

Grant number R40MC30755

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A Longitudinal Analysis of Health Care Utilization among Pregnant and Postpartum Homeless Women
and their Infants

No Embargo

Introduction

Helping children get a healthy start in life is one of the most important and potentially rewarding challenges that health care providers face. Housing instability and poverty are among the most often cited social determinants affecting the health of children and families. Unstable housing is associated with increased psychological stress and mental illness, poorer prenatal care, more birth complications and increased use of neonatal intensive care and other expensive health services.(1-4) Yet, healthcare providers have relatively little information to guide them in developing effective responses for families who struggle with homelessness and low incomes. Although the number of homeless families has grown over the past two decades, and pregnant homeless women are at exceedingly high risk for adverse outcomes, a recent review highlighted the need for current research to guide the public health and provider communities.(5) Much of the literature describing the health status of homeless mothers and children was published in the 1980's and 1990's, prior to the Affordable Care Act (ACA), Medicaid expansion and other significant developments; research on the health conditions and healthcare utilization of homeless pregnant women is especially sparse. New research is needed to elucidate the needs of families and children who are homeless in a post-ACA environment and to guide the development of interventions that will improve their health and well-being.

We linked emergency housing applications from homeless families, obtained from the Massachusetts Department of Housing and Community Development (DHCD), with Medicaid claims from 2008 through 2015 to describe similarities and differences between Massachusetts pregnant and postpartum women and infants who received emergency housing benefits, and similar Medicaid members.

The goal of the study was to produce practical information that healthcare systems and policymakers can use to develop more effective interventions for improving the health of women and infants who are unstably housed.

Our specific aims with associated hypotheses were to:

1. Describe the demographic and clinical characteristics of homeless women receiving Emergency Housing Assistance between 2008 and 2015 who have claims-based diagnoses related to pregnancy and/or childbirth.
2. Describe the demographic and clinical characteristics of infants from birth to 2 years of age who are members of a homeless family between 2008 and 2015; and to compare healthcare utilization and sources of care while housed and during episodes of homeless.
3. Develop a set of longitudinal models to explore the associations of pregnancy and maternal health with homelessness and with adverse infant outcomes.

Study Design and Methods

We conducted three separate sub-studies to address various elements of the three aims. In part, separate analyses were required because we could not reliably link claims for mothers and children. Instead of one analysis with linked records of all family members, mothers, and their children, we conducted three separate analyses: one of all family members, one focusing only on pregnant women, and one including children who were born in the period surrounding shelter entry.

Data

We began by creating a master database comprised of linked family applications for emergency shelter assistance, obtained from the Massachusetts Department of Housing and Community Development, and MassHealth medical claims; MassHealth is Massachusetts' Medicaid agency. Emergency assistance applications were available for the period beginning January 1, 2008 and ending June 30, 2015. This database was the source of all data for homeless families used in our analyses of the three aims. For analyses of pregnant women and of infants and children, we added comparison groups of similar MassHealth members who did not use emergency shelter during the study period

Emergency housing assistance in Massachusetts is specifically directed to families with at least one adult and one child younger than 21 years of age, or families in which a woman is pregnant. Shelter applicants must be homeless due to specific causes, including fire, flood, domestic violence, no-fault eviction, or substantial health and safety risk for a child. Massachusetts is a "right to shelter" state, which guarantees public shelter for homeless individuals and families. Single homeless persons are served by a separate system of shelters.

Income eligibility requirements for emergency shelter and MassHealth are similar. Most families who meet shelter requirements are also eligible for MassHealth. Pregnancy is a federally mandated eligibility category for Medicaid programs in all states.

Shelter and MassHealth claims were matched by birthdate, social security number, and sex. Ninety-six percent of shelter records matched with a MassHealth record. After linking these data, we used the date of shelter entry as a reference point to create a longitudinal database of shelter episodes, with each episode beginning twelve months before and ending twelve months after shelter entry. Measures for each month included total Medicaid expenditures, number of hospital admissions, emergency department visits, and several other measures of service utilization. Diagnoses, derived from International Classification of Disease, 9th edition codes, were summarized using Clinical Classification Software categories developed by the Agency for Healthcare Research and Quality(6). This data structure was modified somewhat for the final study of infants and children, where we aggregated data by twelve-month periods beginning at birth and continuing for up to six years for each child.

Overall Analytic Approach

Each of the three studies used a slightly different analytic strategy. In the first analysis, we sought to describe the longitudinal course of service use and expenditures for families before and after entering shelter, focusing on patterns associated with subgroups: all adults, all children, adults with behavioral health disorders, and pregnant women. We used generalized estimating equations (GEE) to compare changes in various outcomes measured in each month. The second study focused on pregnant women and included matched groups of women who did and did not use emergency shelter. In this study we compared rates of various health conditions, focusing on pregnancy complications. We used a series of logistic regression analyses to compare the two groups. The third analysis identified children born during the year before or after their families entered shelter. For this study we used all diagnostic information available on claims to determine the most common health conditions and follow all enrolled children for up to six years of age. In this analysis, we used simple bivariate statistics to compare diagnosed prevalence and service use between homeless and comparison groups in each year.

Limitations

Several factors limit the generalizability of all three studies. First, our data are limited to residents of Massachusetts. Other states may have different Medicaid enrollment or coverage criteria, as well as different approaches to providing shelter for homeless families. Second, missing or inaccurate data on shelter exit dates prevented us from analyzing the impact of varying lengths of shelter stays. Third, although claims data are a reasonably comprehensive measure of service use, we were not able to follow participants who lost MassHealth coverage or enrolled in another form of health insurance. Fourth, diagnoses used to identify health conditions represent only those conditions that were diagnosed and recorded by a clinician. Finally, relationships between variables in all three studies represent associations and cannot be interpreted as causal. Other limitations associated with a single analysis are discussed in descriptions of the analysis for that sub-study. Strengths of our database include a unique, multi-year combination of administrative data and health claims that accurately identifies families who used homeless shelters and provides a rich longitudinal record of service use and spending.

Each of the following three analyses builds on the database we have described. However, each analysis addresses a different population, beginning with all adults and children, moving to pregnant women, and finally to infants and children who were born while unstably housed.

Study # 1. Healthcare utilization and expenditures of homeless family members before and after emergency housing.(7)

The first study gives a broad overview of healthcare spending for adults and children in the months leading up to and following shelter entry. The longitudinal analysis demonstrates how health care encounters begin to increase as housing instability grows, peaking at, or shortly after shelter entry, then begin to decline after the family is sheltered.

Methods

We followed health care use and spending for 44,040 children and 34,783 adults during episodes of housing instability that resulted in emergency shelter use. Each episode of shelter use was defined as the twelve months before and twelve months after shelter entry. Longitudinal patterns of use were analyzed with GEE, episodes were clustered by family for those with more than one episode. The analysis is described more fully in the American Journal of Public Health paper and accompanying appendices where this study was published (7).

Results

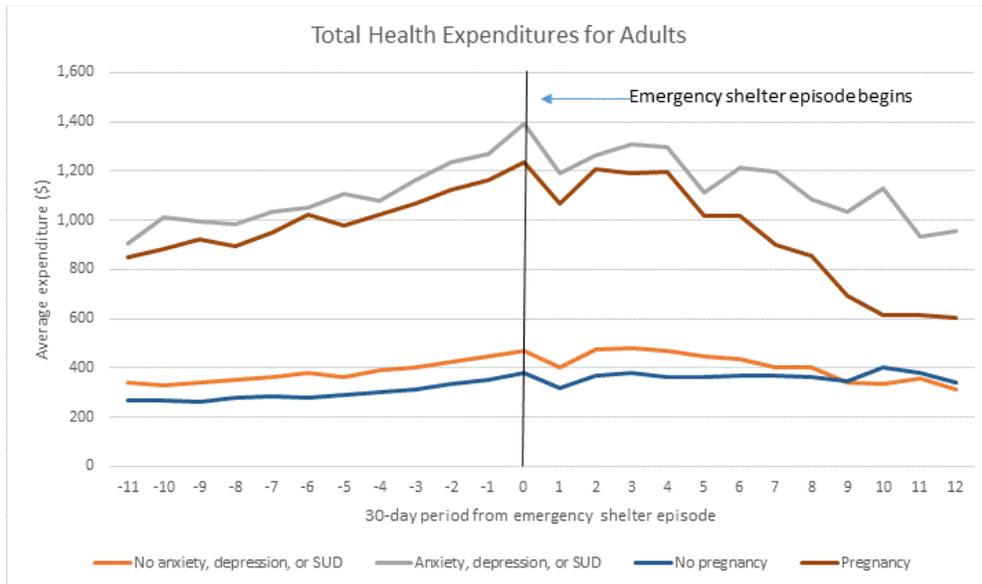
Children averaged between five and six years of age. Average age for adults was 29 years. Approximately eight in ten adults were women. Most families (87%) had only one shelter episode during the study period, 12% had two episodes and only one percent experienced three or more episodes.

Key outcomes included hospitalizations, emergency department visits, and expenditures. Children and adults had significantly different service use patterns and were analyzed separately. In the 12 months before shelter entry the percentage of adults with emergency department visits increased from approximately eight to almost eleven percent. Adult hospitalization rates increased by a small but significant amount during the same period. Children's emergency department use increased from four

percent to six percent during the same period. Hospitalization rates did not change significantly for children. Adult emergency department visits and hospitalizations peaked during the month of shelter entry and declined steadily afterward. Health care use was similar for children, but emergency visits and hospitalizations peaked in the month after shelter entry.

Further analysis showed that adults with a behavioral health disorder, including mental health or substance use, and pregnant women had substantially higher Medicaid expenditures and different trajectories of cost compared to adults without these conditions. Spending related to childbirth was excluded from the analysis. While all groups demonstrated a pattern of increasing spending in the months before shelter entry and decreasing spending afterward, total spending for the behavioral health and pregnancy groups was three to four times greater than spending for other adults (Figure 1). After shelter entry, spending in the pregnancy group declined more rapidly than in the behavioral health group. Combined spending for all children followed a similar pattern of increasing costs up to shelter entry and steadily declining costs afterward.

Figure 1.



Discussion

Declining use of emergency departments and hospitals, with accompanying decreases in spending after shelter entry suggest that shelter helps to stabilize health and lower health care costs. The pattern of increasing service use and spending leading up to shelter also suggests that health problems begin escalating months before families become literally homeless and qualify for emergency shelter. More effective screening coupled with rapid intervention could reduce spending and likely improve the health of children and vulnerable adults in unstably housed families. Still, health care providers are just beginning to experiment with various approaches to screening for social determinants of health and methods for addressing social needs that fall outside the areas typically addressed in health care settings. More research is needed to identify the most effective and efficient methods for identifying and helping homeless families.

Study #2. Associations between housing instability and pregnancy complications (8).

Building on findings from the first study of all family members, our second study sought to understand the health and service use challenges pregnant women face when unstably housed. Although several studies have reported birth outcomes associated with homelessness, few describe how unstable housing impacts pregnancy. We wondered if homeless women would have more co-occurring health problems than similar women during pregnancy and, specifically, more pregnancy complications. Health care utilization and spending were also included in the study.

Methods

Using MassHealth claims we identified 9,124 women who were pregnant in the 12 months before or 12 months after entering emergency shelter. These women were directly matched (with replacement) with other MassHealth members who were pregnant during the same year, in the same MassHealth eligibility category, and who had similar ages and health risk scores. After removing some women with dual insurance coverage, 8,757 remained in the comparison group

We compared rates of various health care conditions that have been shown in previous studies to be associated with housing instability or poor birth outcomes. These included alcohol, opioid and other drug use disorders; anxiety, depression, and adjustment disorders; and injuries. Pregnancy-related conditions included spontaneous abortion, hypertension, prolonged pregnancy, deficiency and anemia, polyhydramnios, obstetric-related trauma, nausea, hemorrhage, early or threatened labor, abdominal pain, and a general category of all other pregnancy-related conditions. We used bivariate statistics to compare prevalence of the conditions across groups and logistic regression to compare pregnancy complication rates, first adjusting for age, year of pregnancy, race, and region; then adjusting for all covariates used in the first model, plus alcohol, opioid and drug use and mental health disorders.

Results

Women in the homeless group had significantly higher rates of all types of substance use and mental health disorders as well as injuries. Except for spontaneous abortion, all pregnancy-related conditions were significantly more frequent among homeless women. These bivariate findings were confirmed in the logistic regression analyses. Sensitivity analyses showed that rates of hemorrhage and birth complications affecting the mother were slightly higher for women who were pregnant during a shelter stay compared to women who were pregnant before entering shelter. Logistic regression results for each pregnancy-related condition did not change when substance use and/or mental illness was added to the model. Women in the homeless group were significantly more likely to visit an emergency department during pregnancy, had significantly fewer ambulatory care visits, more months in which they received no billable care, and had lower total healthcare expenditures.

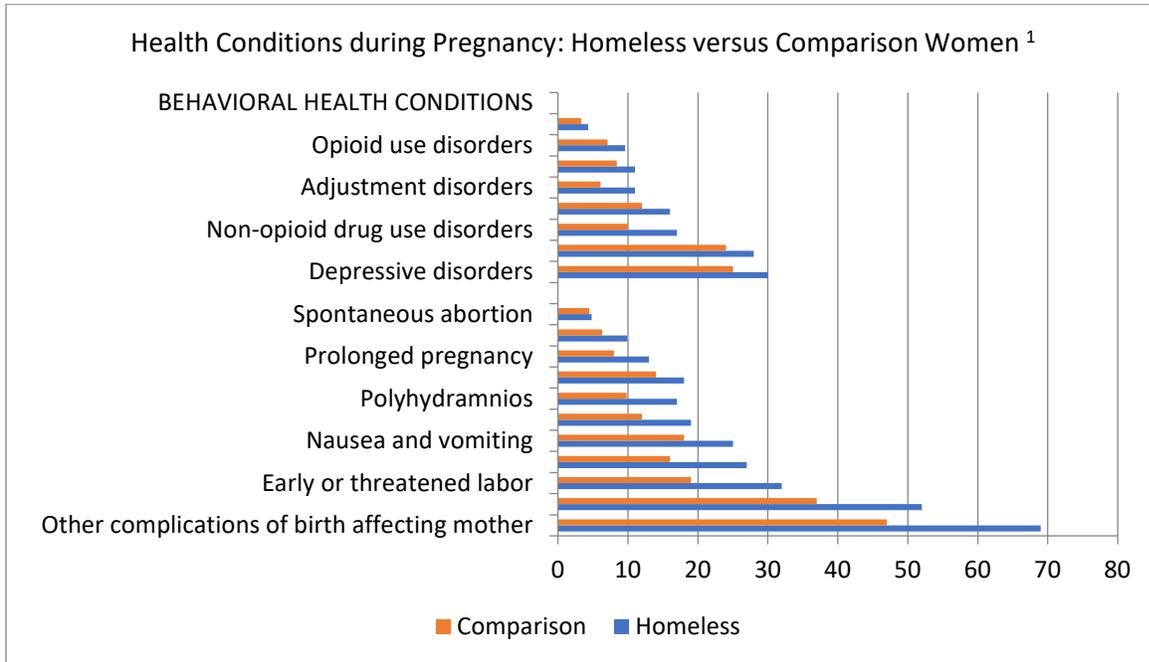
Discussion

Our analysis shows that homelessness was associated with higher rates of several behavioral health conditions during pregnancy. Pregnancy complications were more frequent among homeless women. Differences in pregnancy complication rates appeared to be driven by homelessness rather than being mediated by behavioral health conditions.

Service use patterns—including a higher probability of visiting an emergency department, fewer ambulatory care visits, and more months without health care—suggest that continuity of care was substantially poorer for homeless women than for women in the comparison group.

One limitation of the current study is that we were unable to accurately measure the full exposure to unstable housing. As illustrated in our first study and in others, it appears that housing instability and the health problems associated with it often begins months before shelter entry. Unfortunately, we were unable to gauge the impact of exposure length on health outcomes.

Figure 2.



Homelessness appears to be independently associated with pregnancy complications. Housing and behavioral health disorders should be addressed simultaneously. Addressing one of these factors alone is unlikely to substantially improve the course of pregnancy for homeless women. Apparent interruptions in health care continuity and greater reliance on emergency departments suggest that improving access to health care during periods of unstable housing could have significant benefits for homeless women. Health screening in homeless shelters coupled with rapid engagement in prenatal care that can follow women as they transition from one housing situation to another may help to reduce some of the pregnancy complications observed in this study.

Study # 3: Infants Exposed to Homelessness: Health, Health Care Use, and Health Spending (9)

The final study in the project followed, from birth into early childhood, infants born during a period of unstable housing that resulted their family entering a homeless shelter. Data limitations prevented us from linking health data for mothers with claims for infants and children, as originally planned. Aims for this study were to compare the health, health care use and spending of infants and children exposed to homelessness with a similar group that did not use emergency shelter in the year surrounding birth.

Methods

Using diagnosis and procedure codes, we identified all live births during the 12 months before or the 12 months after shelter entry. Infants born during the same month but who did not use emergency shelter formed the comparison group. Groups were matched on the month and year of birth, sex, race/ethnicity, and region of last residence. Health conditions, service utilization and Medicaid expenditures were compared yearly, through age 6, using bivariate measures.

Results

After removing infants with third party insurance coverage, for whom we did not have complete claims, our final sample comprised 5,762 infants exposed to homelessness and 5,553 comparison infants (see Clark et al 2019 (9) for a detailed description of group characteristics and methods).

Table 1 shows that the homeless and comparison groups were significantly different on several health and healthcare use measures during the first year of life. Homeless infants had more emergency

Measure	Year of Birth		
	Homeless	Comparison	p-value
	n=5762	n=5553	
Mean # ED visits/year (SD)	1.75 (2.16)	0.96 (1.55)	<.0001
Mean # hospitalizations/year (SD)	0.24 (0.98)	0.17 (0.91)	<.0001
Mean # well child visits/year (SD)	3.53 (2.18)	3.96 (2.28)	<.0001
Mean expenditures/year (SD)	7,921 (34,997)	6,191 (27,676)	0.004
Median expenditures/year (IQR)	2,851 (1452, 5898)	2,200 (1195, 4229)	<.0001
% of year with \$0 expenditures	23 (0.40)	60 (1.08)	<.0001
% with 1 or more ED visits	3742 (64.94)	2553 (45.98)	<.0001
% with 1 or more hospital admissions	836 (14.51)	574 (10.34)	<.0001
Upper respiratory infection (n (%))	3408 (59.15)	2868 (51.65)	<.0001
Other lower respiratory disease (n (%))	2531 (43.93)	1789 (32.22)	<.0001
Fever (n (%))	2260 (39.22)	1648 (29.68)	<.0001
Allergic reaction (n (%))	2187 (37.96)	1825 (32.87)	<.0001
Other nutrition (n (%))	2156 (37.42)	1795 (32.32)	<.0001
Injuries (n (%))	702 (12.18)	486 (8.75)	<.0001
Developmental disorder (n (%))	655 (11.37)	324 (5.83)	<.0001
Asthma (n (%))	567 (9.84)	329 (5.92)	<.0001
NICU* stay	342 (5.94)	350 (6.30)	0.41
NICU LOS** (days) median (IQR)	9.0 (2, 20)	6.5 (1, 18)	0.009
NICU LOS** (days) mean (SD)	16 (20)	14 (19)	0.11
Low birthweight	179 (16.13)	122 (12.07)	0.01
Fetal growth retardation	158 (14.23)	116 (11.47)	0.06

*Neonatal Intensive Care Unit **Length of Stay

department visits, more hospitalizations and fewer well-child visits. They also had longer neonatal intensive care stays and higher rates of many common health conditions (Table 1). Differences in fever

and allergic reactions were significant for the first two years. Respiratory, nutritional and injury diagnoses remained higher for three years. Diagnosed asthma rates were higher for the entire six-year period. Homeless infants and children continued to have more emergency department visits and higher Medicaid spending throughout the period.

Discussion

Children exposed to homelessness during infancy had significantly higher rates of many health conditions compared to similar children from other Medicaid-enrolled families. Most of these differences persisted for two to three years, some longer. Health care use and spending were also significantly higher among homeless infants. While differences in access to a regular source of health care after birth might explain some disparities, gaps in well child visits were relatively small and seem unlikely to account for much of the variation. Evidence from our study of pregnant women (8), suggests that pregnancy, birth complications and gaps in prenatal care may also have contributed to poorer infant health during the first year of life. Unstable housing and associated exposure to adverse events may also have contributed to more lasting health effects. Improved care during the perinatal period, especially care that can follow pregnant women and families as they move from one location to another would likely reduce the gap between homeless and housed children. However, solutions also require better access to decent housing to prevent homelessness and rapid rehousing when families find themselves without a place to stay.

Successful strategies must combine three elements: primary prevention at the community level, effective individual-level screening to identify families at risk, and rapid intervention to reduce time spent unstably housed. Further research is needed to better define the most effective approaches at each point on this continuum. Policymakers must also identify ways to effectively incentivize, coordinate and integrate efforts to prevent homelessness by reducing poverty and expanding affordable housing with health care interventions that seek to reduce the impact of homelessness on families.

List of products

Peer reviewed articles:

1. Clark RE, Weinreb L, Flahive JM, Seifert RW. A longitudinal study of healthcare utilization and expenditures of homeless family members before and after emergency housing. *American Journal of Public Health*, 108(6), 808-814, 2018.
2. Clark RE, Weinreb L, Flahive JM, Seifert RW. Homelessness contributes to pregnancy complications. *Health Affairs*, 38(1), 139-146, 2019.
3. Clark RE, Weinreb L, Flahive JM, Seifert RW. Infants Exposed to Homelessness: Health, Healthcare Utilization and Health Expenditures from Birth to Six. *Health Affairs*, 38(5), 721-728, 2019

Presentations:

“Health and Healthcare of Pregnant Women using Emergency Shelter: Increasing Risk,” Clark RE, Weinreb L, Flahive JM, Seifert RW. American Public Health Association Annual Meeting, San Diego, CA, November 12, 2018.

“Healthcare Utilization and Expenditures for Families Receiving MassHealth and Emergency Housing Assistance, 2007-2015.” Governor’s Interagency Task Force on Housing and Homelessness. Boston, MA, October 5, 2017

“Health and Healthcare of Families who use Emergency Shelter,” Presentation to Homes for Families, an organization of emergency shelter providers in Massachusetts, May 18, 2018

“How Family Homelessness Affects the Health of Mothers, Infants and Children.” Presented at the Maternal and Child Health Symposium, Family Homelessness: A Crisis in a Mother’s Life. T.H. Chan School of Public Health, Harvard University, May 21, 2019.

Dissemination activities and plans beyond peer-reviewed publications

In addition to the presentations above, papers from this project have been featured in a Kaiser Health News Morning Briefing post; a Medscape article; two “How Housing Matters” newsletters, published by the Urban League; one blog post from Academy Health, and one blog post from UMass Medical School.

How Housing Matters: <https://howhousingmatters.org/articles/early-detection-intervention-improve-health-outcomes-homeless-families/>

<https://howhousingmatters.org/articles/pregnant-homeless-unstable-housing-affects-maternal-health-outcomes/>

Kaiser Morning Briefing: Research Roundup: Homelessness; Medicaid: <https://khn.org/morning-breakout/research-roundup-homelessness-medicaid-hpv-vaccinations/>

Medscape Medical News: Homelessness in Infancy Has Lasting Health Effects in Kids, Troy Brown, RN, May 7, 2019. <https://www.medscape.com/viewarticle/912664>

Health Affairs Blog, Health Affairs May Issue: Social Determinants, Children & More, May 6, 2019 <https://www.healthaffairs.org/doi/10.1377/hblog20190506.532228/full/>

AcademyHealth Members Publish Research on Substance Use Treatment, Health Policy Recommendations, and More

<https://academyhealth.org/blog/2019-02/academyhealth-members-publish-research-substance-use-treatment-health-policy-recommendations-and-more>

UMassmed Now: <https://www.umassmed.edu/news/news-archives/2019/01/new-study-shows-homeless-women-more-likely-to-face-pregnancy-complications/>

Plans to continue this line or program of research through additional external funding

We are currently exploring options for further research in collaboration with Massachusetts state agencies to evaluate the impact of rapid rehousing, flexible spending options, and other targeted interventions on maternal and child health.

Research Grant Impact Analysis

No. of Research Sites ¹	Total No. of Studies ¹	Total No. of Participants ever Enrolled	No. of Peer-Reviewed Publications ²	No. of Non-Peer Reviewed Publications ³	Total No. of Researchers Involved in Research ⁴	Total No. of Trainees Mentored ⁵	No. of External Funding Apps Submitted	No. of External Funding Apps Received
1	2	78,823	3	3	4	0	1	0

References

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2. Richards R, Merrill RM, Baksh L. Health behaviors and infant health outcomes in homeless pregnant women in the United States. *Pediatrics*. 2011;128(3):438-46.
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6. Agency for Healthcare Research and Quality. HCUP CCS Fact Sheet. Healthcare Cost and Utilization Project (HCUP). 2012 [<https://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccsfactsheet.jsp>.]
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8. Clark RE, Weinreb L, Flahive JM, Seifert RW. Homelessness Contributes to Pregnancy Complications. *Health Aff (Millwood)*. 2019;38(1).
9. Clark RE, Weinreb L, Flahive JM, Seifert RW. Infants Exposed To Homelessness: Health, Health Care Use, And Health Spending From Birth To Age Six. *Health Aff (Millwood)*. 2019;38(5):721-8.