

Timing and Duration of Pre- and Postnatal Homelessness and the Health of Young Children

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abstract

OBJECTIVES: Prenatal homelessness is associated with elevated risks of adverse neonatal outcomes. How the timing and duration of homelessness during pregnancy and/or a child's early life relate to postnatal child health is unclear.

METHODS: We interviewed 20 571 low-income caregivers of children <4 years old in urban pediatric clinics and/or emergency departments in 5 US cities. Categories of homelessness timing were prenatal, postnatal, both, or never; postnatal duration was >6 months or <6 months.

RESULTS: After controlling for birth outcomes and other potential confounders, compared with never-homeless children, children who were homeless both pre- and postnatally were at the highest risk of the following: postneonatal hospitalizations (adjusted odds ratio [aOR] 1.41; confidence interval [CI] 1.18–1.69), fair or poor child health (aOR 1.97; CI 1.58–2.47), and developmental delays (aOR 1.48; CI 1.16–1.89). There was no significant association with risk of underweight (aOR 0.95; CI 0.76–1.18) or overweight status (aOR 1.07; CI 0.84–1.37). Children <1 year old with >6 months of homelessness versus those who were never homeless had high risks of fair or poor health (aOR 3.13; CI 2.05–4.79); children 1 to 4 years old who were homeless for >6 months were at risk for fair or poor health (aOR 1.89; CI 1.38–2.58).

CONCLUSIONS: After controlling for birth outcomes, the stress of prenatal and postnatal homelessness was found to be associated with an increased risk of adverse pediatric health outcomes relative to those who were never homeless. Interventions to stabilize young families as quickly as possible in adequate and affordable housing may result in improved pediatric health outcomes.



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WHAT'S KNOWN ON THIS SUBJECT: Adverse housing conditions, such as homelessness, affect the well-being of young children. However, the effects of the timing and duration of homelessness are not fully understood.

WHAT THIS STUDY ADDS: Children who experience homeless both pre- and postnatally and for >6 months were at the highest risk of negative health outcomes.

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More than 500 000 people in the United States are homeless on any single night, and ~40% of those are families with children.¹ On an annual basis, childhood homelessness impacts as many as 1 in 30 (2.5 million) children in the United States each year.² In 2015, the US Department of Housing and Urban Development found that almost half of families experiencing homelessness had a child under the age of 6 years, and 10.4% of homeless families had an infant <12 months of age.³ Decades of scientific research demonstrate the harmful effects of homelessness that are experienced during early childhood on young children's growth and development.^{4,5} In a growing body of evidence, researchers identify pregnancy as a vulnerable period in young children's lifetime health and development.⁶⁻⁹ In our previous research, we reported that infants whose mothers' experienced homelessness prenatally had significantly increased adjusted odds of low birth weight status compared with infants of mothers who were consistently housed and infants who experienced postnatal homelessness only.¹⁰ Additionally, the stress of homelessness during early development can disrupt the developing brain's architecture and lead to potentially persistent adverse changes in brain and body function and higher levels of stress-related chronic diseases later in life.¹¹

Few studies have explored the effects of the timing and duration of homelessness separately on child health.¹² We hypothesized that poor child health is associated with the timing of homelessness across 3 specific critical developmental time periods: prenatal only, postnatal only, or both prenatal and postnatal versus never homeless. We hypothesized that homelessness during any time period would be associated with poor child health outcomes, and those with both prenatal and postnatal homelessness would have

the greatest adjusted odds of poor child health compared with those who were never homeless, those with prenatal homelessness only, or those with postnatal homelessness only. Furthermore, we hypothesized that a longer duration (6 or more months) of postnatal homelessness would be associated with higher adjusted odds of adverse child health outcomes compared with those who were never homeless.

METHODS

Between May 1, 2009, and January 1, 2015, researchers with the ongoing Children's HealthWatch study interviewed 20 571 caregivers of children <4 years old seeking medical care in emergency rooms or primary care clinics in Baltimore, Maryland; Boston, Massachusetts; Little Rock, Arkansas; Minneapolis, Minnesota; and Philadelphia, Pennsylvania. Institutional review board approval was obtained at each site before data collection and renewed annually. Interviewers elicited caregivers' verbal responses to a survey of household demographics, experiences with homelessness, and child health and development. Eligibility criteria included the following: child age ≤48 months; residency in the state of the research site; caregiver ability to speak English, Spanish, or Somali (in Minneapolis only); respondent living in the child's household; and consenting to be interviewed.

Of the 28 067 caregivers approached, 3108 (11.1%) were ineligible for the study, and 1912 (7.7% of the eligible) refused or were unable to complete the interview. Those with missing data about homelessness ($n = 231$) were excluded. As a proxy for low income, families with private health insurance were excluded ($n = 2245$), leaving a final study sample of 20 571 caregiver-index-child pairs with public or no insurance.¹³

Measures

Homelessness

Prenatal and postnatal homelessness were determined via affirmative responses to the questions, "Were you ever homeless, or did you live in a shelter when you were pregnant with this child?" and "Since your child was born, has she or he ever been homeless or lived in a shelter?" For the latter question, interviewers followed up on affirmative answers by asking about the duration of homelessness during the child's lifetime (<6 months, 6-12 months, and ≥12 months). For these questions, homelessness was defined as living in a shelter, motel, temporary or transitional living situation, or scattered site housing (in Massachusetts, scattered site housing is paid for by the state emergency shelter system) or having no steady place to sleep at night. Our primary exposure was then defined such that families were categorized by homelessness timing: prenatal, postnatal, both, or never. In a secondary analysis, the duration of a child's postnatal homelessness was characterized as either at least 6 months or <6 months. This analysis was stratified by child age: <1 year of age and >1 year of age. Stratification was performed to determine the presence of effect modification based on child age group. To examine the effects of longer-term homelessness (>6 months) in the youngest children, we needed to stratify at the 6-month cut point. For consistency, we used the same cut point for children ≥12 months of age.

Child Health Outcomes

The child health outcomes examined in this study were as follows: current child health status, history of hospitalizations, developmental risk, and anthropometric measures. Caregivers characterized their children's health as excellent, good, fair, or poor using a question from the 1988-1994 NHANES. We

administered the Parents' Evaluation of Developmental Status (PEDS), a validated, 10-question, widely used screening instrument that is used to identify developmental risk. Because the PEDS sensitivity and specificity are better for children >4 months of age, we asked the PEDS questions of caregivers with index children ≥ 4 months of age. On the basis of the standard scoring of the PEDS, endorsed items are classified as significant or nonsignificant concerns depending on the age of the child. Children with ≥ 2 significant concerns are scored as being at developmental risk with clinical indication for diagnostic testing ("developmental risk").^{14–16}

Caregivers also reported the number of the children's previous hospitalizations, excluding those at birth. Children were categorized as having a history of any postnatal hospitalizations versus having none. Children's weight and length were ascertained from their medical records on the day of the interview to determine whether they fell within normal anthropometric parameters. Anthropometric parameters were defined as whether a child was at risk for underweight status (weight for age less than the fifth percentile or weight for length <10th percentile for Centers for Disease Control and Prevention age- and/or sex-standardized growth trajectories) and whether the child was overweight (weight for length ≥ 95 th percentile for children <24 months old and BMI >85th percentile for children ≥ 24 months old).

Data Analysis

Descriptive statistics were used to characterize participants overall and by homeless status by using χ^2 testing and analysis of variance. Separate multivariable logistic regression models were fit to determine the association between the timing and duration of homelessness and child health and

development. All timing models were adjusted for survey year and site; mother's birthplace, race and/or ethnicity, education, employment status, and marital status; and child's age (<12 months or ≥ 12 months), birth weight, and gestational age. In the secondary analysis, interaction models between age group (<12 months or ≥ 12 months) and duration of homelessness (≥ 6 months or <6 months) were conducted, and the duration of homelessness was then stratified by child age and adjusted for site; mother's birthplace, race and/or ethnicity, education, employment status, and marital status; breastfeeding; and low birth weight. Propensity score matching was performed as a confirmatory analysis of the primary models to further control for potential confounding. Propensity scores were developed to account for factors that are associated with homelessness timing by creating a random sample of never-homeless families that had the same propensity score categories as the primary exposure: prenatal homelessness, postnatal homelessness, or both. Two-tailed tests and an α level of .05 were used for all tests. All analyses were performed by using SAS version 9.3 (SAS Institute, Inc, Cary, NC).

RESULTS

Of the 20 571 caregivers interviewed, 661 (3.2%) reported homelessness prenatally only, 758 (3.7%) reported homelessness postnatally only, and 729 (3.5%) reported homelessness both prenatally and postnatally (hereafter referred to as both). The remainder (18 423; 89.6%) were never homeless (hereafter referred to as never), as indicated in Table 1. Caregivers in the prenatally and postnatally homeless group had the lowest prevalence of being married and/or partnered (19.9%) compared with the prenatally homeless-only

(22.9%), postnatally homeless-only (26.3%), and never-homeless (39.8%) groups. Slightly more than one-third of the sample was Hispanic (31.4%), approximately half was non-Hispanic African American (50.9%), nearly one-sixth was non-Hispanic white (14.2%), and 3.5% was other. The prenatally homeless-only, postnatally homeless-only, and prenatally and postnatally homeless groups are all compared with the never-homeless group.

Prenatally and Postnatally Homeless Group

Children in the both group had higher odds of the following adverse health outcomes than children in the never-homeless group: history of postnatal hospitalizations (adjusted odds ratio [aOR] 1.41; confidence interval [CI] 1.18–1.69; $P < .001$), fair or poor child health (aOR 1.97; CI 1.58–2.47; $P < .001$), and developmental risk (aOR 1.48; CI 1.16–1.89; $P < .01$). There were no statistically significant differences for risk of underweight (aOR 0.95; CI 0.76–1.18; $P = .62$) or overweight status (aOR 1.07; CI 0.84–1.37; $P = .57$) compared with children in the never-homeless group (Table 2).

Prenatally Homeless-Only Group

Children in the prenatally homeless-only group were significantly more likely to have been hospitalized since birth (aOR 1.20; CI 1.00–1.45; $P = .05$) and be in fair or poor health (aOR 1.35; CI 1.06–1.74; $P = .02$). There were no statistically significant differences in developmental risk (aOR 1.12, CI 0.85–1.48; $P = .42$) compared with children in the never-homeless group. There were no statistically significant differences in risk of underweight (aOR 0.92; CI 0.73–1.15; $P = .45$) or overweight status (aOR 0.93; CI 0.71–1.23; $P = .62$) compared with children in the never-homeless group.

Postnatally Homeless-Only Group

Children in the postnatally homeless-only group were also

TABLE 1 Demographics

Variable	Overall, n (%)	No Pre- or Postnatal Homelessness, n (%)	Prenatal Homelessness Only, n (%)	Postnatal Homelessness Only, n (%)	Pre- and Postnatal Homelessness, n (%)	P
Total	20571	18423 (89.6)	661 (3.2)	758 (3.7)	729 (3.5)	
Site						
Baltimore	3895 (18.9)	3525 (19.1)	186 (28.1)	96 (12.7)	88 (12.1)	<.0001
Boston	4151 (20.2)	3087 (16.8)	233 (35.2)	413 (54.5)	418 (57.3)	—
Little Rock	4457 (21.7)	4327 (23.5)	39 (5.9)	52 (6.9)	39 (5.3)	—
Minneapolis	3124 (15.2)	2826 (15.3)	91 (13.8)	85 (11.2)	122 (16.7)	—
Philadelphia	4944 (24.0)	4658 (25.3)	112 (16.9)	112 (14.8)	62 (8.5)	—
Mother's place of birth						
United States	15694 (76.4)	13890 (75.6)	599 (90.6)	583 (77.0)	622 (85.4)	<.0001
Immigrant	4836 (23.6)	4494 (24.4)	62 (9.4)	174 (23.0)	106 (14.6)	—
Race and/or ethnicity						
Hispanic	6409 (31.4)	5848 (32.0)	138 (21.1)	244 (32.4)	179 (24.9)	<.0001
African American, non-Hispanic	10375 (50.9)	9169 (50.2)	403 (61.7)	392 (52.1)	411 (57.2)	—
White, non-Hispanic	2900 (14.2)	2657 (14.5)	80 (12.3)	76 (10.1)	87 (12.1)	—
Other	710 (3.5)	597 (3.3)	32 (4.9)	40 (5.3)	41 (5.7)	—
Married and/or partnered						
No	12721 (61.9)	11067 (60.2)	487 (73.7)	584 (77.1)	583 (80.1)	<.0001
Yes	7815 (38.1)	7323 (39.8)	174 (26.3)	173 (22.9)	145 (19.9)	—
Caregiver education						
Less than high school	5619 (27.4)	4962 (27.0)	203 (30.7)	238 (31.6)	216 (29.6)	.0047
High school	7997 (39.0)	7175 (39.1)	268 (40.5)	270 (35.8)	284 (39.0)	—
College or more	6901 (33.6)	6236 (33.9)	190 (28.7)	246 (32.6)	229 (31.4)	—
Caregiver employment						
No	12744 (62.0)	11134 (60.5)	478 (72.3)	569 (75.2)	563 (77.2)	<.0001
Yes	7819 (38.0)	7282 (39.5)	183 (27.7)	188 (24.8)	166 (22.8)	—

—, not applicable.

TABLE 2 Timing

Child Health Outcomes ^{a,b}	Prenatal Homelessness Only		Postnatal Homelessness Only		Pre- and Postnatal Homelessness	
	aOR (95% CI)	P	aOR (95% CI)	P	aOR (95% CI)	P
Child hospitalization (lifetime)	1.20 (1.00–1.45)	.05	1.22 (1.03–1.45)	.03	1.41 (1.18–1.69)	<.001
Fair or poor child health	1.35 (1.06–1.74)	.02	1.37 (1.09–1.73)	.01	1.97 (1.58–2.47)	<.001
PEDS: 2 or more concerns	1.12 (0.85–1.48)	.42	1.34 (1.07–1.69)	.01	1.48 (1.16–1.89)	.002
At risk for underweight	0.93 (0.71–1.15)	.45	0.83 (0.65–1.05)	.12	0.95 (0.76–1.18)	.62
Overweight	0.93 (0.71–1.23)	.62	1.09 (0.86–1.39)	.49	1.07 (0.84–1.37)	.57

^a Adjusted for site; mother's birthplace, race and/or ethnicity, education, employment, and marital status; child's age (<12 mo or ≥12 mo); survey year; preterm birth; and low birth wt.^b Referent group was never pre- and/or postnatal homelessness.

significantly more likely to have been hospitalized since birth (aOR 1.22; CI 1.03–1.45; $P = .03$), be in fair or poor health (aOR 1.37; CI 1.09–1.73; $P = .01$), and be at developmental risk (aOR 1.34; CI 1.07–1.69; $P = .01$) compared with children who were never homeless. There were no statistically significant differences in risk of underweight (aOR 0.83; CI 0.65–1.05; $P = .12$) or overweight status (aOR 1.09; CI 0.86–1.39; $P = .49$) compared with children in the never-homeless group. Confirmatory

propensity score analysis yielded similar results to the primary analysis (data not shown).

A significant interaction ($P < .05$) was found between child age and the duration of homelessness for fair or poor health, developmental risk, and overweight status. Age-stratified analysis revealed that infants (≤ 12 months old) and toddlers (> 12 months old) who experienced homelessness for > 6 months in the postnatal period had higher odds of adverse health outcomes than

infants and toddlers who were never homeless.

Infants

Infants who had been homeless for > 6 months versus those who had never been homeless were significantly more likely to have a history of hospitalizations (aOR 1.51; CI 1.03–2.22; $P = .04$), be in fair or poor health (aOR 3.13; CI 2.05–4.79; $P < .001$), be at developmental risk (aOR 1.81; CI 1.11–2.94; $P = .02$), and have overweight status (aOR 1.74; CI 1.12–2.70; $P < .01$), as shown in

TABLE 3 Duration of Postnatal Homelessness (<6 or ≥6 Months) by Child Age and Associations With Child Health Outcomes

	No Pre- or Postnatal Homelessness	Child Age <12 mo		Child Age ≥12 mo	
		Postnatal Homelessness, aOR (95% CI)	<i>P</i>	Postnatal Homelessness, aOR (95% CI)	<i>P</i>
Homelessness duration <6 mo, child health outcomes					
Lifetime hospitalizations (yes or no)	1.00	1.20 (0.92–1.57)	.1770	1.19 (0.94–1.50)	.1437
Child health fair or poor	1.00	1.71 (1.21–2.40)	.0021	1.36 (0.99–1.85)	.0543
PEDS: 2 or more concerns	1.00	1.87 (1.26–2.77)	.0019	1.33 (1.00–1.76)	.0492
At risk for being underweight	1.00	0.96 (0.72–1.28)	.7702	0.65 (0.46–0.93)	.0186
Overweight	1.00	1.19 (0.85–1.65)	.3099	1.10 (0.78–1.55)	.5723
Homelessness duration >6 mo, child health outcomes					
Lifetime hospitalizations (yes or no)	1.00	1.51 (1.03–2.22)	.0368	1.47 (1.15–1.87)	.0020
Child health fair or poor	1.00	3.13 (2.05–4.79)	≤.0001	1.89 (1.38–2.58)	≤.0001
PEDS: 2 or more concerns	1.00	1.81 (1.11–2.94)	.0030	1.25 (0.93–1.68)	.1430
At risk for being underweight	1.00	0.90 (0.57–1.42)	.6470	1.14 (0.83–1.54)	.4059
Overweight	1.00	1.74 (1.12–2.70)	.0133	1.04 (0.74–1.46)	.8334

Table 3. There were no statistically significant differences in being at risk for underweight status (aOR 0.90; CI 0.57–1.42; *P* = .64) compared with infants who were never homeless.

Toddlers

Toddlers who were homeless for >6 months were significantly more likely to have a history of hospitalizations (aOR 1.47; CI 1.15–1.87; *P* = .002) and to be in fair or poor health (aOR 1.89; CI 1.38–2.58; *P* < .001). There were no statistically significant differences in developmental risk (aOR 1.25; CI 0.93–1.68; *P* = .14) or being at risk for overweight (aOR 1.04; CI 0.74–1.46; *P* = .83) or underweight status (aOR 1.14; CI 0.83–1.54; *P* = .14) compared with toddlers who were never homeless.

In comparison, infants who had been homeless for <6 months were significantly more likely to be in fair or poor health; however, we found no significant association with history of hospitalizations, developmental risk, or being at risk for underweight or overweight status. Toddlers who had been homeless for <6 months were significantly more likely to be at developmental risk and at risk for underweight status; however, we found no significant association

with history of hospitalizations, fair or poor health, or overweight status.

DISCUSSION

Previous researchers have found that there is an independent relationship between homelessness in childhood and poor health status.^{17,18} Prenatal homelessness negatively affects birth outcomes and can be used to predict poor child health outcomes.^{16,19–22} Crowding, which is associated with low birth weight, is commonly found in shelters and short-term living situations and has been associated with increased food insecurity, which is a known child health risk. Limited social capital, which often precedes homelessness, may be associated with reduced material resources as well as a lack of emotional support that is essential to maternal self-care.^{14,16,23} Women who are homeless tend to report higher levels of maternal stress, depression, and anxiety than women with housing; in turn, each of these conditions is related to hypertension, increased cortisol, and a higher risk of low birth weight and prematurity.^{24,25}

The data reported here reveal 2 specific harmful associations of homelessness with child health and development: timing and duration. This reveals that both the

developmental timing and postnatal duration of homelessness may compound the risk of negative child health outcomes. Thus, there is no safe time during early development for experiencing homelessness.

We acknowledge several limitations. First, the retrospective design reveals associations between homelessness and children's health; caution needs to be exercised with assuming causality because of the potential for unmeasured confounding. Other unmeasured covariates may potentially alter the adverse child health outcomes described in this study, although confirmatory propensity score matching revealed similar results. Additionally, with the exception of child weight and height, all data were self-reported, including the caregivers' disclosure of experiencing homelessness, which may have introduced reporting bias and shared-method variance. Data on the type and quality of living arrangements of those who were not identified as homeless before pregnancy, during pregnancy, or since the child's birth were not available.

CONCLUSIONS

The findings of this study have clinical and public policy implications. Experiencing

homelessness early in development, whether before or after birth, may contribute to a variety of negative outcomes for children's health and well-being.¹² Greater health care use because of poor health status, increased hospitalizations, and the need for developmental interventions creates substantial family costs associated with caregiver, household, and economic stresses and societal costs, including increased health care expenses and loss of human capital.^{26,27}

Interventions that are used to prevent family homelessness can be extremely effective from both public health and child development perspectives. By responding to the upstream needs of pregnant women who are at risk for homelessness, the risk of poor birth outcomes and later poor child health and development outcomes may be reduced.

Practitioners should assess patients for housing instability, documenting its prevalence and associated health risks to advocate for more resources and drive innovations in addressing housing stability as a clinically important social determinant of health.¹³ Potential interventions include early identification of pregnancy and access to appropriate nutrition and medical care as well as targeting homelessness prevention services for at-risk families.^{10,28}

Additionally, hospitals and health systems have created permanent, supportive housing initiatives with the aim of reducing health care use among the chronically homeless.²⁹ For example, the Camden Coalition of Healthcare Providers in New Jersey and Hennepin County Health Center in Minnesota use housing vouchers to reduce health care costs; UnitedHealth Group has invested in new housing across the country; Bon Secours Health System in Baltimore, Maryland, and Nationwide Children's Hospital in Columbus, Ohio, have built affordable housing units; and Boston Medical Center in Boston, Massachusetts, has invested in a variety of affordable housing projects throughout Boston.^{30,31} Interventions that are used to rapidly house children and families are associated with reduced risk of poor birth and child health outcomes.³² In rapid rehousing programs, homeless families are relocated into permanent housing as soon as possible, and this acts as a preventive treatment to mitigate the health risks of prolonged child homelessness, resulting in smaller expenditures than other interventions and fewer reversions to homelessness, thus reducing homelessness levels overall.³³ Given the adverse impact of prolonged exposure to homelessness during

early development, minimizing the duration of homelessness by making affordable housing more available to women and children, in addition to rapid rehousing that provides long-term subsidized housing, is a critical and likely cost-effective treatment to promote child health and well-being.

These new research findings can be used to refine our understanding of associations between homelessness experienced during early childhood and poor health and development among young children. The earlier and longer in development a child experiences homelessness may have a larger cumulative toll of poor health and development outcomes, which in turn can have long-lasting effects on the child, family, and community. This new medical knowledge creates an urgent rationale for policy makers to develop ways to disrupt homelessness as a source of toxic stress and effectively promote the healthy development of young children.³⁴

ABBREVIATIONS

aOR: adjusted odds ratio
CI: confidence interval
PEDS: Parents' Evaluation of Developmental Status

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