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Abbreviations

Blood lead level (BLL): The concentration of lead in a sample of blood. In this report, the concentration is expressed in micrograms per deciliter (µg/dL).
EIBLL: environmental intervention blood lead level
LPPP: New York City Department of Health Lead Poisoning Prevention Program
UHF: United Hospital Fund neighborhood
µg/dL : micrograms per deciliter

Area characteristics: age of housing

Data on age of housing came from the 1990 Census, U.S. Bureau of the Census. There are a few issues that influence the ability to assess the distribution of lead poisoning by age of housing: (1) Age of housing does not differentiate between units that have been well-maintained versus those that are in poor condition; (2) Even within small areas there can be a wide mixture of housing types, with new housing developments amidst older housing; (3) Census 1990 may not fully represent the age of NYC's housing stock in 2000 because of demolition and new construction that occurred in the 1990's; At the time this report was published, the US Bureau of the Census had not released Census 2000 ZIP code level socio-demographic data.

Area characteristics: percent of children living in poverty

Data on the percent of children living in poverty came from the 1990 Census. Poverty is determined by total household income (adjusted for household size and ages of household members) and the cost of a nutritionally adequate food plan. Federal poverty thresholds do not vary by locality. In 1989, the average poverty threshold for a family of four persons was $12,674. The 1990 Census may not fully represent NYC's socio-demographic profile in 2000. At the time this report was published, the US Bureau of the Census had not released Census 2000 ZIP code level socio-demographic data.

Area characteristics: race/ethnic distribution of children in the population

Data describing the distribution of race/ethnicity in the NYC population came from NYC DOH Vital Records 1995-2000. These data represent the mother's race as reported by the mother and recorded on the child's birth certificate. To create race/ethnicity maps (see Figure 29), 1990 Census data were used (percent of non-white or Hispanic persons in each ZIP code). Please note, the 1990 Census may not fully represent NYC's socio-demographic profile in 2000. At the time this report was published, the US Bureau of the Census had not released ZIP Code level Census 2000 socio-demographic data.

Blood lead levels: environmental intervention blood lead levels (EIBLL)

Since the 1970's, the Centers for Disease Control and Prevention (CDC) has established blood lead level thresholds which necessitate environmental assessment and medical evaluation. This report uses the term "environmental intervention blood lead level" in order to differentiate the children for whom the CDC recommends environmental assessment and medical evaluation (EIBLL) and children with elevated blood lead levels (≥ 10 µg/dL) for whom the CDC recommends less intensive monitoring. The term, "environmental intervention blood lead level," was coined by the US Department of Housing and Urban Development.[38]

The LPPP began collecting citywide blood lead level surveillance data in 1971. High numbers of children newly identified with blood lead levels ≥ 60 µg/dL in 1970 and 1971 reflect this startup activity; a child may have had a high lead level prior to 1971, but was first identified by the LPPP in 1971 and 1972.

Electronic data were not available for cases identified during 1970-1982. The numbers presented for 1970-1982 were extracted from paper documents that listed the total number of cases each year. In addition to children with venous blood lead tests, these counts may have included a small[40] number of children with high "free erythrocyte protoporphyrin" (FEP) tests and high capillary tests.

Data for 1983 through 2000 represent children with blood lead levels at or above the EIBLL, diagnosed with a venous test.

The NYC EIBLL threshold has changed over the years (see Table 5 for the full history of the EIBLL threshold). Lowering the EIBLL thresholds resulted in increases in EIBLL cases in years 1975, 1981, 1986, 1993. Within threshold years we are accustomed to seeing decreases in case numbers; variability within EIBLL threshold years is likely due to the small[2] and changing number of children being tested for lead poisoning.

Blood lead levels: limitations

Measurement variation can produce inaccuracies and imprecision in blood lead levels that may be particularly problematic for low blood lead levels. Laboratory instruments introduce measurement error as do certain blood lead sampling methods (capillary samples versus venous samples). Venous blood lead tests produce the most reliable results. Capillary samples have a high level of sensitivity but lower specificity (producing false positive high blood lead levels). Each year, among NYC children tested for lead poisoning, most (approximately 80%) are tested by a venous blood test.

With surveillance data, there is no ability to control testing in such a way that would eliminate bias caused by intra-person biologic variation (e.g., in research, bias can be controlled by repeatedly testing each child and randomly selecting a representative test). However, the large number of tests analyzed may have reduced variability and misclassification.

Blood lead levels: limits of detection

In the LPPP database, blood lead levels below 6 µg/dL are affected by 'limits of detection.' The 'limit of detection' is the smallest amount of a substance that can be reliably distinguished from zero, according to a particular analytic method and instrument. NYC receives blood lead test results from approximately 60 laboratories;

[38]See Code of Federal Regulations, Title 24, Volume 1, April 1, 2001, 24CFR35.325

[39]Between 1971 and 1994, no more than 205,000 children were reported each year and this number was likely inflated because (at that time) the LPPP database had very limited capabilities for identifying duplicate children.

[40]"Confirmed" is defined as a blood lead level of 10 µg/dL from a venous test or from two capillary tests drawn within 12 weeks of each other.

each laboratory has its own limits of detection (ranging from 0 µg/dL to 5 µg/dL). There is no distinction in the LPPP database between detectable and non-detectable blood lead level values (for non-detectable results, LPPP records the value of the detection limit without a qualifier). Since the majority of blood lead levels are below 5 µg/dL, this data limitation precludes reporting mean blood lead levels. (See Figure 7 for categorical reporting of blood lead levels.)

Blood lead levels: rounding values

Most laboratories report blood lead results to the 10th decimal place. The LPPP database rounds the decimal to the nearest whole number. While this imprecision affects all blood lead levels, it is not likely to change the overall distribution of blood lead levels.

Geocodes: Boroughs and ZIP codes

As mandated by NY State law, a child's address is reported with their test result (LPPP data processing normalizes addresses and assigns geographic codes). In 2000, less than 0.05% of children tested for lead poisoning lacked borough information and 11% had an unidentifiable ZIP code. This report used a 'master' list of (mostly residential) ZIP codes (n=196) prepared by the NYC Department of City Planning and by the NYC DOH Office of Data Management and Analysis. ZIP codes were considered valid if they were on the master list. Children who were unable to be geocoded at the borough or ZIP code level are listed in the Appendix tables as 'borough unknown" or "ZIP code unknown".

ZIP (an acronym for "Zone Improvement Program") codes are comprised of spatially clustered street ranges but are not formal spatial entities and thus do not observe county and state boundaries. In this report, population and test records were assigned to only one county. Two residential ZIP codes cross NYC county lines so assignment to county was done according to the county with the largest share of the population within the ZIP code (10463 was assigned to the Bronx and 11370 was assigned to Queens). One ZIP code, 11001, crosses county lines between Queens NYC and Nassau County Long Island; in this instance, test records received by NYC DOH were assigned to Queens.

Geocodes: United Hospital Fund neighborhood (UHF)

Beginning in 1982 and then later updated in 1998, the United Hospital Fund aggregated contiguous NYC ZIP codes into 42 neighborhoods (UHFs). However, not all NYC ZIP codes have been assigned to a UHF neighborhood. (See Appendix Table 4 for undesignated ZIP codes.)

Race/ethnicity

Data on the race/ethnicity of children tested for lead poisoning is missing from a large percent (80%) of tests reported to the LPPP. As a consequence, the LPPP can only report race/ethnicity for families that were interviewed (children at or above the environmental intervention blood lead level). In addition, the race data reported here may be deficient due to well-documented difficulties in the standardization of racial classification (e.g. differences in classification between interviewee self-classification and interviewer-classification, the classification scheme is often misunderstood, classification into more than one race was not possible in the database, etc.).

Selection of blood lead tests: "testing" versus "screening"

Except for Table 1b, this report presents information on children "tested" for lead poisoning. "Tested" represents children tested with any blood lead test, regardless of previous blood lead levels. NYC presents the number of children "tested" for lead poisoning in order to assess New York State's requirement to screen all children at age one and at age two (not just children with an elevated blood lead result).

Table 1b presents the data according to the criteria for "screening" defined by the CDC and New York State Department of Health. Children "screened" for lead poisoning represent children who have never had a confirmed blood lead level of 10 µg/dL or higher in a previous year. The definition for a "screen" highlights the diagnostic nature of a test for lead poisoning when no elevated blood lead level has been detected.

Selection of blood lead tests: associating a year with a blood test

The year of the blood lead test was based on the date the blood sample was collected; if the date the blood sample was collected was missing, then the year represents the date NYC-DOH received the blood test result.

Selection of blood lead tests: children with multiple blood lead tests in a year

If a child had more than one blood lead test in a calendar year, only one test per child was represented for the year. For each child, an elevated blood lead test (≥ 10 µg/dL) was selected based on the following hierarchy: the venous test with the highest blood lead level, the capillary test with the highest blood lead level when no venous test was available, and finally the highest blood lead level reported when no test-type was available. Selecting test results based on this schema could result in a slight inflation of the true prevalence of elevated blood lead levels. However, the schema was used for tests for all years thus, any bias would not affect the observed trend. Note: for children with blood lead levels at or above the environmental intervention blood lead level, only venous blood lead tests were included. (Also see Appendix, Technical Notes: Blood lead levels, limitations).

Selection of children: newly identified versus prevalence

Children “newly identified” in a given year were never previously identified as having an elevated blood lead level. The count of children newly identified with elevated blood lead levels could also be referred to as an incident count. "Prevalence" is the number of children identified with an elevated blood lead level in a given year regardless of an elevated blood lead level in a previous year (therefore, the “newly identified” number is a subset of the "prevalence" number).

CALCULATION OF RATES

Population counts and denominators

The population counts for children less than 6 years old in 1995 and 2000 were calculated from summing NYC births 1990-1995 and 1995-2000 (data from the New York City Department of Health (NYCDOH) Office of Vital Statistics, see Figures 23 and 24).

Denominators for rates of children tested in a given year are 1990-2000 vital records from the NYCDOH Office of Vital Statistics (see Figure 5 and Appendix, Tables 2, 3, and 4). NYCDOH vital records includes all births that occurred in New York City to mothers who reported their residence as NYC.

Denominators for rates of children tested by a given age (by age 2 and by age 3) were from 1996-1999 vital records from the New York State Department of Health (NYSDOH) Bureau of Biometrics (see Figures 1 through 4 and Appendix Tables 1a and 1b). NYSDOH vital records includes all births that occurred in New York State to mothers who reported their residence as NYC. Because NYSDOH includes out-of-NYC events, the number of births recorded by NYSDOH is larger than the number recorded by NYCDOH. We used NYSDOH vital records in order to improve the denominator data in Figures 1-4 and Tables 1a and 1b, however, NYSDOH vital records data were not available for all years represented in this report.

Denominators for rates of children with elevated (≥ 10 µg/dL) blood lead levels or for rates of children with blood lead levels at or above the environmental intervention blood lead level are the numbers of children residing in NYC who were tested for lead poisoning, as reported to the NYCDOH Lead Poisoning Prevention Program.

Testing rates: limitations of calculations

The testing rates reported here should be viewed only as a general description of testing. Small area testing rates are influenced by limitations with denominators due to inaccurate population counts. In this report, the denominator for testing rates was vital records. The limitation of computing population by adding births across years is that in- and out- migration are not accounted for. The use of vital records data can be justified with the following reasoning: (a) the subject of this report is very young children and so the opportunity for migration may be reduced, (b) using vital records allowed us to calculate the population for intervening decennial census years while using only one data source; and (c) compared to other population counts (Census 2000), the testing rates reported here for children in a given year err on the conservative side (they may underestimate the true testing rate).[41]

Testing rates: percent of children tested before their third birthday

In Figures 1 through 4, testing rates are expressed as the number of children tested for lead poisoning who had a birth date in 1997 and who resided in NYC at the time they were tested per 100 children born in 1997 whose reported residence was NYC (as determined by 1997 vital records from the New York State Department of Health Bureau of Biometrics, see description of denominator above). These rates do not take into account in-out-migration. In other words, the numerator includes some children (born in 1997) who resided outside of NYC at the time of birth who then relocated to NYC and were tested for lead poisoning. Likewise, the denominator includes some children (born in 1997) who resided in NYC at the time of birth who then relocated outside of NYC and were never tested for lead poisoning in NYC.

Testing rates: percent of children tested for lead poisoning in a given calendar year

In Figure 5, testing rates for children less than six years old are expressed as the number of children tested in a given calendar year per 100 children in the population in the calendar year (as determined by vital records 1990-2000 from the New York City Department of Health Bureau of Vital Statistics). Population counts and testing rates are not presented for ages 6 years to less than 18 years because these children are not commonly at risk for lead poisoning and thus, a low number of these children are tested.

Elevated blood lead level rates and EIBLL rates

The rate of children newly identified with elevated blood lead levels is based on the number of children in a given year at or above a specified blood lead level per 1,000 children tested in the year. The number of children tested is used as the denominator because NYC mandates screening and reporting of all childhood blood tests for lead poisoning thus we generally consider children tested to be representative of the population; 50% of children 6 months to less than 6 years are tested for lead poisoning.[42]

The neighborhood rates (Figures 14, 15, 26, 27) should be considered alongside the number of children tested and/or the size of the child population in the neighborhood. Rates can be misleading and/or meaningless when the number of children tested is very small and/or when very few children reside in the area. If the testing rate is very low, it may indicate the sample tested was not representative of the children in the neighborhood and thereby would counter our assumption that the children tested provided a good representation of the neighborhood's risk for lead poisoning (e.g., if only the highest risk children are tested then elevated blood lead levels will appear to be higher than they actually are, and vice versa). If the rates of children with elevated blood lead levels are high but there are only a few children in the population, the rate may be accurate but it may overstate the magnitude of the problem.

[41] When counts for ages 6 months to less than 6 years for the 2000 Census were compared to counts for NYC vital records summed for years 1995 - 2000, there was a substantial difference. The vital records count was approximately 10% higher than the 2000 Census (the greatest difference was in Manhattan, approximately 20% different).

[42] When using the population as the denominator, neighborhood rates of children with environmental intervention blood lead levels differentiated in a similar pattern to rates that used tested children as the denominator (though the magnitude of the rates were smaller).