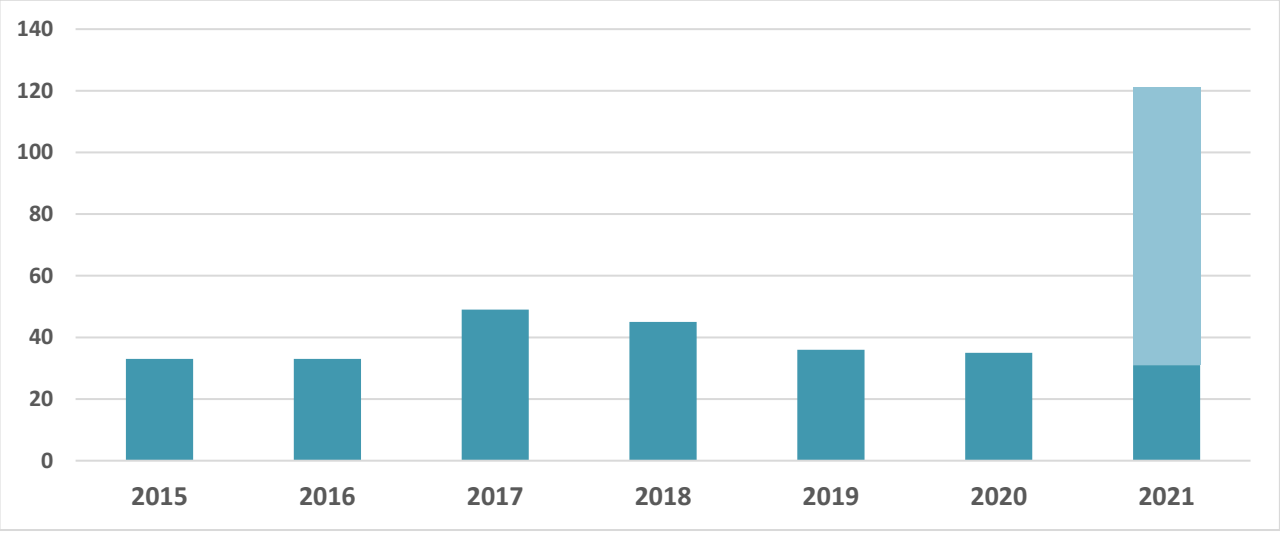
A total of 135 cases were reported to LEICSS in 2021. Of these, there were 120 unique cases detected in 2021 that met the case definitions. 72% of cases were direct laboratory reports to LEICSS, lower than the 2015 to 2020 proportion of 79% (Table 1). Figure 1 shows the number of cases reported per year 2015 to 2021, in England.

Table 1. Count and percentage of LEICSS cases, by reporting route to LEICSS, England 2021, and 2015 to 2020

Route of detection by LEICSS	Count of cases 2021 (% of total)	Count of cases 2015 to 2020 (% of total)
Direct laboratory reports	21* (70)	194 (79)
	65**(72)	
HPZone search	10* (30)	51 (21)
	25**(28)	
Total	**121**	**245**

*Pre-case definition change
**Post-case definition change

Figure 1. Count of LEICSS cases, England 2015 to 2021



Note: The darker blue bar in 2021 denotes the number of cases, post-case definition change

Timeliness of reporting of lab-detected cases to LEICSS and notification to health protection teams

For the laboratory reported cases, the median delay between the date of specimen collection and the date the case was entered onto HPZone (as a proxy for date of report to HPTs) was 11 days, substantially less than the previous year (17.5 days) and within the range of the 2015 to 2020 inter quartile range (IQR), close to the median of 9.4 days for 2015 to 2020 (Table 2). It is likely that the pressures of responding to the COVID-19 pandemic by the health system were responsible for an increased delay in 2020 and 2021.

Table 2. Time between specimen collection and entry of case onto HPZone for case management for lab-detected LEICSS cases, England 2021, and 2015 to 2020

Year	Cases	Cases with valid data*	Median days delay	IQR[$]
2021	**86**	**80**	**11**	**8 to 15**
Pre-case definition change	21	19	14	9-95
Post-case definition change	65	61	11	7-14
2015 to 2020	**194**	**175**	**9.4**	**7 to 14**

* Cases where both a valid specimen date and a valid date of entry onto to HPZone were extracted from HPZone;
[$]IQR= Inter quartile range

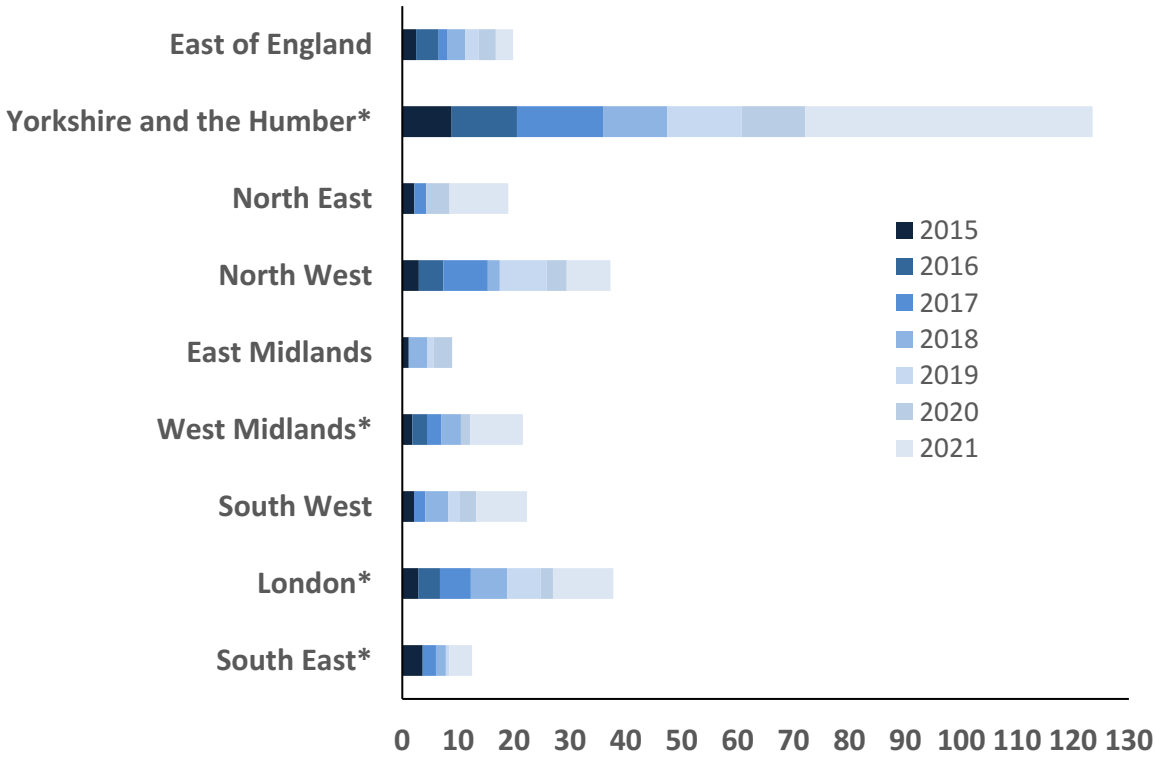
Occurrence and trends of cases of lead exposure in children

Count and detection rate (by LEICSS) of cases by Regions and year

A substantially higher number of cases were detected in all regions than previous years in 2021 due to the lowering of the case definition, apart from in the East Midlands and East of England regions (see Table 3). It is still likely that the numbers continue to significantly under-ascertain the true number of cases (see section on ascertainment, page 16). No cases were detected in the East Midlands region in 2021, whereas numbers more than tripled in 2021 for South East, London, West Midlands and the Yorkshire and Humber region (see Figure 2, Table 3).

Note: this should not be interpreted as incidence. The average detection rate for England between 2015 and 2021 was 6.97 cases per million children aged 0 to 15 years, although there was large regional variation. Yorkshire and Humber remains the highest reporting region (Figure 2, Table 3, Figure 3).

Figure 2. Graph showing detection rate of LEICSS cases per regional population of 0 to 15 year olds, per million, 2015 to 2021, England



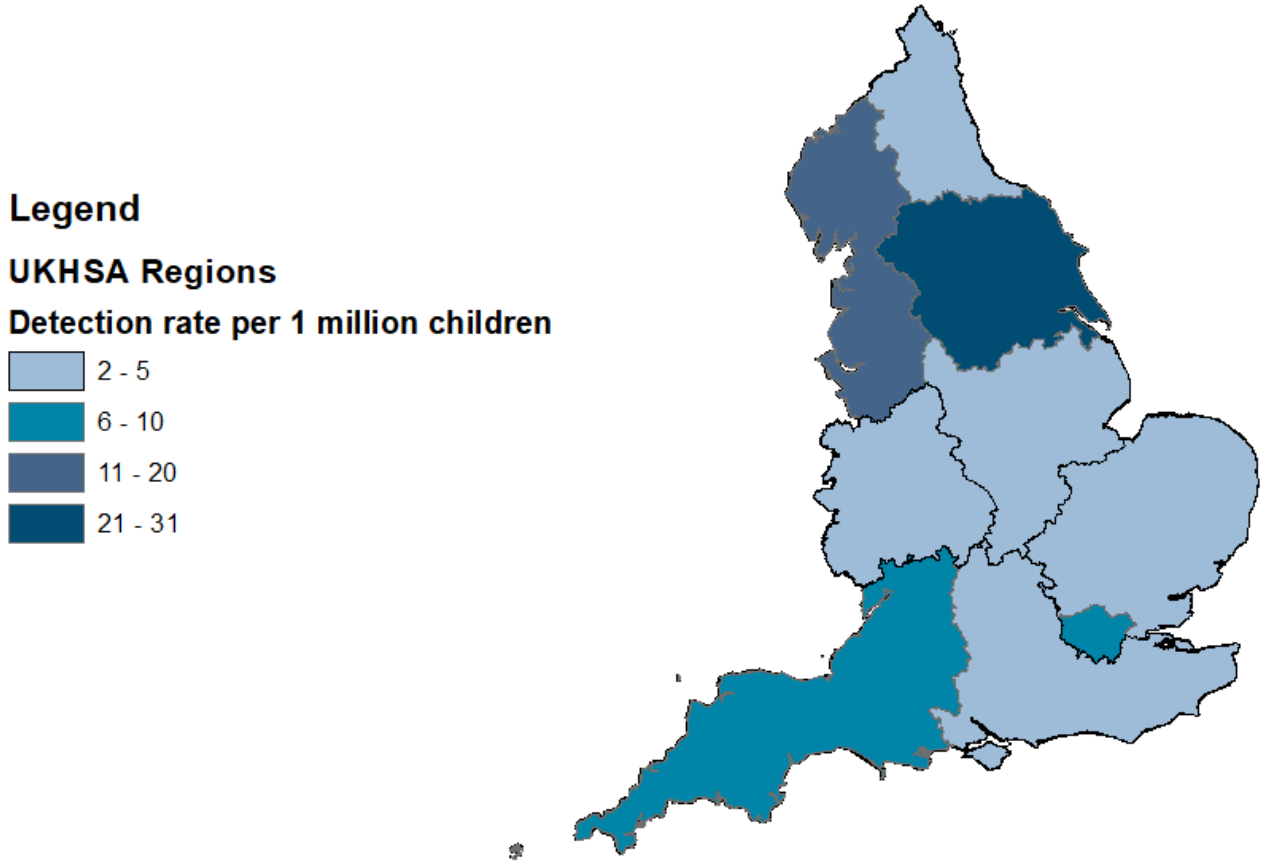
* Centres where an SAS laboratory that participates in the surveillance system is situated.
Note: 2019 population data was used as the denominator for 2020 and 2021 cases

Table 3. Count and percentage of LEICSS cases, and average detection rate† of cases (per million 0 to 15 year old children) by Region and year of notification, England 2015 to 2021

Region	Cases 2015 (%)	Cases 2016 (%)	Cases 2017 (%)	Cases 2018 (%)	Cases 2019 (%)	Cases 2020 (%)	Cases 2021 (%)	Cases 2015 to 2021 (%)	Average detection rate‡ of cases (per million per year) 2015 to 2021
South East*	6 (18)	0 (0)	4 (8)	3 (7)	1 (3)	0 (0)	7 (6)	21 (6)	**3.10**
London*	5 (15)	7 (21)	10 (20)	12 (27)	11 (31)	4 (11)	20 (17)	69 (20)	**9.41**
South West	2 (6)	0 (0)	2 (4)	4 (9)	2 (6)	3 (9)	9 (7)	22 (6)	**9.77**
West Midlands*	2 (6)	3 (9)	3 (6)	4 (9)	0 (0)	2 (6)	11 (9)	25 (7)	**5.39**
East Midlands	1 (3)	0 (0)	0 (0)	3 (7)	1 (3)	3 (9)	0 (0)	8 (2)	**2.24**
North West	4 (12)	6 (18)	11 (22)	3 (7)	4 (11)	5 (14)	11 (9)	44 (13)	**11.96**
North East	1 (3)	0 (0)	1 (2)	0(0)	0 (0)	2 (6)	5 (4)	9 (2)	**4.74**
Yorkshire and the Humber*	9 (27)	12 (36)	16 (33)	12 (27)	14 (38)	12 (34)	54 (45)	129 (37)	**30.82**
East of England	3 (9)	5 (15)	2 (4)	4(9)	3 (8)	4 (11)	4 (3)	25 (7)	**4.95**
England	**33**	**33**	**49**	**45**	**36**	**35**	**121**	**352**	**6.97**

† Should not be interpreted as an estimate of incidence – see note on ascertainment, page 18.
‡ The numerator for this indicator is incident cases in 2015 to 2021, and the denominator is the summed mid-year estimate of the 0 to 15 population for 2019 multiplied by 4. Cases allocated to then-UKHSA centre according to postcode of residence.
* Centres where an SAS laboratory that participates in the surveillance system is situated.

Figure 3. Average detection rate† of LEICSS cases (per million 0 to 15 year-old children) by Region, England 2015 to 2021



† Should not be interpreted as an estimate of incidence – see note on ascertainment, page 16.

Incidences and clusters of cases, regionally

There were a number of incidents or clusters of cases of lead exposure that were reported to HPTs during 2021 to 2022. These may help to account for an increase in cases in the midlands and northern regions.

This includes a cluster of cases was reported in the Leeds city centre area (LS8 postcode). It is unclear as to the reasons for the cluster, and it is currently being explored.

This also includes, in July 2022, 9 staff at a firing range in Walsall (West Midlands) were hospitalised due to high levels of lead poisoning. Exposure was associated with their work at an indoor shooting range; previous occupational exposure may have occurred in earlier years potentially affecting families in the area. This may account for increases in cases in the area.

The case detection rate and ascertainment

Because lead exposure below the concentration causing overt toxicity commonly causes few or non-specific symptoms, surveillance of clinically reported cases is likely to under ascertain the number of affected children. International population surveys, which more accurately estimate the number of children exposed to lead, suggest an expected incidence of cases of paediatric lead exposure higher than detected through LEICSS (3 to 5, 11).The figures above should not therefore be considered representative of the incidence of child lead exposure in England.

Factors affecting case ascertainment are also likely to be driving the variation seen between regions. For instance, UKHSA is aware of a system introduced by Leeds SAS laboratory (based in Yorkshire and Humber) to actively prompt clinicians to consider testing for lead exposure in children whose blood is being tested for suspected iron deficiency, where that child is also known to have pica (17). There is also active engagement of local clinicians by this laboratory. The 90% increase in testing and case reporting in this region following the introduction of this system demonstrates that differences in clinician awareness and testing rate strongly influence case ascertainment by the surveillance system (and potentially more than differences in the frequency of lead hazards in the environment between regions). Testing of cases in laboratories not reporting cases to LEICSS may also explain part of the regional variation in case ascertainment, though it is expected SAS labs perform the large majority of BLC tests in children in England. Non-reporting of cases by participating laboratories may also have (more rarely) occurred. Irregular case entry onto HPZone may have prevented some cases being detected by our search, though cases first notified to LEICSS are entered using a standard procedure. Estimating area-specific testing rates would aid the interpretation of case detection rates but is difficult given the supra-regional catchment of SAS laboratories.

Count and detection rate of cases by gender and age

The majority of cases in 2021 were male (58%), similar to the 2015 to 2020 proportion (65%) (Table 4). Across all age groups the detection rate was higher in males than females (Figure 4). This gender disparity is also evident in some international survey findings (11) and may reflect a pre-disposition for males to behaviours or comorbidities that result in lead exposure such as autism (18), itself associated with pica (19), or a greater susceptibility to lead toxicity, and hence clinical presentation (20).

Table 4. Count and percentage of LEICSS cases by sex, England, 2021, and 2015 to 2020

Sex	Count of cases 2021 (%)	Count of cases 2015 to 2020 (%)
Female	51(42)	73 (32)
Male	70 (58)	151 (65)
Unknown	0(0)	7(3)
Total	**121**	**231**

The highest case detection rate was in children aged 1 to 4 years, both in males and females (Figure 4). This was also seen in 2021 with 73% of cases aged 1 to 4 years, higher than the 5-year average (59%) (Table 5). Less cases were aged between 5 to 11 years (20%), while 5% were in the oldest age group.

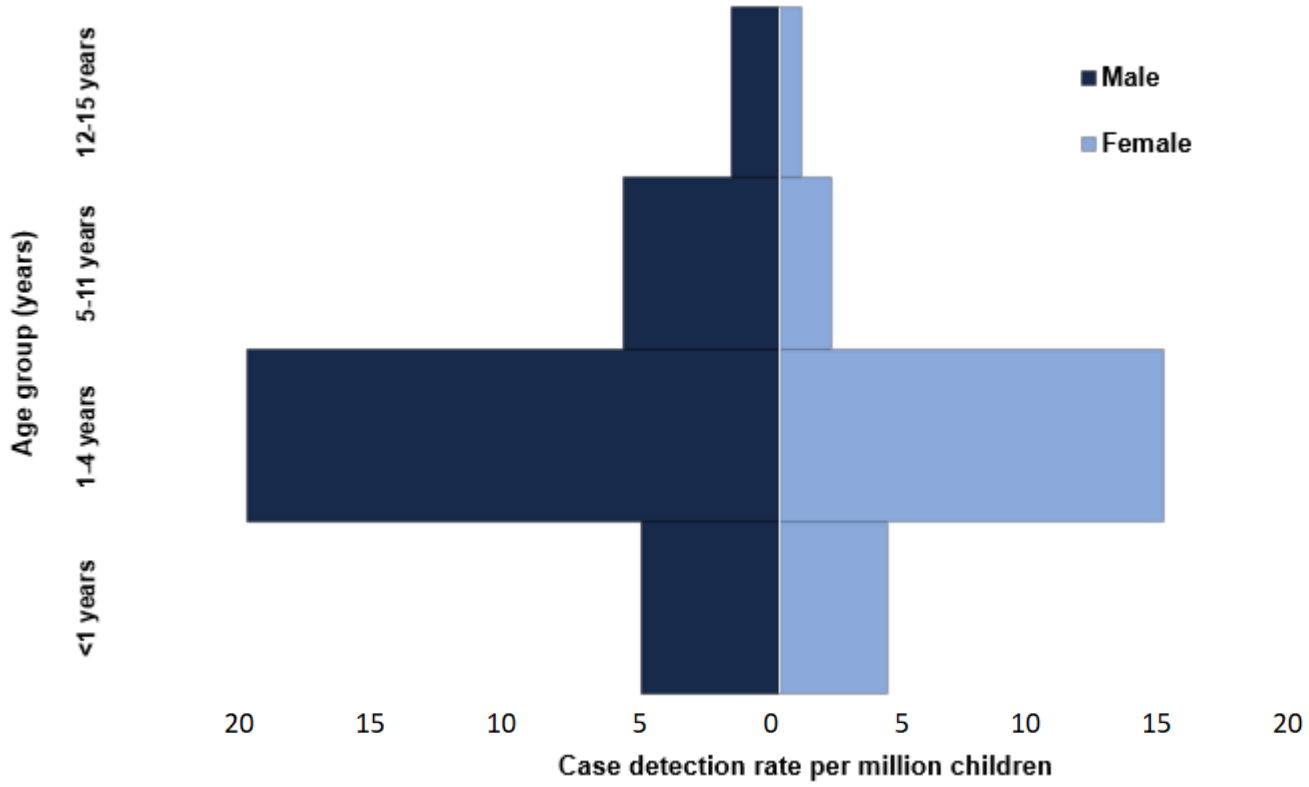
The high percentage of cases in pre-school age children may reflect a greater vulnerability to lead exposure due to mouthing behaviours, as ingestion of lead containing substances (particularly from deteriorating paint) is likely to be the predominant route of exposure in children (4). It is also possible that at this age-group developmental delay becomes the most obvious and autistic symptoms may become more clear which may lead to increased investigations for these children. For the adolescents, it is unknown what the common exposure sources are. They may be detected after exposure pathways other than pica are explored.

Table 5. Count and percentage of LEICSS cases by age group*, England, 2021, and 2015 to 2020

Age group*	Count of cases 2021 (%)	Count of cases 2015 to 2020 (%)
Under 1 year	3 (3)	11 (5)
1 to 4 years	88 (73)	137 (59)
5 to 11 years	24 (20)	73 (32)
12 to 15 years	6 (5)	10 (4)
Total	**121**	**231**

*Age of child at date of entry onto HPZone

Figure 4. Average case age-gender* specific detection rate† per million 0 to 15 year old children per year, England 2015 to 2021 (n=343 cases with gender and age data)

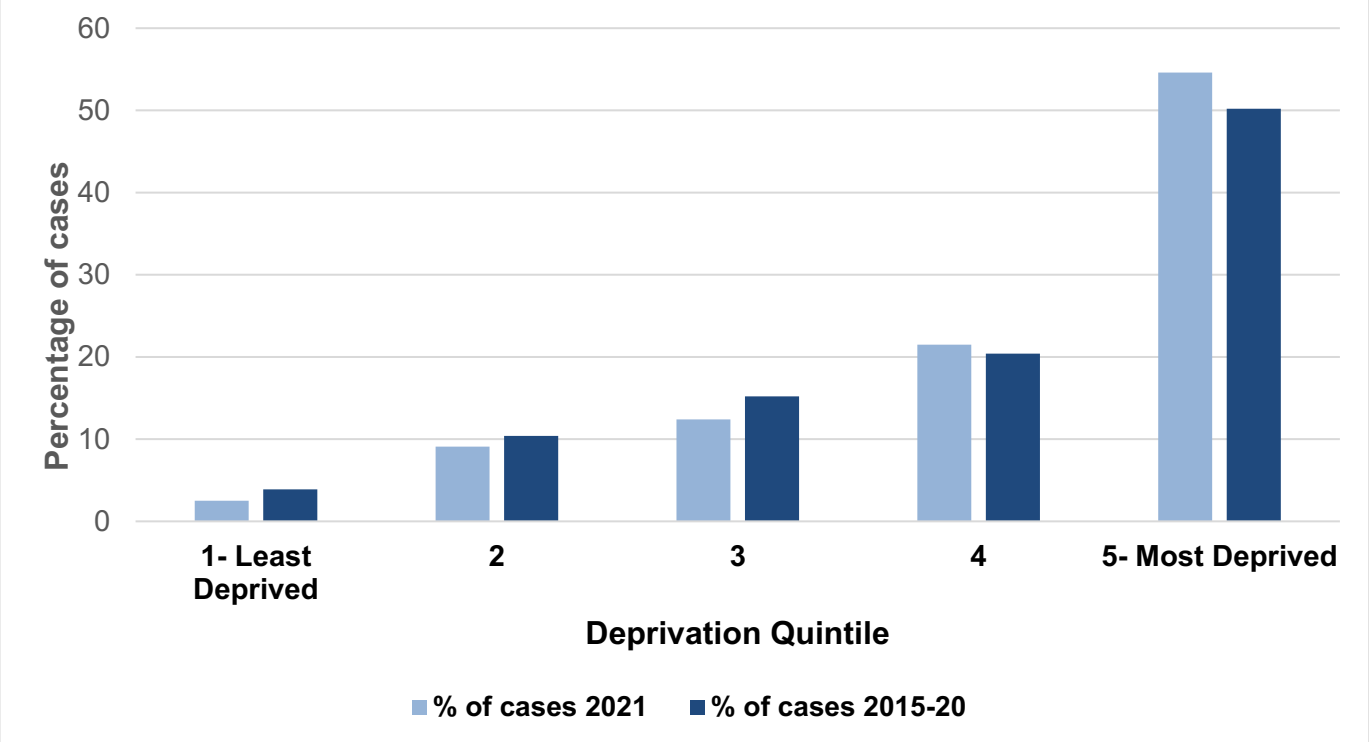


* Age of child at date of entry onto HPZone.
† The numerator for this indicator is the count of age-gender specific incident cases in 2015 to 2021, and the denominator is the summed mid-year estimate of the age-gender specific 0 to 15 year old population for 2019 multiplied by 4.

Percentage of cases by quintile of index of multiple deprivation (IMD) status

IMD provides a measure of deprivation, evaluated across 7 domains[6], measured at the area-level. Seventy-five per cent of cases in 2021 lived in areas in the 2 most deprived quintiles of IMD, slightly higher than the previous 5-year average (70%) (Figure 5). This is still higher than expected given that only 45% of the young English population reside in areas falling within these 2 quintiles[7]. More cases in 2021 lived in the most deprived areas (Q5) These observations are similar to patterns of lead exposure by socio-economic status in US national survey data (11), and may reflect greater exposure to lead containing hazards, a higher frequency of co-morbidities (for example, iron deficiency anaemia) or other factors pre-disposing to lead toxicity, and/or a greater tendency for clinician testing of children from deprived areas. If the association we can see is due to higher environmental risk factors in more deprived areas, this may disproportionately impact children of ethnic minority origin, as a higher percentage of ethnic minorities generally live in more deprived areas in the UK. However, due to poor ethnicity data reported in LEICSS data, this could not be investigated further (21).

Figure 5. Percentage of LEICSS cases in each quintile of index of multiple deprivation ¥, England 2021 and 2015 to 2020



¥ Index of multiple deprivation (IMD) assigned to the Lower-level Super Output Area of the cases' residential postcode, using IMD scores from 2019

[6] See English indices of deprivation 2019.
[7] Calculated using ONS mid-year estimate populations for England, assigned to deciles of IMD 2019.

Blood lead concentrations of laboratory-detected cases

The median blood lead concentration (BLC) in 2021 was 0.38 µmol/L (7.87 µg/dL), much lower than the 2015 to 2020 median (0.71 µmol/L (14.7 µg/dL)) (Table 6), this is as expected following the lowering of the case definition. Eighty-seven per cent (data not shown) of blood lead concentrations were <1.93µmol/L (<40 µg/dL) in 2015 to 2021, a concentration below which children would most likely be asymptomatic, or present with non-specific neuro-behavioural clinical manifestations (6), indicating these children were detected based on a high index of clinical suspicion.

Table 6. Blood lead concentration (µmol/L) of laboratory detected LEICSS cases, England, 2021, compared to 2015 to 2020.

Year	Lab-detected cases (total cases)	Minimum	Maximum	Median	Lower Quartile	Upper Quartile	Mean
2021*	86 (121)	0.10	4.49	0.38	0.29	0.70	0.66
Pre-case definition change	21 (31)	0.01	4.49	0.61	0.35	0.89	0.80
Post-case definition change	65 (90)	0.10	8.91	0.35	0.26	0.66	0.61
2015 to 2020	180 (231)	0.27	3.30	0.71	0.53	1.09	1.00

* Only children with a BLC≥0.48µmol/L were eligible for notification to LEICSS until 4 July 2021, there after those with a BLC≥0.24µmol/L were eligible for notification to LEICSS

Duration of case investigation

Of the cases where the investigation had been concluded by the time of data extraction for this report (92%, January 2022), the median duration of the investigation was 12 weeks in 2021, almost double that of 2020 (7 weeks) but similar to the median for 2015 to 2020 of 11 weeks (Table 7). Possible explanations include cases being delayed in the system as a consequence of the delays from the COVID-19 pandemic; further investigation would be required to determine the true cause.

Table 7. Duration, in weeks, of the public health investigation of LEICSS cases* reported to the surveillance system, England, 2021, and 2015 to 2020

Year	Closed cases (total cases) [%]	Median duration (weeks)* (LQ-UQ)
2021	110 (120) [92]	12 (2 to 22)
2015 to 2020	214 (231) [93]	11 (4 to 28)

* Period between date entered onto HP Zone and date case closed on HPZone; cases must have been closed at date of data extraction from HPZone in January 2022; LQ – Lower Quartile; UQ – Upper Quartile.

Children whose death was attributed to lead exposure

In the period of 2015 to 2021, one death of a child occurred (2015) partly or wholly attributed to lead exposure. This information is taken from data extracted from the UKHSA HPZone case management system to the LEICSS data set. Only deaths attributed partly or wholly to lead exposure are shown, and only in cases that meet the LEICSS case definitions. Case information was also corroborated with the investigating HPT. A case report has since been published, showing the death occurred in a two-year-old boy with pica and iron deficiency, who ingested lead-containing paint, resulting in acute lead toxicity (17). Lack of clinician awareness of the association between pica and lead exposure was cited as the root cause of the delayed diagnosis and subsequent death of the child (17). Historical data has shown deaths from lead exposure in children to be very infrequent in England (22).

System developments

Progress on developing surveillance of lead cases has continued in 2021. UKHSA's major efforts in health protection in 2020 to 2022 focused on responding to the COVID-19 global pandemic. We have continued to respond to cases reported to UKHSA, but developments in surveillance functions have been delayed as resources were reallocated to the pandemic response.

Public health intervention concentration for lead

The public health intervention concentration for lead has been lowered over time to reflect both the gradual decline in population exposure, and the changing knowledge that lead exposure in children is associated with toxicity at very low blood concentrations. We now know that lead exposure is associated with neuro-behavioural impairments at blood concentrations of 0.24µmol/L (5µg/dl) and even lower (6, 23). Lowering the intervention concentration for lead would follow international precedent set by recommendations in the USA (24, 25), Australia (26), Germany (27), France (28) and Wales (29), and would offer benefits of case management to more affected children and communities. An evaluation conducted by UKHSA in 2018 recommended that the public health intervention concentration for lead be lowered from ≥10µg/dL (≥0.48µmol/L) to ≥5µg/dL (≥0.24µmol/L) in England and should apply to children aged up to and including 15 years, and to pregnant women (for protection of the foetus). This recommendation is based on estimates in pre-school children who have the highest BLCs, to maximise the specificity to detect children most likely to benefit from public health action. The evaluation concluded that lowering the intervention concentration for lead to ≥5µg/dL (≥0.24µmol/L) would identify children with a BLC in the top 2% of the population range and would have a net positive impact on health inequalities. Analysis from UK SAS laboratories data estimated that lowering the intervention concentration for lead to ≥5µg/dL (≥0.24µmol/L) would result in a 2- to 3-fold increase in case notification to UKHSA in the short- to medium-term (there was a 3-fold increase in cases notifications from 2020 to 2021); representing a small absolute increase in the number of notifications to a single HPT. This now harmonises the public health invention concentration across England, Wales and Scotland. Children with BLC lower than the case definition reported to LEICSS and HPTs are still actively followed up with advice to parents and clinicians.

A working group was set up to coordinate communication of the new intervention concentration to stakeholders and updates to the lead action card, the SOP for HPTs, guidance for practitioners and clinicians, and LEICSS documentation. This documentation and guidance went live on 5 July 2021. An intervention concentration for lead of ≥10µg/dL (≥0.48µmol/L) for non-pregnant adults remains.

To reflect the multi-disciplinary nature of managing lead exposures, sources, interventions and clinical management, the governance of the UKHSA working group has been updated. The new

Lead Exposure Public Health Interventions and Surveillance (LEPHIS) Working Group now meets regularly to oversee co-ordination of surveillance, intervention work and health promotion campaigns.

Invitation of further laboratories to participate in surveillance

We continue to invite laboratories in the UK National External Quality Assessment Scheme for Trace Elements (which includes measurement of blood lead concentration) to participate in case reporting to LEICSS; Presentations to the Association of Clinical Biochemists (ACB) on the surveillance raises awareness of reporting by laboratories and has resulted in the recruitment of more laboratories participating in surveillance. These include Nottingham University NHS Trust, Bristol Southmead, Alder Hey, Royal Liverpool, Northern General (Sheffield), Birmingham Heartlands and the Doctors Laboratory (London). Other UKAS accredited laboratories testing for child BLC are also welcome to participate.

Contact ephss@ukhsa.gov.uk for more information.

Governance and procedures

Following implementation of a permanent surveillance system in 2015 and in accordance with the governance framework for other UKHSA surveillance systems, a data sharing agreement was introduced with participating laboratories and a new case notification form was issued in 2018. The data sharing agreement was updated in 2021 to ensure full compliance with data protection requirements and new UKHSA requirements. New procedures were also introduced to enter laboratory data onto HPZone and extract it for analysis which reduced the requirement to maintain a separate laboratory data set. Standard Operating Procedures for the surveillance continue to be updated.

Alerts for testing for blood lead

Introduction of an alert on the electronic test request system by Leeds SAS laboratory to encourage clinicians to consider testing for blood lead (for those children suspected of pica or iron deficiency) increased test requests by 90% since 2017. We supported laboratories to explore the feasibility of implementation of a similar model across the SAS laboratory network but unfortunately due to the diversity of information systems being used, a standardised alerting system is not feasible to implement.

Exposure assessment

Information on exposures in children with elevated BLC was in the past captured through a questionnaire completed by HPTs on paper or as an electronic document which was uploaded to HPZone. This questionnaire has been converted into an online survey format to help HPTs explore and scope exposure information and collect relevant information for initial case management and surveillance purposes. The new online questionnaire went live at the same time as the public health intervention concentration was lowered. This information will enable us to scrutinise exposure sources for surveillance purposes (15).

UKHSA's Environmental Public Health Surveillance System

The Environmental Public Health Surveillance System (EPHSS) collates and integrates data from selected databases on environmental hazard, exposures and health outcome data; further details are provided on the UKHSA web page Environmental public health surveillance system. A lead exposure in children module incorporated into EPHSS allows for anonymous aggregated LEICSS data to be interrogated and analysed, producing user defined outputs for surveillance reporting purposes. Currently, the EPHSS platform is available to UKHSA staff, but will shortly become accessible to external users. 2021 case data has recently been uploaded into EPHSS so users can pull reports on data from 2014 to 2021 inclusive.

To find out more about gaining access to LEICSS outputs via EPHSS, email: ephss@ukhsa.gov.uk.

Current and future activities

1. The LEPHIS Steering Group was surveyed to identify the priorities for lead exposure research and practice in 2021. Topics identified included:

- prevalence study of lead levels in population*
- exposure assessment for lead exposure cases*
- survey of blood lead concentrations in samples*
- interventions impact review*
- developing case management advice
- awareness raising activities
- prioritising lead research and surveillance
- lead surveillance resourcing
- supporting labs with development of lead testing and awareness
- long-term prevention strategies

To focus work and create a series of working groups, the steering group were asked to prioritise these topics. As a result, the 4 topics marked with * above were prioritised. As a result, a separate group have worked on planning a prevalence study of blood lead concentrations in children in England. This Elevated Childhood Lead Prevalence Study (ECLIPS) is working on defining a protocol for taking blood from a representative sample of children, and are seeking funding to conduct the study.

2. The SAS laboratory network, clinicians and health protection practitioners requested further guidance on repeat testing of BLC in children who are already under investigation for elevated blood lead concentrations. We worked with the National Poisons Information Service (NPIS) to develop additional guidance documents aimed at supporting the management of children with lead exposure. These updated documents form part of a suite of documents and standardised letters available to practitioners as part of the duty doctors pack. A new publication (30), gives a summary of this guidance.

3. The Environmental Epidemiology Group at RCE are working to produce hazard maps for soil lead concentration, housing age and index of multiple deprivation to develop a lead exposure model. The first research output from this project is detailed in the publications section below.

4. UKHSA were approached by the UK National Screening Committee in 2021 to comment on the preparations for an evidence review to support their review of the need for a screening programme for lead in children. Comments on the proposal were provided by members of the LEICSS Steering and Working groups. It was noted that prevalence studies such as ECLIPS would provide up-to-date data on the prevalence of elevated lead in children in England and hence be of value for the NSC review.

5. A collaboration with academics from University of Oxford and University of Warwick is ongoing, working on mapping disparities in lead exposure in children. UKHSA is supporting the research by sharing risk factor information on cases captured through surveillance.

6. UKHSA were approached by the Ministry of Justice to discuss the issue of environmental lead exposure and its association with crime, as identified in a number of research studies (31 to 35). UKHSA recognises the importance of these findings and will discuss the possibility of further work in this area with the LEICSS Steering Group.

7. A national audit of lead cases is being completed to explore sources of lead explore and treatment outcomes. The findings of this audit will be presented to stakeholders and a summary reported in the next annual report.

8. UKHSA is working with the Georgian National Centre for Disease Control on a research project to identify sources of lead exposure in children. Lead isotope analysis is being used to match blood lead and environmental lead in spices, food, milk, water, soil, dust and toys as part of a national prevalence study. The study has so far identified spices to be a significant source of lead ingestion and a significant decline after intervention (36, 37). Further work is in progress.

LEICSS outputs

The following outputs have been produced in relation to LEICSS, LEPHIS and its precursors since 2014.

Publications

Crabbe H, Verlander NQ, Iqbal N, Close R, White G, Leonardi GS, Busby A. As safe as houses: the risk of childhood lead exposure from housing in England and implications for public health BioMed Central Public Health 2022: volume 22, article 2052

Laycock A, Chenery S, Marchant E, Crabbe H, Saei A, Ruadze and others. The Use of Pb Isotope Ratios to Determine Environmental Sources of High Blood Pb Concentrations in Children: A Feasibility Study in Georgia. International Journal of Environmental Research and Public Health 2022: volume 19, number 22

Pye, T. Preventing lead exposure in the population (letter) British Medical Journal 2022

Roberts DJ, Bradberry SM, Butcher F, Busby A. Lead exposure in children British Medical Journal 2022

Emond, A. Lead poisoning cannot be consigned to history books yet: new guidance to help us reach that goal Archives of Disease in Childhood 2022: volume 107, pages 313 to 314

Ruadze E, Leonardi GS, Saei A, Khonelidze I, Sturua L, Getia V and others. Reduction in Blood Lead Concentration in Children across the Republic of Georgia following Interventions to Address Widespread Exceedance of Reference Value in 2019. International Journal of Environmental Research and Public Health 2021

Lead Exposure in Children Surveillance System (LEICSS) Annual Report, 2021. Summary of 2020 data Health Protection Report: volume 15, number 17, 26 October 2021

Evaluation of whether to lower the public health intervention concentration for lead exposure in children Public Health England Report, July 2021

Lead Exposure in Children Surveillance System (LEICSS) Annual Report, 2019 Health Protection Report: volume 15, number 5, 9 March 2021

Roberts DJ, Crabbe H, Owodunni T, Gordon-Brown H, Close R, Reshat S and others Case epidemiology from the first three years of a pilot laboratory-based surveillance system for elevated blood lead concentrations among children in England, 2014-17: implications for public health action and surveillance Journal of Public Health 2019

Lead Exposure in Children Surveillance System (LEICSS) Annual Report, 2018 Health Protection Report: volume 14, number 1, 3 January 2020

Lead Exposure in Children Surveillance System (LEICSS) Annual Report, 2017 Health Protection Report: volume 12, number 39, 2 November 2018

Thomas E, Close R, Ruggles R. Surveillance of Elevated Blood Lead in Children (SLiC) – a British Paediatric Surveillance Unit analysis 2018

Crabbe H, Dabrera G, Close R, Morris J, Keshishian C, Leonardi G, Ruggles R. Lead poisoning in children; evaluation of a pilot surveillance system in England, 2014 to 2015 Abstracts of the 2016 International Society of Environmental Epidemiology (ISEE). Environmental Health Perspectives

'Evaluation of the Pilot Laboratory Based Surveillance of Lead Poisoning in Children in England 2014-2015' Crabbe H, Ruggles R, Dabrera G, Close R, Morris J, Leonardi G. Public Health England Report, September 2016

Dabrera G, Sampson B, Ruggles R, Leonardi G. 'Investigating lead poisoning in children – could surveillance help?' QJM: An International Journal of Medicine 2015: volume 108, number 11, page 849

Presentations

Crabbe, H, Verlander NQ, Iqbal N, Close R, White G, Leonardi GS, Busby A. 'As safe as houses; the risk of childhood lead exposure from housing in England and implications for public health' Poster presentation at International Society of Environmental Epidemiology Conference, September 2022, Athens, Greece

Iqbal N, Crabbe H, White G, Close R, Leonardi GS, Busby A. 'Lead exposure reporting in England, 2015-2020' 15th Annual UK and Ireland Occupational and Environmental Epidemiology Conference, April 2022

Crabbe, H. 'Paediatric blood lead surveillance. Lead Exposure in Children Surveillance System-update 2021' Association for Clinical Biochemistry and Laboratory Medicine (ACB) regional meeting, Birmingham, December 2021

Dack S. 'Lead. Still here… still causing health problems' Construction Industry Research and Information Association (CIRIA) Virtual Conference: Dealing with persistent and emerging land contaminants, November 2021

Iqbal N, Crabbe H, Verlander N, White G, Close R, Owodunni T, Leonardi GS, Busby A. ‘Disparities in childhood lead exposure cases in England 2015-19’ Public Health England Research and Science Conference, May 2021

Marchant E, Crabbe H, Saei A, Marczylo T, Watts M, Ruadze E, Khonelidze I, Sepai O, Fletcher T, Leonardi GS. ‘Protocol for a national survey on key sources of lead (Pb) exposure among children’ UK and Ireland Occupational and Environmental Epidemiology Conference, Bristol, March 2020

Hodgson S, Wei G, Crabbe H, Roberts D, Leonardi G, Busby A. ‘Creating a lead hazard map to support public health action in England’ Public Health England Research and Science Conference, University of Warwick, 20 to 21 March 2018

Roberts D, Crabbe H, Busby A, Reshat S, Owodunni T, Gordon-Brown T and others. *‘*Case epidemiology from the first 3 years of laboratory-based surveillance of children with elevated blood-lead concentrations in England, 2014-17’ Public Health England Research and Science Conference, University of Warwick, 20 to 21 March 2018

Roberts D. ‘Development of an Environmental Public Health Surveillance System: surveillance of lead poisoning in children’ National Poisons Information Service CPD event, Cardiff, March 2017

Roberts DJ, Crabbe H, Leonardi G, Close R , Owodunni T, Reshat S, Busby A. ‘Lead poisoning in children; overcoming challenges to develop a surveillance system for case management and population health’ Public Health England Public Health Research and Science Conference, University of Warwick, March 2017

Crabbe H, Dabrera G, Close R, Morris J, Keshishian C, Leonardi G, Ruggles R. ‘Lead poisoning in children; evaluation of a pilot surveillance system in England, 2014-15’ International Society of Environmental Epidemiology (ISEE) conference, Rome, August 2016

Crabbe H. ‘Lead poisoning in children; evaluation of a pilot surveillance system in England, 2014-15’ US Centers for Disease Control and Prevention summit ‘CHARTing the Course’ Atlanta, January 2016

Appendix 1: Procedures for reporting of lead exposure cases to UKHSA

For adult cases with a BLC of ≥0.48µmol/L (equivalent to ≥10µg/dl), contact the local HPT of the case. Find your local HPT in England by entering the cases postcode.

For pregnant women with a BLC of ≥0.24µmol/L (equivalent to ≥5µg/dl), contact the local HPT of the case. Find your local HPT in England by entering the cases postcode.

For children aged under 16 years old at the time of first elevated BLC, please report cases to the LEICSS, using lpic@nhs.net

Appendix 2: Sources of lead exposure in children, children at most risk of exposure and presentations of lead exposure in children

Important sources of lead exposure in children are:

- deteriorating leaded paint (particularly houses built prior to early 1970s)
- herbal medicinal preparations
- consumer products (if unregulated) – medicines, food, spices, ceramic cookware, toys, make-up, jewellery, glasses, brass taps and fittings
- parental hobbies or occupations (including dust on clothing)
- lead water pipes and lead from drinking water pipe fittings (namely, solder) (particularly houses built prior to early 1970s)
- contaminated soil or land

Children at most risk of lead exposure are children:

- with pica or increased hand to mouth behaviour (for example children with autism or global developmental delay), particularly with iron deficiency
- who have recently migrated from countries with less regulation to prevent lead exposure
- living in older homes and attending older schools containing leaded paint
- living in more urban or industrial environments

Presentations of lead exposure in children are:

- acute exposure resulting in high BLC – anorexia, abdominal pain, constipation, irritability and reduced concentration, encephalopathy
- chronic exposure
- lower BLCs
- mild cognitive and behavioural impairments, may contribute to global developmental delay, decreased academic achievement, IQ, and specific cognitive measures (S); increased incidence of attention-related behaviours and problem behaviours (S), and delayed puberty and decreased kidney function in children ≥12 years of age (L)
- higher BLCs – reduced appetite, abdominal pain, constipation, anaemia, delayed puberty, reduced postnatal growth, decreased IQ, and decreased hearing (S); and increased hypersensitivity or allergy by skin prick test to allergens and increased IgE (L)

Where (S) = sufficient evidence and (L) = limited evidence

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Resources

UKHSA's Environmental Public Health Surveillance System

The Environmental Public Health Surveillance System (EPHSS) collates and integrates data from selected databases on environmental hazard, exposures and health outcome data. Further details are provided on the EPHSS webpages. A lead exposure in children module incorporated into EPHSS allows for anonymous aggregated LEICSS data to be interrogated and analysed, producing user defined outputs for surveillance reporting purposes. 2021 case data has recently been added to EPHSS. Currently, the EPHSS platform is available to UKHSA staff, but will shortly become accessible to external users.

To stay updated with the work of UKHSA's Environmental Public Health Tracking (EPHT) group and EPHSS, email epht@ukhsa.gov.uk. To find out more about gaining access to LEICSS outputs via EPHSS, email ephss@ukhsa.gov.uk.

The LEICSS working group, with The British Paediatric Surveillance Unit (BPSU) and Royal College of Paediatrics and Child Health planned and presented a webinar on lead as part of their series on rare diseases (to raise awareness of LEICSS amongst clinicians). The details of this are listed in the presentations section above.

Further UKHSA resources for the public health management of cases of lead exposure

- Lead pages in the UKHSA chemicals compendium
- Lead Exposure in Children Surveillance System: Surveillance Reports
- Evaluation of whether to lower the public health intervention concentration for lead exposure in children
- Duty Doctors Pack – containing Lead Action Card, SOPs and standardised letters and advice (available to UKHSA staff only at present, updated resources following lowering of intervention level)

Resources for clinicians

Clinicians with clinical lead exposure queries should consult TOXBASE or contact the National Poisons Information Service.

Contacts

- to notify cases (participating laboratories only): ukhsa.leicss@nhs.net
- general enquiries: epht@ukhsa.gov.uk
- lead surveillance module in UKHSA's Environmental Public Health Surveillance System: ephss@ukhsa.gov.uk
- to notify cases directly to an HPT in England, identify the relevant HPT by entering the residential postcode of the case into the Find your local HPT in England tool

Steering and working group members

LEICSS surveillance team

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Kerry Foxall Ovnair Sepai	UKHSA, Toxicology
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Paul Davidson	UKHSA, Health Protection

LEPHIS steering group

As the working group (above) plus the following members:

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Darren Bagheri	UKHSA, Environmental Epidemiology
Eirian Thomas	UKHSA, Chemicals and Poisons
Rahul Gupta	UKHSA, Software Development Unit
Jack Gordon-Brown	UKHSA, Communications
Geoffrey Mullings	UKHSA, CIMS
Alan Emond	University of Bristol/British Paediatric Surveillance Unit
Louise Ander	British Geological Survey
Sally Bradberry	National Poisons Information Service, City Hospital, Birmingham
Kishor Raja Carys Lippiatt	Supra-regional Assay Service Trace Elements laboratories
Andrew Kibble	Public Health Wales
Tim Pye	Lead Exposure and Poisoning Prevention (LEAPP) Alliance

Acknowledgement to laboratories

NHS Supra-regional Assay Services Trace Elements laboratories:

- Birmingham
- Leeds
- Southampton
- Guildford
- London Charing Cross
- London Kings College

Other laboratories notifying cases included in this report:

- the Doctors' Laboratory, London
- Cardiff Toxicology Laboratories
- Southmead Hospital, Bristol
- Alder Hey Children's Hospital, Liverpool
- Royal Liverpool University Hospital
- Northern General Hospital, Sheffield
- Birmingham Heartlands Hospital
- Nottingham University NHS Trust Hospital

About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

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