Brief Report

A preliminary examination of elevated blood lead levels in a rural Georgia county

R. Christopher Rustin, DrPH, MT, REHS[1], Yu Sun, MD, MPH[2], Chris Calhoun, MPH[2], and Christy Kuriatnyk, MSPH, REHS[2]

[1]Jiann-Ping Hsu College of Public Health, Georgia Southern University and [2]Georgia Department of Public Health, Environmental Health Section

Corresponding Author: R. Christopher Rustin • P. O. Box 8015, Statesboro, GA, 30460 • 912-478-2414 • rrustin@georgiasouthern.edu

ABSTRACT

Background: Rural areas are often viewed as lower risk for lead poisoning and toxic exposures seriously impacting development of the brain and central nervous system; this report examines the prevalence of elevated blood lead levels for children <6 years of age in rural Ben Hill County, GA.

Methods: Lead surveillance data from the Georgia Department of Public Health (DPH) were analyzed using SAS®v-9.3 to calculate the prevalence of elevated blood lead levels (≥5ug/dL) among those children in Ben Hill County who had been tested for lead; the results were compared to Georgia and national data.

Results: A preliminary analysis of 2010-2015 screening data for Ben Hill County indicates that 8.73% (95%- CI: 7.4%-10.1%) of children that were tested for lead exceeded the Centers for Disease Control reference level (≥5ug/dL) and is approximately 3.5 and 2.4 times higher, respectively, when compared to the National (2.5%) and State (3.64%) percentages of children exposed to lead at or above the reference level.

Conclusions: While these data are preliminary and more analysis is planned to ascertain the full breadth, source, and scope of the problem, it highlights lead poisoning risks rural communities face that are often overlooked in population-based risk analysis and research on lead exposure in children.

Key words: rural, reference level, elevated blood lead level, prevalence, risk

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INTRODUCTION

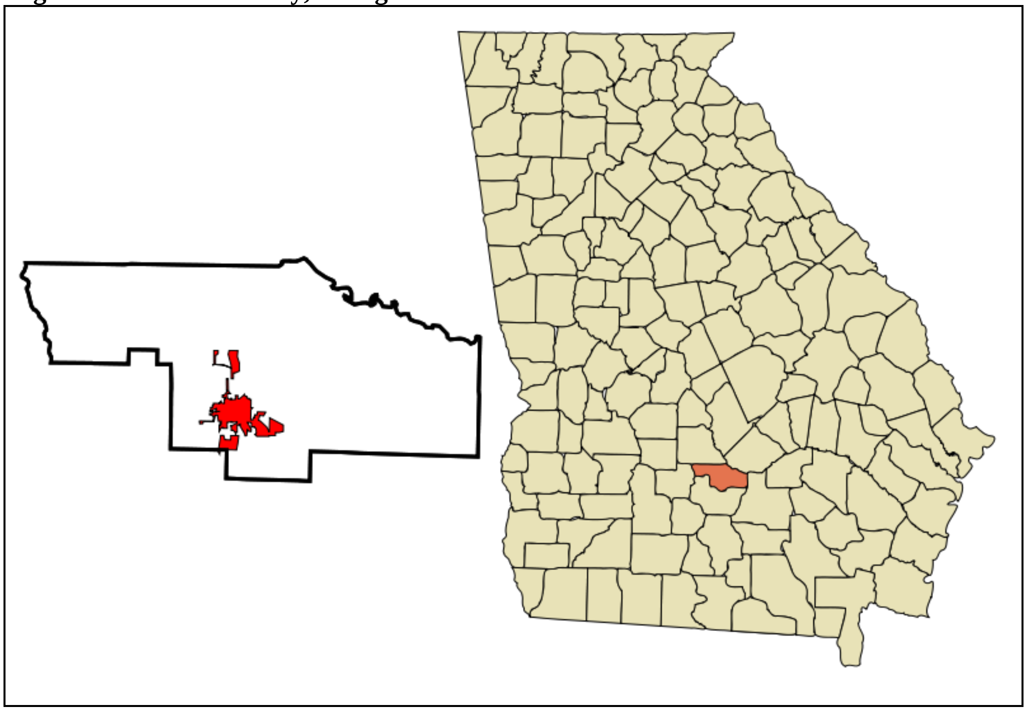
Lead poisoning in children affects the brain and central nervous system, leading to intellectual and behavioral deficits (Kim et al., 2013; Cecil et al., 2008; Bellinger & Needleman, 2003; Canfield, et al., 2003). Studies have shown that increased blood lead levels in young children are associated with neurobehavioral and cognitive abilities (Hou et al., 2013) including lower reading readiness (McLaine, et al., 2013) and lower 4th grade reading and math scores (Miranda et al., 2007). Assessing and preventing lead exposures are often overlooked in rural communities but are important to rural children's learning ability.

METHODS

The authors partnered with the Georgia Department of Public Health's (DPH), Environmental Health Section, to conduct a preliminary analysis of initial elevated blood lead (EBL) levels (≥5ug/dL) from screening data in rural children from 2010-2015. A rural county was defined as having a population of less than 35,000 per the estimated 2015 Census. Lead screening is recommended for children at 12 and 24 months or 36 -72 months if not previously screened (DPH, 2016). Medical providers and laboratories are mandated to report all blood lead testing to the DPH, which then analyzes the data to identify elevated cases and trends and posts surveillance reports on the DPH's website. DPH categorizes blood lead surveillance data by county, the total number of children screened, and blood lead levels of ≥5-9ug/dL and ≥10ug/dL. Based on CDC and Georgia recommendations, levels of ≥5-9ug/dL initiate public health action (case management, education, additional screening), with levels ≥10ug/dL warranting an environmental source investigation.

Ben Hill County and the City of Fitzgerald highlighted, shown in Figure 1, has an estimated 2014 population of 17,547 people and approximately 2,008 children under the age of six (Census, 2016). This county was selected because it met the rural criterion and an initial review of data showed a high number of children with EBLs (≥5ug/dL) compared to the overall number of children screened. Using publicly available initial screening data, the prevalence of EBLs for years 2010-2015 with 95% confidence intervals were calculated from overall children screened using SAS®v-9.3 and then compared to state and national data. Overall screening rates were calculated by dividing the total number of children screened by the population of children < 6 years of age in Ben Hill County using a 6-year average of 2,013 children. Data were then compared to DPH lead exposure risk maps reported in Rustin et al. (2015).

Figure 1. Ben Hill County, Georgia



Source: Wikimedia Commons

RESULTS

The authors analyzed initial screening data from 2010-2015 and preliminary results are presented in Table 1. Table 1 shows a yearly breakdown of the number and percent of children screened, EBL cases, and the prevalence of EBLs calculated from the overall number of children screened with 95% confidence intervals. Results indicate a slight, but non-significant decrease, X2 (1, N=720) =1.18, p <0.28, in EBL prevalence ranging from 9.28% in 2010 (95% CI: 6.8-12.3%) to 6.9% in 2015 (95% CI: 4.2-11.03%) of children screened. This parallels a decrease in the number and percent of children screened, most notably a nearly 50% decline between years 2010 and 2015. This may suggest that the high prevalence of EBLs in light of overall low screening rates for Ben Hill County is due to a renewed focus on screening the highest risk children because of public health education and/or renewed media attention. In addition, an unexplained prevalence increase in 2011 (10.98%) and 2012 (9.75%) compared to 2010 (9.28%) requires further investigation.

In 2012, the CDC's previous blood lead "level of concern" at 10ug/dL was replaced with a "reference level" of 5ug/dL, which was based on the highest blood lead level of 2.5 % of children tested for lead nationally (CDC, 2016). This reference level is derived from the National Health and Nutrition Examination Survey's (NHANES) 97.5th percentile distribution of blood lead in children ages 1-5 and is updated every four years (CDC, 2016). Ben Hill County's overall 2010-2015 EBL prevalence of 8.73% (95% CI: 7.47%-10.14%**)** is nearly 3.5 times higher than the National 2.5 percent distribution of children with an EBL. In addition, this is nearly 2.4 times higher than the overall State prevalence of 3.64 % of children with an EBL as calculated by DPH.

Table 1. Prevalence of EBL and screening %, children <6 years, Ben Hill County, 2010-2015

Year	Total Number Children Screened	Overall % Children Screened	EBL (≥5ug/dL)	Prevalence of EBL	95% Confidence Intervals
2010	474	23.55%	44	9.28%	6.83%-12.26%
2011	328	16.30%	36	10.98%	7.81%-14.87%
2012	236	11.72%	23	9.75%	6.28%-14.26%
2013	210	10.43%	14	6.67%	3.69%-10.93%
2014	292	14.50%	22	7.53%	4.78%-11.18%
2015	246	12.22%	17	6.91%	4.08%-10.83%
Total	**1,786**	**14.79%**	**156**	**8.73%**	**7.47%-10.14%**

DISCUSSION/CONCLUSIONS

This analysis is limited due to low numbers of children screened and the prevalence should be interpreted accordingly. However, this preliminary examination demonstrates public health issues that often go unseen in rural communities. There is limited current research on the factors, both social and structural, contributing to lead poisoning in rural communities, but previous rural studies demonstrated high prevalence rates and the need for awareness of lead exposure risk factors (Norman et al., 1994). In a previous study by Rustin et al., (2015), DPH lead risk maps were updated to prioritize the highest risk counties in Georgia. Counties identified as highest risk were urban, which have a larger population of children with EBLs and a higher percentage of homes built pre-1978 compared to rural counties. Ben Hill County is categorized as low risk for lead poisoning by DPH due a lower percent of homes built pre-1978 and the small population of children exposed. However, while lead exposures typically come from old lead paint, Ben Hill County is home to a former lead battery plant, which may contribute to the high prevalence of children with an EBL. Additional research is planned to ascertain the source of exposures, child demographics, awareness of lead poisoning, and lead screening knowledge among health care providers in Ben Hill County. The results of an enhanced rural study can assist DPH's goal of improving brain health in young children by providing much needed data from rural areas, which can lead to eliminating physiological barriers that impede a child's learning and educational outcomes.

In conclusion, rural areas face many public health challenges, such as isolation from resources and access to health care. Enhanced analysis of screening data can be utilized to target anomalies in exposures and assist with developing programs that are tailored to the needs of rural communities.

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