Inadequate Prenatal Care and Elevated Blood Lead Levels Among Children Born in Providence, Rhode Island: A Population-Based Study

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SYNOPSIS

Objective. This study was conducted to determine whether children born to mothers receiving inadequate prenatal care are at an increased risk for having an elevated blood lead level during early childhood.

Methods. The authors conducted a population-based study of children born in Providence, Rhode Island, from 1997 to 2001 whose mothers had received adequate, intermediate, or inadequate prenatal care. The children's blood lead levels were compared between groups using bivariate and logistic regression. To understand the regulatory implications and public health impact of changing the definition of an elevated blood lead level, "elevated" was defined as 5 µg/dL, 10 µg/dL, and 15 µg/dL.

Results. Children born to mothers who received inadequate prenatal care were at an elevated risk for having an elevated blood lead level later in life. This relationship remained statistically significant for each definition of elevated blood lead level and after controlling for other socio-economic status measures and birthweight (at 5 µg/dL, odds ratio [OR]=1.36, 95% confidence interval [CI] 1.09, 1.68, p=0.006; at 10 µg/dL, OR=1.68, 95%CI 1.26, 2.24, p<0.0004; at 15 µg/dL, OR=1.83, 95% CI 1.10, 3.04, p=0.019) represent an opportune moment to identify expectant mothers living in lead-contaminated environments.

Conclusions. Results suggest that conducting lead screening as a regular part of prenatal care provision could help identify women possibly experiencing ongoing lead exposure and help reduce or prevent exposures to their offspring.

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An aim of the *Healthy People 2010* initiative is to eliminate blood lead levels (BLLs) greater than 10 µg/dL among American children aged 1–5.[1] However, recent national data estimated that 1.6% of children 1–5 years of age had BLLs greater than 10µg/dL from 1999 to 2002.[2] Lead exposure remains a pressing public health issue for children residing in the United States.[3–6] Childhood lead exposure has been associated with adverse health effects that persist into adulthood, including severe cognitive deficits.[6–11] The lost productivity costs for children with elevated BLLs are approximately $2,552 per 1 µg/dL increase in BLL.[12]

To meet the Healthy People BLL aim, the focus of state prevention programs must be on developing primary prevention measures.[12] For example, improving housing quality can be an effective mode of public health promotion.[13] Due to a legacy of poverty concentration and residential segregation, the majority of old, poor-quality housing that contains lead-based paint is located in underserved urban neighborhoods.[14,15] For the most part, these are the same neighborhoods that also have a disproportionate number of lead-poisoned children residing in them.[16] However, due to the high cost of many primary lead poisoning prevention programs such as full abatement of lead-based paint in homes, many states have concentrated on interim measures. Often these policies focus on identifying children who have already experienced high lead exposures. Despite the successes of these programs, the need remains to identify at-risk children *before* their BLLs are elevated.[7,17,18]

One point of early prevention is the prenatal care setting. Evidence suggests that prenatal care is an effective vehicle for educating women on various health issues. For example, prenatal care education often encourages mothers to stop smoking and reduce alcohol consumption.[19] With respect to lead exposure prevention, prenatal care may be an appropriate place to initiate lead education and to target expectant mothers whose future children may be at high risk for living in lead-contaminated homes.[20] While the mother's BLL may be a reflection of bone-lead mobilization, it may also be a reflection of current lead exposures.[21] By identifying potential exposures early during the pregnancy, future exposures to offspring could be avoided.

While the association between prenatal care and birthweight has been studied extensively, only three studies have examined the association between prenatal care and elevated BLLs. Recknor et al. found that children born to women who received inadequate prenatal care were more likely to have elevated BLLs during the first year of life.[22] Although this finding has important policy implications, the study was limited by a small sample of a predominantly low income African American community residing in South Carolina. We sought to address this limitation through an assessment of the potentially protective effect of prenatal care usage among a relatively large, racially diverse group of children born in Providence, Rhode Island. We also assessed the implications of shifting the benchmark definition of elevated BLLs, based on three regulatory definitions: the Centers for Disease Control and Prevention (CDC) level of concern (10 µg/dL of blood), the action level for Rhode Island (15 µg/dL),[23] and a lower benchmark level of 5 µg/dL based on emerging evidence of adverse effects at this level.[24]

METHODS

This was a population-based study that incorporated multiple assessments of childhood lead exposure. The study population consisted of children born in Providence, Rhode Island from January 1, 1997, to November 7, 2001, and we calculated each child's blood lead levels based on the average of all of the blood tests available during the period of study. The study sample was identified through the KIDSNET database. KIDSNET, implemented in 1997 and compiled by the Rhode Island Department of Health (DOH), integrates data from multiple health programs and includes individual-level information on newborn screening, immunization, lead screening, maternal data, and home visits.[25] Currently, the data set contains information for 75% of children born in Rhode Island since 1997. In 2001, approximately 80% of the children represented in KIDSNET had at least one recorded blood lead test result.[26]

The eligibility criteria for selecting the study population were four-fold: (*1*) existence of at least one venous lead test result for the child, (*2*) information on the month prenatal care was initiated, (*3*) information on the number of prenatal care visits, and (*4*) availability of demographic information. Out of 13,236 children born in Providence during the study period, 5,689 were excluded due to blood testing information lacking at least one venous test result, missing prenatal care information, or missing demographic data. The final study sample consisted of 7,547 children.

The main independent variable of interest was prenatal care, which consists of a combination of medical assessment and psychosocial counseling intended to help prevent pregnancy complications and to ensure the well-being of both mother and child.[27] We categorized adequacy of prenatal care as adequate, intermediate, or inadequate with the Kessner Index.[28] These

categories reflect the trimester prenatal care started and the number of visits received throughout the mother's pregnancy. For example, mothers classified as having received inadequate care ranged from those who initiated care within the fourth or fifth month of pregnancy and received no subsequent prenatal care visits to those who initiated care in the eighth month of pregnancy and had 0–2 subsequent prenatal care visits. Mothers who received no prenatal care were classified as having received inadequate care. To estimate the adequacy of prenatal care, the month prenatal care was initiated was converted into weeks of gestation; it was assumed that prenatal care began in the middle of the month (week two).

The main outcome of interest was elevated BLLs. The CDC defines an elevated BLL as one venous specimen ≥10 µg/dL or two capillary blood specimens greater than, or equal to, 10 µg/dL drawn within 12 weeks of each other.[4] The Rhode Island Childhood Lead Poisoning Prevention Program has adopted this standard.[23] For purposes of this study, an elevated BLL was a dichotomous variable, defined according to three benchmarks. First, the current CDC benchmark of 10 µg/dL was used. Second, because research indicates that adverse effects associated with lead exposure persist at levels below 10 µg/dL,[24] new standards have been proposed to lower the definition of elevated BLLs to 5 µg/dL.[4] Thus, to understand how changing the regulatory standard would impact policy decisions, elevated BLLs were also defined at 5 µg/dL. Finally, Rhode Island provides full case management, environmental investigation services, and in-home education to families of children with persistent elevated BLLs ≥15 µg/dL.[23] To explore which subpopulations currently receive intervention and how changing this standard would impact Providence families, elevated BLLs were defined at 15 µg/dL. For each child with at least one venous test, the average of their blood test results was calculated in order to assess whether they had elevated BLLs compared to the three benchmarks described above.

We considered as possible confounders a number of child and maternal characteristics—the child's race/ethnicity, birthweight, and risk disposition at birth, as well as the mother's educational attainment, insurance status, age, and marital status. Birthweight was dichotomized, with less than 2,500 grams considered low. In Rhode Island, infants at risk of developmental delays are screened by considering both mother and infant risk factors. These factors include: existence of developmental disabilities, neonatal intensive care unit hospitalization, mother with hepatitis B, single caregiver status, and a newborn's gestational age. For this study, we used the same risk assessment categories as the KIDSNET dataset, where children are identified as risk positive, risk negative, or risk suspect. Mother's age was categorized as teen (<20 years of age), or non-teen (≥20 years of age). Medical insurance coverage was used as a proxy of the mother's socio-economic status (SES). Enrollment in Medicaid, a government-funded insurance program for low-income individuals, is a good indicator of SES,[29] and has been correlated with an increased risk for childhood lead poisoning.[30] The mother's educational attainment was also used as a proxy for socioeconomic status as it can be an indicator of an individual's probability of future success.[31] This variable was dichotomized as having or not having completed high school.

Multivariable logistic models were fit, predicting the odds of having an elevated blood lead level by adequacy of prenatal care received and adjusting for the potential confounders discussed above. Variables were entered using a forward step-wise procedure. All analyses were conducted using SAS, release 8.2.[32]

RESULTS

Table 1 describes the study population and the excluded population. There were 7,547 children included in the study, and 5,689 excluded. Compared to the analytic sample, a larger proportion of excluded children were identified as having no insurance or other/unknown insurance, and more were identified as being risk negative. Of the mothers in the excluded population, slightly fewer were younger than age 19, and fewer had received more than 11 years of education. Of these mothers, more had received inadequate prenatal care as compared to the study population. In addition, more children characterized as white were in the excluded group than included in the study. All other characteristics were similar between the study population and excluded children.

Information on prenatal care was not available for mothers of 1,338 children. Of the rest, 6,946 (92.0%) had received adequate prenatal care, 212 (2.8%) had received intermediate care, and 389 (5.2%) had received inadequate prenatal care (Table 2). The percentage of children receiving adequate prenatal care was slightly higher in Providence than the Rhode Island average of 85.2% (data not shown).[33] Among children with inadequate prenatal care, a higher percentage had elevated BLLs (16.7%, n=65), as compared to children with adequate prenatal care (9.3%). Approximately 30% of white children and 17% of black children received adequate prenatal care. Children whose mothers received public health insurance or had no

health insurance were more likely to have received either inadequate or intermediate prenatal care.

Results of the logistic regression analysis indicate that, compared to children with adequate prenatal care, children with inadequate care were more likely to have elevated BLLs across all benchmarks definitions of elevated BLL (Table 3). When the BLL benchmark of 10 µg/dL was used, children with inadequate prenatal care were 1.68 times as likely to have elevated BLLs compared with children whose mothers had received adequate prenatal care (95% CI 1.26, 2.24). In addition, black/Cape Verdean children had a significantly higher risk compared with white children for elevated BLLs for all three benchmarks of 5, 10, and 15 µg/dL. By contrast, Hispanic children had a lower risk compared with white children of having elevated blood lead levels across all three BLL benchmarks (at 10 µg/dL, OR=0.72; 95% CI 0.58, 0.88). The protective effect for Hispanic children was stronger as the benchmark for elevated BLL increased. The effect of low birthweight was independent of a child's risk of an elevated BLL (at 10 µg/dL, OR=0.81; 95% CI 0.59, 1.10). Finally, having public insurance appeared to have a statistically significant and positive relationship with elevated BLLs for all three benchmarks.

Table 1. Demographic characteristics of study population and excluded children

	Characteristics of study population (n=7,547)		*Characteristics of excluded children (n=5,689)*	
	n	*Percent*	n	*Percent*
Birthweight				
Adequate weight	7,001	92.8	5,086	89.6
Low weight	544	7.2	591	10.4
Risk disposition				
Risk positive	4,672	61.9	3,373	59.3
Risk suspect	1,399	18.5	936	16.5
Risk negative	1,476	19.6	1,377	24.2
Child's race/ethnicity				
White	2,181	28.9	2,314	40.6
Hispanic	3,461	45.9	1,903	33.5
Black/ Cape Verdean	1,289	17.1	1,062	18.7
Asian	565	7.5	366	6.4
American Indian	24	0.3	11	0.2
Other/unknown	27	0.4	33	0.6
Child's gender				
Male	3,885	51.5	2,920	51.3
Female	3,662	48.5	2,767	48.6
Average age of children	3.2		2.4	
Prenatal care				
Adequate	6,946	92.0	3,922	90.1
Intermediate	212	2.8	163	3.7
Inadequate	389	5.2	266	6.1
Insurance status				
Public	4,872	64.6	3,206	56.4
Private	2,326	30.8	2,047	36.0
No insurance	136	1.8	146	2.6
Other/unknown	213	2.8	287	5.1
Mother's education				
Less than 11 years	2,384	31.6	1,210	23.1
Greater than or equal to 11 years	6,163	68.4	4,033	76.9
Marital status				
Married	2,709	35.9	2,464	43.3
Single	4,485	59.4	2,972	52.3
Divorced/ separated/ widowed	353	4.7	248	4.4
Average age of mother	25.6		26.6	
Mother's age				
12–19	1,389	18.4	870	15.3
20–40+	6,158	81.6	4,809	84.7

To assess for effect modification, logistic regression models were stratified by birthweight (Table 4). Birthweight was chosen for the study as an effect modifier because the literature has suggested that for biologic reasons low birthweight infants may be more vulnerable to lead exposure[34,35] and therefore may be at higher risk for having elevated blood lead levels.[22] Children with low birthweight often have low iron and calcium stores, which could place them at a greater risk for lead poisoning.[34,36–39] The stratified models showed a persistent increased risk of elevated BLLs for adequate birthweight children whose mothers received inadequate prenatal care (5 µg/dL: OR=1.31, 95% CI 1.04, 1.65; 10 µg/dL: OR=1.72, 95% CI 1.27, 2.33; 15 µg/dL: OR=1.96, 95% CI 1.61, 3.31). There was an increased risk of elevated BLLs among low birthweight children whose mothers had received inadequate prenatal care for the 5 µg/dL and 10 µg/dL benchmarks, but these results were not statistically significant. Birthweight did not appear to modify the association between prenatal care and risk of having an elevated BLL.

DISCUSSION

This study indicates that children whose mothers received inadequate prenatal care are at risk for having elevated BLLs in childhood. Our results also show that this relationship persists across three definitions of an elevated BLL (5, 10, and 15 µg/dL). Our findings are consistent with an earlier study of children residing in Charleston, South Carolina;[22] however, our study had a larger and more racially and socio-economically diverse sample, and our analysis incorporated all of the children's available lead data.

Table 2. Covariates stratified by level of prenatal care received

	Inadequate prenatal care (n=389)		*Intermediate prenatal care (n=212)*		*Adequate prenatal care (n=6,946)*	
Predictor	n	*Percent*	n	*Percent*	n	*Percent*
Birthweight						
Adequate weight	335	86.1	189	89.2	6,477	93.3
Low weight	54	13.9	23	10.8	467	6.7
Elevated blood lead (>/10 μg/dL)						
No	324	83.3	190	89.6	6300	90.7
Yes	65	16.7	22	10.4	646	9.3
Risk disposition						
Risk positive	325	83.5	212	100.0	4,135	59.5
Risk suspect	45	11.6	0	0.0	1,354	19.5
Risk negative	19	4.9	0	0.0	1,457	21.0
Child's race/ethnicity						
White	68	17.5	37	17.5	2,076	29.9
Hispanic	191	49.1	103	48.6	3,167	45.6
Black/Cape Verdean	91	23.4	48	22.6	1,150	16.6
Asian	35	9.0	23	10.8	507	7.3
American Indian	0	0.0	1	0.5	23	0.3
Other/unknown	4	1.0	0	0.0	23	0.3
Insurance status						
Public	305	78.4	179	84.4	4,388	63.2
Private	42	10.8	20	9.4	2264	32.6
No insurance	35	9.0	11	5.2	90	1.3
Other/unknown	7	1.8	2	0.9	204	2.9
Mother's education						
Less than 11 years	149	38.3	92	43.4	2,143	17.7
Greater than or equal to 11 years	240	61.7	120	56.6	5,714	82.3
Marital status						
Married	75	19.3	33	15.6	2,601	37.4
Single	298	76.6	161	75.9	4,026	58.0
Separated/divorced/ widowed	16	4.1	18	8.5	319	4.6
Mother's age						
12–19	103	26.5	54	25.5	1,232	17.7
20–40+	286	73.5	184	74.5	5,714	82.3

Our findings suggest that although prenatal care may be a proxy for the breadth and depth of a mother's social support as well as educational and economic resources, prenatal care has an independent protective effect against elevated BLLs in the future. Mothers who have not completed high school are more likely to be unemployed or underemployed and therefore have fewer economic and financial resources.[31] Higher SES may reflect the resources available to the mother, which may enhance her capacity to reduce environmental lead exposure. These women tend to be married and receive social and emotional support from the infant's father during pregnancy.[40] Second, recipients of adequate prenatal care are likely to have better nutrition, which in turn can lessen the impact of lead exposure both *in utero* and during childhood.[41] Nevertheless, even after controlling for other SES measures such as maternal education, marital status, and insurance status, the protective effect of prenatal care against elevated BLLs persisted, suggesting that this form of early intervention can potentially reduce the risk of childhood lead poisoning.

Our results should be considered in light of the strengths and limitations of the study. First, the available SES variables could only partially account for child and maternal socioeconomic position. We used insurance coverage as a proxy for SES and access to health care, but this is an imperfect measure that may have allowed for residual confounding. Within Rhode Island major providers for RIte Care, Rhode Island's Medicaid Managed Care Program also offers private insurance plans. Because we could not distinguish

between these two plans, recipients of subsidized health insurance through private insurance companies may have been misclassified as having private insurance. This would have underestimated the true effect of receiving public health insurance, or of being of low socioeconomic status. Second, there was no way to determine whether black Hispanic children had been identified as Hispanic or black. If many of the children identified as black were in fact Hispanic, the true relationship between Hispanic ethnicity and the risk of having an elevated blood lead level would be stronger than shown in this study. This may explain the lower effect observed among Hispanic children compared with white children. Third, we had no data on the nutritional status of the mother or the infant, which may be a potential confounder of the observed relationship between the adequacy of prenatal care and elevated blood lead levels. Finally, because the Kessner Index does not consider information about the entire pregnancy, the measure tends to underestimate the inadequacy of prenatal care.[42] Consequently, potential misclassification could have underestimated the strength of association between inadequate prenatal care and elevated BLLs. Although other more precise

Table 3. Results of logistic regression modeling the odds of elevated BLLs

	Elevated blood lead level ≥5 µg/dL (n=3,692)			*Elevated blood lead level ≥10 µg/dL (n=733)*			*Elevated blood lead level ≥15 µg/dL (n=196)*		
	Adj. OR	*95% CI*	*p-value*	*Adj. OR*	*95% CI*	*p-value*	*Adj. OR*	*95% CI*	*p-value*
Prenatal care									
Adequate	1.00	—	—	1.00	—	—	1.00	—	—
Intermediate	0.96	0.73, 1.28	0.794	0.93	0.59, 1.46	0.747	0.83	0.33, 2.07	0.692
Inadequate	1.36	1.09, 1.68	0.006	1.68	1.26, 2.24	0.0004	1.83	1.10, 3.04	0.019
Birthweight									
Adequate weight	1.00	—	—	1.00	—	—	1.00	—	—
Low weight (<2,500g)	0.81	0.67, 0.97	0.022	0.81	0.59, 1.10	0.174	0.82	0.46, 1.46	0.491
Risk disposition									
Risk negative	1.00	—	—	1.00	—	—	1.00	—	—
Risk suspect	1.09	0.92, 1.30	0.323	1.13	0.82, 1.57	0.448	1.38	0.76, 2.52	0.289
Risk positive	1.12	0.94, 1.34	0.223	1.17	0.84, 1.63	0.349	1.23	0.67, 2.27	0.504
Child's race/ethnicity									
White	1.00	—	—	1.00	—	—	1.00	—	—
Hispanic	0.80	0.71, 0.91	0.0003	0.72	0.58, 0.88	0.002	0.56	0.38, 0.83	0.004
Black/Cape Verdean	1.57	1.35, 1.82	0.0001	1.58	1.26, 1.98	0.0001	1.57	1.06, 2.32	0.024
Asian	1.16	0.96, 1.40	0.132	1.12	0.82, 1.52	0.485	0.96	0.54, 1.71	0.904
American Indian	1.42	0.61, 3.31	0.416	1.10	0.32, 3.77	0.876	2.83	0.64, 12.54	0.170
Other/unknown[1]	0.77	0.35, 1.72	0.529	1.42	0.42, 4.84	0.573			
Insurance status									
Private	1.00	—	—	1.00	—	—	1.00	—	—
Public	1.26	1.12, 1.43	0.0002	1.61	1.29, 2.00	0.0001	1.43	0.96, 2.14	0.077
No insurance	1.06	0.74, 1.53	0.744	1.57	0.90, 2.75	0.113	0.30	0.04, 2.27	0.246
Other/unknown	0.86	0.64, 1.15	0.316	1.48	0.90, 2.41	0.120	1.73	0.77, 3.90	0.186
Mother's education									
Less than 11 years	1.44	1.28, 1.61	0.0001	1.42	1.18, 1.71	0.0002	1.21	0.86, 1.71	0.279
Greater than or equal to 11 years	1.00	—	—	1.00	—	—	1.00	—	—
Marital status									
Married	1.00	—	—	1.00	—	—	1.00	—	—
Single	1.24	1.07, 1.42	0.003	1.06	0.83, 1.35	0.639	1.05	0.66, 1.65	0.839
Separated/divorced/ widowed	1.26	0.99, 1.61	0.061	0.86	0.55, 1.28	0.509	1.53	0.76, 3.10	0.237
Mother's age									
12–19	1.20	1.05, 1.37	0.007	1.03	0.84, 1.27	0.742	1.12	0.76, 1.63	0.573
20–29	1.00	—	—	1.00	—	—	1.00	—	—

[1]No study subjects in Other/unknown category for elevated blood lead levels ≥15µg/dL

OR = odds ratio

CI = confidence interval

Table 4. Logistic models stratified by birthweight

Elevated blood lead levels ≥5 µg/dL	*Low birthweight*			*Adequate weight*		
	Adj. OR[1]	*95% CI*	*p-value*	*Adj. OR*[1]	*95% CI*	*p-value*
Prenatal care						
Adequate	1.00	—	—	1.00	—	—
Intermediate	1.34	(0.55, 3.26)	0.514	0.93	(0.69, 1.25)	0.633
Inadequate	1.54	(0.83, 2.83)	0.168	1.31	(1.04, 1.65)	0.021
Elevated blood lead levels ≥10 µg/dL	*Low birthweight*			*Adequate weight*		
	Adj. OR[1]	*95% CI*	*p-value*	*Adj. OR*[1]	*95% CI*	*p-value*
Prenatal care						
Adequate	1.00	—	—	1.00	—	—
Intermediate	0.90	(0.19, 4.30)	0.896	0.93	(0.58, 1.5)	0.775
Inadequate	1.44	(0.58, 3.60)	0.43	1.72	(1.27, 2.33)	0.0004
Elevated blood lead levels ≥15 µg/dL	*Low birthweight*			*Adequate weight*		
	Adj. OR[1]	*95% CI*	*p-value*	*Adj. OR*[1]	*95% CI*	*p-value*
Prenatal care						
Adequate	1.00	—	—	1.00	—	—
Intermediate[2]				0.92	(0.37, 2.29)	0.853
Inadequate	0.826	(0.10, 6.86)	0.859	1.96	(1.61, 3.31)	0.012

[1]Adjusted for risk disposition, child's race/ethnicity, insurance status, mother's educational attainment level, marital status, and mother's age.

[2]Sample size too small for analysis.

Adj. OR = odds ratio

CI = confidence interval

indices such as Kotelchuck Adequacy of Prenatal Care Utilization Index are available, these indices require information that was unavailable in our dataset.[42]

Despite some of these limitations, our analysis improves on previous studies by estimating blood lead levels averaged across several tests for each child, which allows for more stable estimates than would be possible with a single measure, as is the case with extant studies on the association between prenatal care and lead exposure. Although Rhode Island has relatively high insurance enrollment rates, our study sample is racially and socioeconomically diverse. These strengths combined with our large sample size make it likely that our findings can be generalized to urban populations along the Eastern seaboard.

Our results suggest that the prenatal care setting may be an appropriate place to identify pregnant mothers at high risk of living in lead-contaminated environments. Effective models of such preventative counseling in prenatal care settings already exist.[19,22,43,44] In the case of childhood lead prevention, comprehensive and timely prenatal care could connect women to nutrition programs such as WIC. Second, prenatal care is a suitable place to begin lead education and to identify those women whose future children may be at high risk of living in lead-contaminated environments. Blood lead testing of the pregnant mother could help identify mothers experiencing high exposures from contaminated environments or other sources. While the mother's BLL may be a reflection of bone-lead mobilization, it may also reflect current lead exposures from either lead paint or from cultural items such as the use of lead-glazed cooking vessels, traditional remedies, or spices that contain lead that could later poison the child.[21,45,46] Expanding access to prenatal care through outreach programs and conducting lead screening as a regular part of care provision could help identify women possibly experiencing ongoing lead exposure and enable health care providers to inquire about lead hazards in the mother's home.[47] By identifying mothers living in homes that pose a high risk of lead exposure early in the pregnancy, future exposures to offspring could potentially be avoided. Given limited resources for conducting effective childhood lead prevention programs, tapping into existing public health promotion infrastructure and expanding the provision of prenatal care to support lead exposure reduction efforts would be prudent.

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