

Eliminating Disparities in Children's Lead Exposure: An Unfinished Job

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Objectives. To examine trends in blood lead levels (BLLs) among US children aged 5 years or younger using national and state data.

Methods. We analyzed 2011 to 2023 National Health and Nutrition Examination Survey (NHANES) data by year and available demographic characteristics. We report geometric means, the prevalence of BLLs of 3.5 micrograms per deciliter or above and 5.0 micrograms per deciliter or above, and linear trends. In addition, we summarize 2017 to 2023 surveillance data from 7 states.

Results. National BLLs continue to decline. In 2021 to 2023, geometric mean BLLs and the prevalence of BLLs of 3.5 micrograms per deciliter or above were lower for all groups than in previous years. Small recent NHANES sample sizes and limited state-level subgroup data constrained detailed analyses. However, state-level data revealed disparities by geography, race, and ethnicity.

Conclusions. National data indicate decreasing BLLs among children and elimination of racial disparities, but state and local BLL data unmask ongoing disparities.

Public Health Implications. To better describe childhood lead exposures, NHANES should increase its sample size, oversample high-risk populations, and release timely data, and states should expand surveillance and risk factors and make data publicly available. Together, the data assessed here provide benchmarks to target prevention efforts and warn of emerging risks. (*Am J Public Health.* Published online ahead of print June 11, 2026:e1–e9. <https://doi.org/10.2105/AJPH.2026.308468>)

For nearly 50 years, the National Health and Nutrition Examination Survey (NHANES) has supplied public and clinical health care providers, government agencies, parents, child health advocates, and policymakers with information about blood lead levels (BLLs) among children. This information is the cornerstone for reducing BLLs among children and, particularly, for sharply decreasing the disproportionate impact of elevated BLLs in high-risk groups according to race, family income, and degree of urbanization. We now know, however, that even very low exposures to lead can

have significant neurodevelopmental effects, underscoring the impact of prevention efforts and the importance of their continuation.¹

Significant progress has been made to reduce BLLs among children in the United States. In the second NHANES cycle (1976–1980), an alarming 50% of children 1 to 5 years old were estimated to have BLLs of 15 micrograms per deciliter ($\mu\text{g}/\text{dL}$) or higher, and nearly all children had levels of 3.5 $\mu\text{g}/\text{dL}$ or higher, the Centers for Disease Control and Prevention (CDC) current upper reference value for BLLs.² Almost

30 years later, in the 2011 to 2016 NHANES cycle, the geometric mean (GM) BLL for children was 0.8 $\mu\text{g}/\text{dL}$.

Until recently, NHANES revealed persistent racial, ethnic, and socioeconomic disparities in BLLs. In 1976 to 1980, the geometric mean BLL for Black children was 21 $\mu\text{g}/\text{dL}$, as compared with 15 $\mu\text{g}/\text{dL}$ for White children. There was also a startling disparity in BLLs at higher concentrations, with 50% of Black children having BLLs of 20 $\mu\text{g}/\text{dL}$ or higher, in comparison with 37% of White children.³ Children from low-income families (less than \$6000 annually at the time)

were 9 times more likely than children from high-income families (more than \$15 000 annually) to have blood lead concentrations greater than 30 $\mu\text{g}/\text{dL}$. Each subsequent NHANES wave revealed the persistence of racial, ethnic, and income disparities, even as BLLs overall decreased.

These surveys demonstrate that risks and effects of lead exposure are not shared equally among children. The long history of structural racism in this country has placed racial/ethnic minority, foreign-born, and low socioeconomic subgroups of children at higher risk for lead poisoning. These groups often have more limited access to quality housing options and live in older houses and apartments with greater lead hazards.

Despite its utility at the national level, NHANES is not designed to provide estimates of BLLs at the state or local level. Since its inception, the CDC has funded more than 60 state and local childhood lead poisoning prevention programs. These programs generally test more children in different population subgroups than does NHANES, including more children receiving federal or state assistance such as Medicaid. State and local surveillance data have greater statistical power to provide granular-level information and detect important disparities that can be masked by national estimates. These data are used by state and local clinical and public health providers to direct resources to children and communities disparately affected by lead exposure. They have also provided evidence of emerging lead sources and high-risk subpopulations.

Our objective in this study was to examine BLL trends among US children aged 5 years or younger using both national and state data to assess whether

and to what extent disparities persist. We present available BLL data for children in the most recent NHANES cycle (2021–2023) and compare estimates with previous data cycles between 2011 and 2016. We also provide estimates of BLL data collected at the state or local level to identify persisting disparities in risk of lead exposure across sociodemographic groups that require further clinical and policy attention.

METHODS

The National Center for Health Statistics (NCHS) conducts the NHANES, measuring health and nutrition in a representative sample of the US noninstitutionalized civilian population 3 months and older via a multistage probability design. The study design and methods have been described elsewhere.⁴

We analyzed publicly available NHANES BLL data for children aged 5 years or younger from 2011–2012, 2013–2014, 2015–2016, and August 2021 to August 2023.⁵ NHANES did not release 2017–2018 BLL data for children aged 5 years or younger publicly because of privacy concerns and did not collect BLL data beyond March 2020 for the 2019–2020 cycle as a result of the COVID-19 pandemic.⁶ Combined 2017 to March 2020 BLL data are also not publicly available because of privacy concerns. BLL data sample sizes for children aged 5 years or younger ranged from 713 to 818 during the 2011–2016 survey cycles but decreased to 301 in the 2021–2023 cycle. The limit of detection for BLLs has improved over time (2011–2012: 0.25 $\mu\text{g}/\text{L}$; 2013–2016: 0.07 $\mu\text{g}/\text{L}$; 2021–2023: 0.049 $\mu\text{g}/\text{L}$). In the case of BLLs below the limit of detection (less than 1.0% of the sample), we imputed

values by dividing the limit by the square root of 2 for each survey cycle.⁷

We included data from the CDC Childhood Blood Lead Surveillance System on the number of children screened and the number with BLL levels above clinically important thresholds (5–9, 10–14, 15–19, 20–24, 25–44, ≥ 5 , ≥ 10 , and ≥ 45 $\mu\text{g}/\text{dL}$) from 2017 to 2021.

Finally, we collected information on the percentage of children with BLLs of 3.5 $\mu\text{g}/\text{dL}$ or higher or 5 $\mu\text{g}/\text{dL}$ by race and ethnicity from a convenience sample of 7 states that provided these data. This allowed us to determine whether important disparities not seen in the NHANES national-level sample are apparent at the state or local level. These state programs target children enrolled in Medicaid and can stratify data by race, ethnicity, housing age, and community income. When these data were reported, most states still used 5 $\mu\text{g}/\text{dL}$ as the threshold for elevated BLLs. However, the current CDC BLL action value for children, revised in 2021, is 3.5 $\mu\text{g}/\text{dL}$. Some states have adopted the new value.

For NHANES analyses, we log transformed BLLs and conducted descriptive analyses in RStudio version 1.3.9 (RStudio Team; R Foundation for Statistical Computing, Vienna, Austria) with base R version 4.0.2 (R Core Team) using the survey package to account for the NHANES nonrandom sampling design and sample population weights. We applied the NHANES Mobile Examination Center blood metal 2-year weights for each survey wave and calculated the weighted geometric means for BLLs in each survey wave, overall and by the major sociodemographic characteristics of gender, race and ethnicity (Mexican American, other Hispanic, White non-Hispanic, Black

non-Hispanic, Asian non-Hispanic, another race, or multiracial non-Hispanic), nativity status (US born, foreign born), and household poverty income ratio (<0.5, 0.5–0.99, 1.0–1.9, ≥2.0). The latter was used as a proxy for socioeconomic status, with a poverty income ratio below 1.0 indicating a household income less than or equal to the federal poverty level.

We also estimated the percentage of children aged 5 years or younger who were above the BLL thresholds of 3.5 and 5.0 $\mu\text{g}/\text{dL}$. Variance was estimated via Taylor series linearization with 62 degrees of freedom. We constructed 95% Wald confidence intervals for continuous BLLs and applied a logit transformation for the proportion of BLLs of 3.5 $\mu\text{g}/\text{dL}$ or above and 5.0 $\mu\text{g}/\text{dL}$ or above. In addition, we conducted a linear trend test to assess whether BLLs changed significantly across survey years, overall and for each sociodemographic subgroup, with the 2-sided *P* value set at .05. Geometric mean estimates for groups with sample sizes below 30 were considered unreliable and are not presented.

For state-level data, we present descriptive data across states and years and by available sociodemographic characteristics.

RESULTS

Overall, the BLL geometric mean declined between 2011 and 2023 for the available NHANES years (*P* trend < .001). In the most recent survey cycle (2021–2023), only 1.9% of sampled children had BLLs above 3.5 $\mu\text{g}/\text{dL}$ and no children in the NHANES sample had BLLs of 5.0 $\mu\text{g}/\text{dL}$ or higher. Almost all groups exhibited this decline. Black non-Hispanic children showed the greatest decline, with the geometric mean

decreasing from 1.29 $\mu\text{g}/\text{dL}$ in 2011–2012 to 0.58 $\mu\text{g}/\text{dL}$ in 2021–2023 (*P* trend < .001). As was true in the 2015–2016 cycle, the geometric mean for Black children (as compared with White children) in the 2021–2023 cycle was no longer statistically significant (Black non-Hispanic GM = 0.58 $\mu\text{g}/\text{dL}$; 95% confidence interval [CI] = 0.50, 0.68; White non-Hispanic GM = 0.51 $\mu\text{g}/\text{dL}$; 95% CI = 0.44, 0.59). Differences in geometric mean BLLs by household poverty income ratio also decreased across time, and there were no statistically significant differences in geometric means by sex (Table 1).^{8–14}

Notable limitations in recent NHANES data should be addressed. The 2021–2023 NHANES BLL data for children 1 to 5 years old were based on a much smaller sample size (*n* = 301) than in previous years, allowing only limited subgroup analyses. BLL data for children 0 to 5 years old were not publicly released in the 2017–2018 survey and they combined 2017 to March 2020 as a result of privacy concerns and in 2019–2020 because of COVID-19. Therefore, these data were not included.

State-Based Data

The Childhood Blood Lead Surveillance System collects BLL data from state and local childhood lead poisoning prevention programs. Between 2017 and 2021, 30 states reported data for all or some years. More than 15 million children younger than 72 months were screened for BLLs. Among those screened, 152 571 children had BLLs of 5 to 9 $\mu\text{g}/\text{dL}$, and 57 496 had levels of 10 $\mu\text{g}/\text{dL}$ or higher. Although no children with BLLs of 5 $\mu\text{g}/\text{dL}$ or above were reported in the 2021–2023 NHANES national sample, the Childhood

Blood Lead Surveillance System data indicate that 32 144 children with BLLs of 5 $\mu\text{g}/\text{dL}$ or above were reported in 2021 alone, including a distressing 186 children with BLLs of 45 $\mu\text{g}/\text{dL}$ or higher (Table 2).

The higher prevalence of elevated BLLs among 1- to 5-year-old Black versus White children remained consistent between 2012 and 2018 in up to 44 states reporting these data, with prevalence ratios ranging from 1.23 to 1.80 per 1% increase in Black children in the state. An assessment of 7 states' lead monitoring data indicated that minority children had higher percentages of elevated BLLs in most states (Table 3).

Community socioeconomic status also affected risk of lead exposure in states. In 2022, the prevalence of Massachusetts children with BLLs of 5 $\mu\text{g}/\text{dL}$ or higher was 3.6 times greater in communities with the highest percentages of families at 200% or less of the federal poverty threshold than in communities with incomes in the highest quartile (19.5 per 1000 children vs 5.4 per 1000 children). There was no substantial reduction in the prevalence of elevated BLLs in low-income communities between 2020 and 2024. In 2021 in Illinois, 2.4% of children receiving Medicaid benefits had BLLs of 5 $\mu\text{g}/\text{dL}$ or higher, as compared with 1.2% among children not receiving Medicaid. In US zip codes considered to be "high risk" according to housing data and the percentage of families living at or below the federal poverty threshold, the prevalence of BLLs of 5 $\mu\text{g}/\text{dL}$ or higher was nearly twice that among children in low-risk zip codes (3.1% vs 1.6%; data not shown).¹⁵

Few states compared the percentages of children in rural and urban communities with BLLs of 5 $\mu\text{g}/\text{dL}$ or higher. In

TABLE 1— Weighted Geometric Means and Percentiles of Blood Lead Levels (μg/dL) Among Children Aged 5 Years or Younger in the United States Overall and by Factors Known to Predict High Levels: NHANES 2011–2012, 2013–2014, 2015–2016, and 2021–2023

	2011–2012			2013–2014			2015–2016			August 2021–August 2023		
	No.	GM (95% CI) or % (95% CI)	No.	GM (95% CI) or % (95% CI)	No.	GM (95% CI) or % (95% CI)	No.	GM (95% CI) or % (95% CI)	No.	GM (95% CI) or % (95% CI)	No.	GM (95% CI) or % (95% CI)
Overall BLL	713	0.97 (0.88, 1.06)	818	0.78 (0.71, 0.86)	790	0.76 (0.68, 0.84)	301	0.53 (0.47, 0.58)				
Prevalence ≥ BLL 3.5	26	3.60 (1.69, 7.50)	11	1.35 (0.62, 2.87)	24	3.06 (0.29, 7.12)	6	1.85 (–0.44, 7.44)				
Prevalence ≥ BLL 5.0	14	1.95 (0.72 5.21)	4	0.52 (–0.16, 1.74)	11	1.35 (0.44, 4.02)	0	0.00 (0.00, 0.00)				
BLL by child sex												
Male	368	1.02 (0.90, 1.16)	431	0.81 (0.76, 0.88)	414	0.77 (0.69, 0.86)	156	0.53 (0.46, 0.61)				
Female	345	0.91 (0.84, 0.99)	387	0.75 (0.66, 0.85)	376	0.75 (0.66, 0.84)	145	0.52 (0.44, 0.61)				
BLL by child race and ethnicity												
Black non-Hispanic	238	1.29 (1.11, 1.50)	182	0.98 (0.85, 1.13)	188	0.93 (0.82, 1.06)	51	0.58 (0.50, 0.68)				
Mexican American	157	0.91 (0.78, 1.05)	194	0.74 (0.66, 0.83)	175	0.71 (0.64, 0.79)	<30	N/A				
White non-Hispanic	119	0.92 (0.77, 1.12)	218	0.72 (0.66, 0.79)	226	0.75 (0.61, 0.92)	128	0.51 (0.44, 0.59)				
Asian non-Hispanic	60	0.81 (0.71, 0.91)	58	0.83 (0.67, 1.04)	40	0.85 (0.66, 1.09)	<30	N/A				
Other Hispanic/Latinx	99	0.87 (0.72, 1.04)	96	0.87 (0.74, 1.04)	92	0.64 (0.52, 0.78)	49	0.49 (0.46, 0.53)				
Another race or multiracial	40	0.96 (0.79, 1.17)	70	0.87 (0.67, 1.14)	69	0.76 (0.66, 0.88)	35	0.57 (0.51, 0.64)				
BLL by child nativity status												
US born	696	0.97 (0.88, 1.07)	794	0.78 (0.71, 0.86)	762	0.76 (0.678, 0.84)	291	0.51 (0.47, 0.55)				
Foreign born/other	<30	N/A	<30	N/A	<30	N/A	<30	N/A				
BLL by poverty income ratio												
≥2.0	175	0.75 (0.65, 0.87)	240	0.67 (0.61, 0.73)	251	0.65 (0.59, 0.73)	134	0.50 (0.44, 0.57)				
1.0–1.9	201	0.96 (0.88, 1.06)	205	0.75 (0.63, 0.90)	194	0.78 (0.62, 0.99)	67	0.50 (0.41, 0.62)				
0.50–0.99	161	1.10 (0.99, 1.23)	188	0.84 (0.73, 0.97)	157	0.81 (0.72, 0.91)	48	0.58 (0.47, 0.72)				
<0.50	129	1.43 (1.13, 1.81)	130	1.14 (0.98, 1.34)	115	1.05 (0.93, 1.19)	<30	N/A				
Missing	47	1.09 (0.82, 1.45)	55	0.89 (0.73, 1.08)	73	0.84 (0.67, 1.05)	<30	N/A				

Note. BLL = blood lead level; CI = confidence interval; GM = geometric mean; NHANES = National Health and Nutrition Examination Survey. NHANES BLL data for children were not publicly available from 2017 to 2020. The age range included 0.1 to 5.4 years. Linear trend tests assessed the monotonic relationship between ordinal year category and the specified BLL outcome. N/A refers to subgroup sample sizes of less than 30 participants, indicating unreliable estimates.

TABLE 2— Number and Percentage of Children Aged 5 Years or Younger With Blood Lead Data Reported to the US National Childhood Blood Lead Surveillance System by Year

	2017 (n = 23 940 178), No. (% of Population) or No. (% of Children Screened)	2018 (n = 23 820 393), No. (% of Population) or No. (% of Children Screened)	2019 (n = 23 604 964), No. (% of Population) or No. (% of Children Screened)	2020 (n = 23 355 628), No. (% of Population) or No. (% of Children Screened)	2021 (n = 23 355 628), No. (% of Population) or No. (% of Children Screened)	Total (n = 118 076 791), No. (% of Population) or No. (% of Children Screened)
Children aged ≤5 y screened for blood lead level ^a	3 145 999 (13.14)	3 531 027 (14.82)	3 451 050 (14.62)	2 466 943 (10.56)	2 559 077 (10.96)	15 154 096 (12.83)
Blood lead level, $\mu\text{g/dL}$						
≥5	54 753 (1.7)	50 747 (1.40)	44 091 (1.30)	28 332 (1.10)	32 144 (1.30)	210 067 (1.39)
≥10	14 793 (0.50)	13 924 (0.40)	12 181 (0.40)	7 991 (0.30)	8 607 (0.30)	57 496 (0.38)
5–9	39 960 (1.27)	36 823 (1.04)	31 910 (0.92)	20 341 (0.82)	23 537 (0.92)	152 571 (1.01)
10–14	8 572 (0.27)	8 109 (0.23)	6 903 (0.2)	4 574 (0.19)	4 898 (0.19)	33 056 (0.22)
15–19	3 036 (0.1)	2 848 (0.08)	2 505 (0.07)	1 708 (0.07)	1 749 (0.07)	11 846 (0.08)
20–24	1 437 (0.05)	1 304 (0.04)	1 198 (0.03)	741 (0.03)	873 (0.03)	5 553 (0.04)
25–44	1 515 (0.05)	1 410 (0.04)	1 299 (0.04)	809 (0.03)	901 (0.04)	5 934 (0.04)
≥45	233 (0.01)	253 (0.01)	276 (0.01)	159 (0.01)	186 (0.01)	1 107 (0.01)

Note. The blood lead levels reported are based on confirmed data. The total population is based on US Census estimates of the population younger than 6 years.

Massachusetts, the prevalence of BLLs of 5 $\mu\text{g/dL}$ or higher in rural communities was twice that in urban communities. Conversely, in Pennsylvania, there was little difference in the prevalence of BLLs of 3.5 $\mu\text{g/dL}$ or higher in rural versus urban communities (data not shown).

Data Limitations

There are limitations in access to national and state data. Because of privacy concerns, the 2017–2018 and combined 2017 to March 2020 data are considered restricted use data accessible only through the NCHS Research Data Center. Although it is possible to access these data through the NCHS, the approval process can require months to years. Such a process does not accommodate the timeliness needed for using these estimates to evaluate the impact of policies in reducing children's BLLs.

With respect to our analyses, the gaps in the NHANES data between 2017 and 2020 prevented continuous comparisons of BLLs for children aged 5 years or younger or by sociodemographic factors. In addition, because of the small sample size of young children in the 2021–2023 survey, our estimates are less stable than previous estimates with larger standard errors. These small counts do not adequately support calculation of proportions or provide valid comparisons of the prevalence of BLLs at the higher end of the distribution across racial, ethnic, and income categories. Also, to limit in-person interactions during COVID-19, NHANES did not oversample by race, Hispanic origin, or income in 2021–2023 as done previously, and thus these data are less generalizable to specific subpopulations.⁵

TABLE 3— Percentage of Children Aged 5 Years or Younger with Blood Lead Levels Above the Designated Thresholds, by Race and Ethnicity: Children Screened in 7 US States, 2020–2023

	Race and Ethnicity							P
	White Non-Hispanic, %	Black Non-Hispanic, %	Multiracial, %	American Indian/Alaska Native, %	Native Hawaiian/Pacific Islander, %	Hispanic/Latinx, %	Asian Non-Hispanic, %	
Massachusetts ⁸ (BLL ≥ 5 µg/dL; 2022)	1.22	1.96	4.41	2.42	2.0	1.89	1.40	<.01
Connecticut ⁹ (BLL ≥ 5 µg/dL; 2020)	0.7	1.8	N/A	N/A	N/A	1.5	1.4	N/A
Illinois ¹⁰ (BLL ≥ 5 µg/dL; 2021)	2.77	3.77	N/A	N/A	N/A	2.22	3.10	<.01
Pennsylvania ¹¹ (BLL 3.5–9.9 µg/dL; 2022)	2.06 (tested), 0.44 (population)	6.69 (tested), 1.66 (population)	N/A	N/A	N/A	5.08 (tested), 0.93 (population)	2.63 (tested), 0.51 (population)	<.01 (tested)
Delaware ¹² (BLL ≥ 3.5 µg/dL; 2023)	3.75	4.87	N/A	N/A	N/A	5.71	6.87 ^a	.02
Indiana ¹³ (BLL ≥ 3.5 µg/dL; 2022)	1.33	1.16	0.42	0.67	N/A	1.47	1.78 ^a	<.01
South Dakota ¹⁴ (BLL ≥ 3.5 µg/dL; 2022)	2.7	2.8	N/A	4.1	N/A	2.4	6	.09

Source. Publicly available state-based blood lead data reported by states.

Note. BLL = blood lead level. N/A refers to data elements that were not reported. For Pennsylvania, the estimated percentage among the overall child population by race and ethnicity is also provided.
^aIncluding Asians/Pacific Islanders.

State-based BLL data are collected in pediatric clinical settings and limited by several factors. Surveillance systems are not designed to estimate the population distribution of BLLs but rather to identify children with BLLs known to increase risk of intellectual or behavioral problems. The reasons for testing an individual child's BLL vary across clinical settings and could introduce bias if children more likely to be exposed to lead are more likely to be tested. Moreover, clinical offices vary in reporting BLLs. In addition, blood samples are sent to many different laboratories through a variety of analytic techniques with different levels of detection.

Data are not standardized across states as to the BLL threshold considered elevated or the collection and reporting of data on race and ethnicity. Although states make every effort to report data on individual children, duplicate counting of children with multiple tests cannot be ruled out. Our study is also limited by lack of data from the southern United States. Well-known risk factors such as poverty and older housing suggest that lead exposure occurs in these states. Recently arrived residents and different racial profiles may also result in unidentified lead exposure.

DISCUSSION

The 1970s NHANES data alerted the nation to the prevalence of high BLLs in the overall population, well beyond previously available reports. Our study of NHANES BLL data provides evidence that is, for the most part, reassuring at the national level: BLLs continue to decline overall among children aged 5 years or younger, as do disparities in the prevalence of high BLLs by race, ethnicity, and socioeconomic status.

This is the result of an intense coordinated effort to control or eliminate lead sources by government officials, health and social service providers, and the communities most at risk. Our NHANES findings are generally consistent with those reported in the America's Children and the Environment Study.¹⁶ Although that study revealed that the median BLL for Black children was higher than that for White children according to combined 2015–2020 NHANES data (0.80 vs 0.60 $\mu\text{g}/\text{dL}$, $P = .002$), the differences in medians were no longer statistically significant in models adjusting for age, income level, and sex ($P = .207$).

State and local BLL data are less reassuring. These data indicate persistent disparities in elevated BLLs across state and local geographies, race, and ethnicity, although these disparities are more modest than in the past. Accurately characterizing the epidemiology of lead poisoning can ensure that lead poisoning prevention programs provide the most benefit to the groups at highest risk, making these programs more effective and less expensive. Local data also suggest that there are emergent lead sources not characterized by NHANES, specifically the uptick in lead-contaminated foods, toys, and cultural products.

The emergence of lead in consumer products, food, cosmetics, and cultural and ceremonial powders has been documented by both case reports and the news media. For example, a recent study involving a convenience sample of 230 New York City men, women, and children who self-identified as Bangladeshi, Indian, or Pakistani showed that 15% of children had BLLs of 5 $\mu\text{g}/\text{dL}$ or higher.¹⁷

Since 1979, the federal Healthy People program has set and tracked goals

to improve the health of the US population over the decades. In 2000, reducing elevated BLLs among children and BLL exposure disparities by race were included as objectives. Three governmental agencies (the US Department of Housing and Urban Development, the Environmental Protection Agency, and the CDC) subsequently adopted the Healthy People objectives as performance goals and enacted related actions to help curb childhood lead exposure.¹⁸ According to subsequent waves of NHANES data, these agencies demonstrated that they effectively reduced lead exposure by controlling or eliminating lead hazards.¹⁵ They also targeted resources to populations in which lead exposure risks were disproportionately high and designed cross-agency initiatives that propelled their efforts. This work continues. The Healthy People 2030 national target for lead has been lowered to 1.18 g/dL (representing the 97.5th percentile among children 1–5 years of age) from 3.31 g/dL in 2013–2016.¹⁸

The NHANES data demonstrate that control or elimination of lead hazards effectively reduces population BLLs over time. Monitoring of BLLs among children and other vulnerable populations must continue. In most cases, housing that has been remediated is not “lead free.” Without maintenance, lead on painted surfaces may reemerge as a hazard. This is true of lead in other media as well. Amendments that cover lead contaminated soil at Superfund and other highly contaminated sites can break down. There are also numerous reports of lead-contaminated foods, spices, remedies, pottery, and consumer products marketed to children. Therefore, routine monitoring and testing for BLLs remains the only verified strategy to track exposure

levels and target prevention efforts, especially given the bewildering array of emerging lead sources. Medicaid requirements for routine BLL testing are an important tool to promote testing, although widespread implementation is still needed. A 2021 US Department of Health and Human Services report indicates that more than one third of children with Medicaid benefits do not undergo a BLL test by the age of 2 years.¹⁹

Our ability to identify and respond to these sources cannot depend on NHANES alone. The limited recent NHANES sample sizes prohibit identification of high-risk subgroups. Notably, the samples of Asian and foreign-born children were extremely sparse in the 2021–2023 cycle, and the BLL estimates do not meet standards of reliability. These children are members of subpopulations with a high risk of lead exposure from sources such as imported foodstuffs; therefore, data for these subpopulations are critically important. NHANES should return to having robust statistical power and including oversampling by race, Hispanic origin, and income along with oversampling of particular groups such as foreign-born residents.

NHANES is not designed to estimate BLLs at the local or state level, where disparities are striking. State and local BLL surveillance data allow measurement and analyses that support prevention of children's lead exposures at the community level and measurement of progress toward eliminating childhood lead poisoning. However, there are gaps in state-level surveillance data: not all states collect data and data are not disaggregated by detailed sociodemographic information.

Only careful assessments of both NHANES and state and local level data offer a more complete picture of the

problem and the impact of efforts to resolve it. Data reports that protect confidentiality while allowing identification of subgroups disproportionately affected by lead allow health care providers and government agencies to implement timely, targeted interventions to reduce disparities in children's exposures. Our findings indicate that BLLs continue to decline nationally but that, at local levels, too many children continue to have elevated BLLs, placing their academic and life success at risk. BLL data from these sources illustrate important disparities in the risk of lead exposure and identify emerging risks.

Primary prevention remains the first-line approach to reducing lead exposure and associated morbidities.²⁰ Complete elimination of disparities in children's lead exposure requires eliminating root causes. Clinical and public health care providers and policymakers should know that children in certain racial, ethnic, and income subgroups continue to be at greatest risk.

Public Health Implications

NHANES and state- and city-level childhood lead poisoning programs can address disparities in exposure through the following steps:

1. Increasing screening of young children, especially children in under-represented racial and ethnic groups and others identified as being at high risk, to identify those with elevated BLLs. Publicly funded programs serving high-risk populations should identify and remove any barriers to BLL testing of their clients.
2. Promptly analyzing and sharing data online while fully protecting confidentiality so that health care

providers and government agencies can access the information needed to implement timely, targeted interventions aimed at reducing disparities in lead exposure among children.

3. Including anonymized data on the prevalence of elevated BLL concentrations stratified by racial, ethnic, and socioeconomic groups in public reports of screening data.
4. Providing families with timely, easy-to-understand information about interpreting BLLs, including actions that can be taken to reduce exposures.
5. Increasing the sample size of children examined in the NHANES, oversampling populations at high risk, and releasing data in a timely manner.
6. In the case of states, using consistent definitions and methodologies when reporting data.

Conclusions

Disparities in risk of lead exposure are not evident in national data but are apparent in more granular data. Together, these data sets provide benchmarks for the nation and signal changes in elevated BLL risks at the state and local levels that enable targeted interventions designed to prevent lead exposures among children and reduce disparities. *AJPH*

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M.J. Brown drafted the initial article and reviewed and revised the final version. M. Chu contributed to the analyses and the writing of the article and reviewed and revised the final version. D.C. Bellinger wrote the initial draft of the section on state-level screening data and reviewed the final version of the article. J.M. Braun, E.C. Gartner, M. Mitchell, C. Campbell, and C. Brody reviewed and revised the initial draft and reviewed the final version. C. Hoover reviewed and revised the state-level data and reviewed the final version of the article. A. Lavin participated in developing the initial concept and reviewed and revised the final version of the article. M. Swanson developed the original concept and reviewed and revised all drafts. A. Chen contributed to the analyses and to writing and reviewing the article and revised the final version.

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HUMAN PARTICIPANT PROTECTION

No human participants were involved in this study of publicly available data.

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