



Army Annual Pediatric Lead Report (CY 2021)

ANNUAL HIGHLIGHT

8,669 Army child dependents

received a blood lead test between 1 January and 31 December 2021; 0.3% of those tests indicated an elevated blood lead level. Among child dependents tested within the Military Health System, the rate of elevated blood lead levels in CY2021 is 3.5 per 1,000 children.

INTRODUCTION

Lead is a naturally occurring heavy metal, but can present an environmental and health hazard if it contaminates water, air, soil, or dust. The most common ways that people are exposed to lead are the inhalation or accidental ingestion of contaminated dust and soil as a result of aging or chipping lead-based paint.^{1,2} Lead-based paint was banned from use in the U.S. in 1978, but many homes built prior to the ban still exist in communities across the country. Other potential sources of lead exposure are contaminated water, ammunition, soldering equipment, as well as some foreign-made toys, ceramics, make-up, and packaged foods.

Lead is neurotoxic and can cause cognitive and behavioral issues, as well as gastrointestinal and hematological problems.^{2,3} Children are at higher risk of lead exposure because of more frequent hand-to-mouth behavior. They are also more susceptible to the harmful effects of lead since the brain is in a period of rapid development during childhood.

Because children are at higher risk if exposed to lead, the American Academy of Pediatrics (AAP) recommends that all children ages 6 months to 6 years old, inclusive, be screened via a parental questionnaire for increased risk of lead exposure at routine well-child visits.³ Children who screen positive for an increased exposure risk should be tested for an elevated blood lead level (eBLL). Laws regarding lead exposure screening, testing, and reporting are established at the State level, and Army regulation directs installations to comply with State law.

In 2021, the Centers for Disease Control and Prevention (CDC) lowered the reference value for an eBLL from 5 to 3.5 micrograms per deciliter ($\mu\text{g}/\text{dL}$).⁴ This updated reference value was derived from the 97.5th percentile of the blood lead values among U.S. children aged 1 to 5 years old from the 2015-2016 and 2017-2018 National Health and Nutrition Examination Survey cycles. The CDC reference value should not be interpreted as a “safe” level, and it continues to stress that there is no safe level of lead exposure.

In October 2018, eBLLs were established as a reportable medical event (RME) for Army dependents 0 to 6 years old according to the Army Lead Hazard Management Control Program.⁵ Army dependents with eBLLs should be reported to the Disease Reporting System internet (DRSi) according to Armed Forces Health Surveillance Division (AFHSD) guidelines. The Tri-Service Reportable Medical Event Working Group is in the process of updating the case definition of the elevated lead RME to reflect the change in the CDC reference value. This report tracks all available blood lead level (BLL) test results within the Army dependent population and monitors the occurrence of eBLLs. This iteration will use the previous CDC reference value for eBLL (5 $\mu\text{g}/\text{dL}$).

METHODS

Laboratory Data

The Navy and Marine Corps Public Health Center (NMCPHC) provided available BLL laboratory results for Army dependents from the Composite Health Care System (CHCS) Health Level 7 (HL7) chemistry data system and Military Health System

(MHS) GENESIS. Records are dated according to the BLL collection date, and this report covers test results collected from 1 October through 31 December 2021 (CY2021 Q4), as well as a summary of all CY2021 results. The data include all BLL test results above and below the eBLL cutoff collected within the MHS. This includes test results for Army dependents who receive care at Army military medical treatment facilities (MTFs) and other Department of Defense (DOD) facilities. Test results were excluded from the analysis when the unit of measure or the result could not be determined, or the biological sample was not blood.⁶ Zinc photoporphyrin (ZPP), point of care (POC), and capillary blood tests were also not included as these tests are not considered in the case definition in the Armed Forces RME Guidelines and Case Definitions.⁷

Only BLL results for Army dependents ages 0 to 6 years old were analyzed for this report. According to the Armed Forces RME Guidelines and Case Definitions, a child can only be counted as an eBLL case once per calendar year.⁷ If an individual had more than one BLL result (e.g., duplicate record or follow-up blood test) during CY2021 4th Quarter (Q4), the highest BLL result was retained. Data from each quarter of CY2021 were combined to summarize annual BLL test results. The frequency of BLL test results are displayed by BLL range (<5 µg/dL, 5-9 µg/dL, 10-19 µg/dL, ≥20 µg/dL), Regional Health Command (RHC), and installation. Results ≥5 µg/dL are considered elevated. All CY2021 Q4 eBLL test results are reported.

Disease Reporting System, Internet Data

Since 18 October 2018, eBLLs (≥5 µg/dL) have been reportable through the DRSi for children 0 to 6 years of age.⁵ DRSi is a tri-service reportable medical event system. Only Army dependent cases reported to DRSi are included in this report. Among Army dependents, DRSi cases with medical event report dates from 1 October through 31 December 2021 were counted.

Reporting Compliance

DRSi report dates can differ from the BLL test collection date. Taking this into consideration, cases with test collection dates during CY2021 Q4 were considered in the measure of compliance with the eBLL reporting policy. Reporting compliance was determined using the proportion of all eBLL laboratory results within CHCS and MHS GENESIS collected during CY2021 Q4 that were also reported via a medical event report in DRSi.

Army Public Health Nurses Program Status Report (APHN-PSR)

Starting in April 2019, specific questions regarding Childhood Lead Exposure were included in the APHN-PSR to assess the Environmental Health Hazard Management Control Program. As part of installation safety and housing office-led environmental investigations, the installation’s Department of Public Health (Preventive Medicine Services) conducts parent/guardian interviews after a child six years of age or younger is confirmed to have an eBLL. The APHN-PSR captures the following Lead Hazard Management Control Plan metrics: (1) number of pediatric BLL tests conducted in the past fiscal quarter reported to the state/local authorities; (2) number of confirmed elevated pediatric BLL test results in the past fiscal quarter reported to the state/local authorities per the state/local reporting requirements.

RESULTS

Laboratory Test Results

During CY2021, there were 8,669 Army dependents 0 to 6 years old that received a blood lead test within the MHS, and 30 of those results (0.3%) were elevated (BLL ≥5 µg/dL). In CY2021, one child had a BLL within the highest range (≥20 µg/dL, Table 1); however, no children exceeded the BLL at which chelation therapy is typically recommended (≥45 µg/dL). When repeat blood lead tests were examined, 15 out of the 30 children (50%) with elevated results within the calendar year had a follow-up blood lead test result that fell below the CDC cut-off for elevated blood lead by the end of CY2021 (i.e., <5 µg/dL).

Table 1. Total Count of Pediatric (ages 0-6) Blood Lead Levels in CY2021

BLL Ranges	CY2021 Q4	CY2021
<5 µg/dL	1,659	8,639
5-9 µg/dL	9	22
10-19 µg/dL	1	7
≥20 µg/dL	0	1
Total	1,669	8,669

In CY2021 Q4, 1,659 Army dependents received a blood lead test within the MHS, and ten of those results (0.6%) were elevated (BLL ≥5 µg/dL). Seven of the elevated results in CY2021 Q4 were new eBLL cases. Three Army dependents with an elevated result in CY2021 Q4 had an elevated result reported previously in CY2021. Figure 1 summarizes the number of elevated test results from each quarter in CY2021.

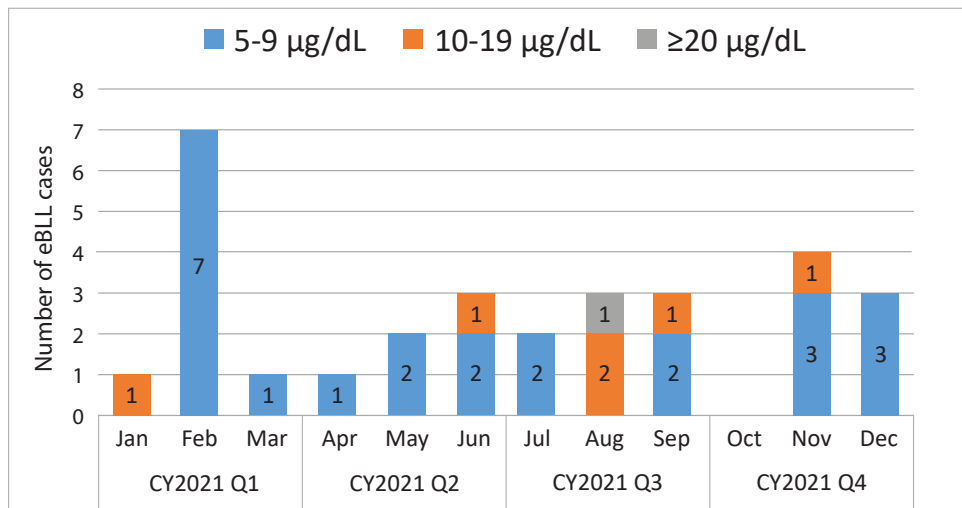


Figure 1. Number of Elevated Blood Lead Cases (≥5 µg/dL) by Month in CY2021
Data source: CHCS HL7 and MHS GENESIS

With the highest test result from the calendar year retained for each dependent, Table 2 summarizes the BLLs by RHC and installation. Elevated BLL results came from Fort (Ft) Bliss (3), Ft Bragg (5), Ft Campbell (1), Ft Drum (3), Ft Hood (2), Ft Lee (1), Ft Leonard Wood (1), Ft Riley (1), Ft Rucker (1), Ft Sill (5), Ft Stewart (3), Joint Base San Antonio (2), Walter Reed National Military Medical Center (NMMC) (1), and Dover Air Force Base (1). Appendix A shows a list of U.S. Air Force (USAF), Marine Corps, and Navy locations where Army dependents received BLL testing during CY2021.

Table 2. Pediatric (ages 0–6) Blood Lead Levels (BLL), by Region and Installation, CY2021

REGION	BLL Ranges				Total
	<5 µg/dL	5-9 µg/dL	10-19 µg/dL	≥20 µg/dL	
ATLANTIC					
Aberdeen Proving Ground	100	0	0	0	100
Carlisle Barracks	16	0	0	0	16
Ft Belvoir	244	0	0	0	244
Ft Benning	239	0	0	0	239
Ft Bragg*	1,130	4	1	0	1,135
Ft Campbell*	214	1	0	0	215
Ft Detrick	27	0	0	0	27
Ft Drum*	335	2	1	0	338
Ft Gordon	12	0	0	0	12
Ft Jackson	36	0	0	0	36
Ft Knox	166	0	0	0	166
Ft Lee*	139	0	1	0	140
Ft Meade	144	0	0	0	144
Ft Rucker*	110	0	0	1	111
Ft Stewart*	254	3	0	0	257
Redstone Arsenal	23	0	0	0	23
Walter Reed NMMC*	66	0	1	0	67
West Point	85	0	0	0	85
CENTRAL					
Ft Bliss*	1,032	2	1	0	1,035
Ft Carson	136	0	0	0	136
Ft Hood*	1,109	1	1	0	1,111
Ft Huachuca	4	0	0	0	4
Ft Irwin	25	0	0	0	25
Ft Leavenworth	77	0	0	0	77
Ft Leonard Wood*	135	1	0	0	136
Ft Polk	180	0	0	0	180

Table 2 (continued). Pediatric (ages 0–6) Blood Lead Levels (BLL), by Region and Installation, CY2021

Ft Riley*	214	1	0	0	215
Ft Sill*	212	5	0	0	217
White Sands Missile Range	1	0	0	0	1
PACIFIC					
Camp Humphreys	8	0	0	0	8
Camp Zama	2	0	0	0	2
Ft Shafter	139	0	0	0	139
Ft Wainwright	33	0	0	0	33
Schofield Barracks	527	0	0	0	527
EUROPE					
Grafenwoehr	16	0	0	0	16
Hohenfels/Amberg	10	0	0	0	10
Kaiserslautern	3	0	0	0	3
Landstuhl	83	0	0	0	83
Vicenza	3	0	0	0	3
Vilseck	54	0	0	0	54
Wiesbaden	44	0	0	0	44
JOINT BASES					
Joint Base Elmendorf-Richardson	34	0	0	0	34
Joint Base Langley-Eustis	217	0	0	0	217
Joint Base Lewis-McChord	18	0	0	0	18
Joint Base Little Creek-Ft Story	5	0	0	0	5
Joint Base McGuire-Dix-Lakehurst	24	0	0	0	24
Joint Base Meyer-Henderson Hall	24	0	0	0	24
Joint Base San Antonio*	443	1	1	0	445
USAF MTF**					
	370	1	0	0	371
NAVAL/MARINE CORPS MTF**					
	117	0	0	0	117

* elevated blood lead level (eBLL ≥ 5 $\mu\text{g}/\text{dL}$) result in CY2021

** list of USAF, Naval, and Marine Corps locations in Appendix A

DRSi Reporting Results

Seven eBLL cases among Army dependents were reported during CY2021 Q4 in DRSi. A total of 24 eBLL cases among Army dependents were reported to DRSi in CY2021. Table 3 summarizes the locations of the cases.

Table 3. Locations Where Elevated Blood Lead Levels (eBLL) Were Reported through DRSi, CY2021

INSTALLATION	Number of eBLL* reports	
	CY2021 Q4	CY2021
Ft Bliss	0	4
Ft Bragg	2	5
Ft Campbell	1	1
Ft Carson	1	1
Ft Drum	1	1
Ft Hood	0	2
Ft Leonard Wood	0	1
Ft Rucker	0	1
Ft Sill	1	5
Joint Base Lewis-McChord	0	1
Joint Base San Antonio	1	2
Total	7	24

*eBLL ≥ 5 $\mu\text{g}/\text{dL}$

Note: Case counts are based on DRSi reporting date and may not reflect the counts in Table 1.

Reporting Compliance

Two out of the seven new eBLL cases identified in the CHCS and MHS GENESIS laboratory data system were reported to DRSi; a 29% reporting compliance for CY2021 Q4. Both cases were reported during CY2021 Q4. Ft Drum and Ft Stewart each had two unreported eBLL cases from CY2021 Q4, and Ft Lee had one unreported eBLL case from the same time period.

Army Public Health Nurses Program Status Report (APHN-PSR)

The results of the APHN-PSR indicated that a total of 790 BLL test results were reported to State and/or local authorities during CY2021 Q4 (Table 4). The APHN-PSR question related to pediatric lead is relevant for installations located in State and local jurisdictions that require reporting of all BLL tests, including test results below 5 µg/dL (e.g., Louisiana, New York, North Carolina). RHC-Central reported the most BLL test results to State and local authorities (n=334) followed by RHC-Atlantic (n=283). Three (0.4%) of those results were elevated.

Table 4. Blood Lead Levels (BLL) Reported through the APHN-PSR, by Region and Installation, CY2021 Q4

REGION	Number of BLL tests reported to the state/local authorities	Number of eBLL tests reported to the state/local authorities
ATLANTIC		
Ft Belvoir	120	0
Ft Benning	95	0
Ft Bragg	1	1
Ft Gordon	1	0
Ft Lee	1	0
Joint Base Langley-Eustis	55	0
Redstone Arsenal	10	0
CENTRAL		
Ft Bliss	216	0
Ft Hood	1	1
Ft Huachuca	4	0
Ft Irwin	18	0
Ft Polk	28	0
Ft Sill	1	0
Joint Base San Antonio	66	1
PACIFIC		
Tripler/Schofield Barracks	170	0
EUROPE		
Baumholder	3	0

Note: Installations that are not listed did not report BLL tests or elevated BLL (≥5 µg/dL) tests.

DISCUSSION

Approximately 0.3% of the BLL tests performed in CY2021 (1 January – 31 December 2021) were elevated. Among Army dependents tested within the MHS, the annual rate of eBLL in CY2021 was 3.5 per 1,000 child dependents, and is similar to the annual rate of eBLL in CY2019 (3.8 per 1,000 child dependents), but slightly lower than the CY2020 rate of 5.1 per 1,000. The number of Army dependents tested during CY2021 compared to CY2020 (n=10,059 BLL tests) decreased by 14%. It is unclear whether the decrease in dependents tested for blood lead is due to the continued impact on preventive care during the pandemic or if more dependents are seeking care outside the MHS.⁸

Since there is no safe level of lead in the blood, the Army will continue its Lead Hazard Management Control Program to prevent childhood lead exposure and monitor children with an eBLL to ensure each case receives proper treatment and management. Reporting eBLLs to DRSi is an important aspect of that control and prevention program, and military MTFs reached 29% reporting compliance this quarter. This is the lowest quarterly reporting compliance in CY2021 (Q1 – Q3 range: 67-88%). While RME reporting has become more challenging during the COVID-19 pandemic, improvement of eBLL case reporting is critical to reliably identify installations where children may be at increased risk of lead exposure. Children with an eBLL are reportable to DRSi once per calendar year. The CY2021 reporting year has ended, and a new

medical event report should be submitted for any cases reported in CY2021 with an elevated result on a repeat test in CY2022. Contact the Disease Epidemiology Branch (usarmy.apg.medcom-aphc.mbx.disease-epidemiologyprogram13@mail.mil) for any questions regarding DRSi reporting of eBLLs.

LIMITATIONS

This report may not include all Army dependent BLL test results. The NMCPHC extracted the BLL results from CHCS one month after the end of Q4 to minimize the chance of missing any results collected during that quarter; however, it is still possible that some of the results were not certified by this time. The inclusion of MHS GENESIS laboratory data in this report is still new. The MHS GENESIS data provided by the NMCPHC was included in this report to provide some visibility on the installations that have converted to that electronic medical record system (at the time of this publication, these include: Ft Carson, Ft Irwin, Ft Leavenworth, Ft Leonard Wood, Ft Riley, Ft Shafter, Ft Wainwright, JB Lewis-McChord, JB Elmendorf-Richardson, Presidio of Monterey, and Schofield Barracks); however, the quality and completeness of this data is still being examined by the NMCPHC. In addition, only BLLs collected within the MHS are available through either CHCS or MHS GENESIS, meaning blood samples collected and tested outside the MHS are not represented in this report.

To improve BLL surveillance, the Army established a RME for eBLLs in children 0 to 6 years old. The Air Force similarly reports eBLLs through DRSi. However, the Navy relies solely on laboratory data and is not reporting eBLLs through DRSi, so it is possible that these cases will not be immediately visible to APHC. However, the data from CHCS/MHS GENESIS show that there were no eBLLs among the Army dependents who received BLL tests at Navy/Marine Corps MTFs.

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Appendix A

Table A-1. U.S. Air Force, Navy, and Marine Corps locations where Army Dependents Received a Blood Lead Test, CY2021

USAF Bases		Naval/Marine Corps Stations
Altus AFB	Maxwell AFB	Annapolis
Aviano AB	McConnell AFB	Camp Lejeune
Barksdale AFB	Mountain Home AFB	Cherry Point
Davis-Monthan AFB	Nellis AFB	Chesapeake
Dover AFB	Offutt AFB	Indian Head
Dyess AFB	Osan AB	Jacksonville
Eglin AFB	Patrick AFB	JB Charleston
Eielson AFB	Peterson AFB	JB Marianas Guam-Andersen
Ellsworth AFB	RAF Alconbury	JB Pearl Harbor-Hickam
Goodfellow AFB	Ramstein AB	Lemoore
Hanscom AFB	Robins AFB	Milton
Hurlburt Field	Scott AFB	Norfolk
JB Anacostia-Bolling	Seymour Johnson AFB	North Chicago
JB Andrews	Sheppard AFB	Okinawa
Kadena AB	Spangdahlem AB	Portsmouth
Keesler AFB	Tinker AFB	Quantico
Little Rock AFB	Travis AFB	Rota
Los Angeles AFB	USAF Academy	Suffolk
Luke AFB	Vance AFB	Virginia Beach
MacDill AFB	Wright-Patterson AFB	
Malmstrom AFB	Yokota AB	