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LIFE SHOCKS AND HOMELESSNESS

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ABSTRACT

We exploit an exogenous health shock—the birth of a child with a severe health condition—to investigate the causal effect of a life shock on homelessness. Using survey data from the Fragile Families and Child Wellbeing study that have been augmented with information from hospital medical records, we find that the health shock increases the likelihood of homelessness three years later, particularly in cities with high housing costs. Homelessness is defined using both a traditional measure and a more contemporary measure that includes residential instability and doubling up without paying rent. The findings are consistent with the economic theory of homelessness, which posits that homelessness results from a conjunction of adverse circumstances in which housing markets and individual characteristics collide. They also add to a growing body of evidence that housing markets are an important contributor to homelessness and suggest that homelessness is a problem not easily addressed by existing public support programs.

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Introduction

Homelessness is a significant and often glaring social problem in the United States, particularly in large urban areas (Lee, Tyler, and Wright 2010). The extent of the problem is difficult to quantify for a number of reasons. The homeless are underrepresented in surveys, many of which are household-based; there is no standard methodology for counting the homeless; and homelessness is often a transient state (Link et al. 1994). Even the definition of homelessness is evolving and subject to debate (Lee, Tyler and Wright 2010). Despite these significant measurement and conceptual issues, however, there is general agreement that homelessness in the U.S. rose dramatically during the 1980s (Burt 1992) and that it has gone up, particularly among families, since the 2008 foreclosure crisis and subsequent Great Recession (The United States Conference of Mayors 2010). Aside from being direct evidence of deprivation of a basic human need, homelessness appears to present unique threats to children's health and development, as it has been linked to a range of resource constraints and adverse mental, physical, and educational outcomes (Buckner 2008).

There is much interest in learning about the causes of homelessness, but little population-based data with which to do so. In an aggregate city-level analysis conducted shortly after the large increase in homelessness during the 1980s, Honig and Filer (1993) found that city-level rents at the low end of the rental distribution had a very strong association with homelessness rates controlling for a host of other city- and state-level factors, with higher rents being associated with higher rates of homelessness. In addition, they found strong negative associations between rates of homelessness and both local employment rate growth and state welfare generosity. A recent study based on the Fragile Families and Child Wellbeing urban birth cohort study found that poor physical and mental health, domestic violence, and residential mobility

significantly increased the likelihood of homelessness among mothers and their young children, even when controlling for city-level variation in housing affordability, local economic conditions, climate, shelter availability, and anti-loitering laws (Fertig and Reingold 2008). The authors also found that being an immigrant, receiving public housing or housing subsidies, and having family support lowered the probability of homelessness holding structural factors constant.

O'Flaherty (2004) argued that homelessness results from a "conjunction of bad circumstances" (p. 2) occurring when market conditions and individual characteristics collide, and that the transitory component of income has been largely overlooked as a potential determinant of homelessness (2008, 2009). He further argued that reducing real income volatility (i.e., smoothing individuals' income flows) to buffer the potential effects of adverse life events, such as health shocks, relationship dissolution, or unemployment, may be the best way to prevent homelessness. O'Flaherty (2009) found that the most common shocks experienced by families involve income or health and that the main shocks precipitating homelessness involve income; however, he cautioned that his descriptive analysis did not allow for causal inferences.

In this paper, we exploit an exogenous health shock—the birth of a child with a severe health condition that is considered by the medical community to be random in the population—to investigate the effect of a life shock on homelessness in an urban, largely disadvantaged population. By exploiting an exogenous life shock that recent literature indicates has economic repercussions, we indirectly test O'Flaherty's hypothesis that income volatility is a key factor affecting homelessness. We consider several different measures of infant health shocks as well as both a traditional measure of homelessness that includes lack of a permanent residence or residence in temporary shelters and a broader and more contemporary measure that also includes

doubling up without paying rent and residential instability. We consider interactive effects of infant health shocks with housing markets, public housing subsidies, and cash assistance generosity. We conduct numerous specification tests to assess robustness and patterns of estimated effects. This study represents perhaps the best test to date of whether adverse life shocks at the individual level appear to be important determinants of homelessness.

Background

This section consists of three parts. The first presents a discussion of how homelessness is defined and measured, particularly in empirical research. The second presents a short discussion of the economics of homelessness, focusing on the role of adverse life events. The third section situates the current study in the existing literature and highlights its contributions.

Defining and measuring homelessness

Measuring homelessness varies by the purpose of the estimate and the available data. Annual homelessness counts conducted by the Department of Housing and Urban Development (HUD) depend on several different techniques and data sources to produce point-in-time counts of all sheltered and unsheltered homeless persons on a single night in January as well as one-year estimates of the total sheltered homeless population based on information from local Homeless Management Information Systems. Along with providing information about the magnitude of homelessness for legislators, these estimates are used to inform service delivery.

Point-in-time estimates from HUD (2010) suggest that, in the U.S., there were approximately 649,917 unsheltered and sheltered homeless individuals in January 2010; within this group, there were 79,446 family households, with 241,951 persons in those families. The characteristics of sheltered individuals and sheltered persons in families are quite different. Homeless individuals are more likely to be older than 30, to be white men, and to have a

disabling condition, while adults in homeless families are more likely to be younger, non-disabled, African-American women. These estimates do not include families that are "doubled up" with family or friends because of economic difficulties or confront eviction or other forms of housing instability short of homelessness as it is traditionally defined (HUD 2010). Although most homeless individuals are single male adults, children and families make up a larger percentage of homeless individuals today than they did in the past (Lee, Tyler and Wright 2010). Single men are more likely to be chronically homeless and therefore "counted" in point-of-time estimates, while children and families are more likely to experience temporary spells of homelessness and missed in those counts. One study of annual prevalence rates rather than point-in-time measurements found a higher risk of sheltered homelessness among young children (less than 5 years old) than among men (Culhane and Metraux 1999).

Researchers using secondary datasets to study homelessness have typically followed federal guidelines (42 USC Sec. 11302), defining homelessness as the lack of a fixed, regular, and adequate nighttime residence, or residence in a temporary accommodation (shelter, transitional housing, or welfare hotel) or in a public or private space not intended for residence (e.g., car or abandoned building). Most studies of family homelessness in particular focus on families who are currently living in emergency or transitional shelters (Miller 2011; Kerker et al. 2011; Swick and Williams 2010; Howard et al. 2009), or self-report a history of having lived on the street, in abandoned property, or in a shelter at some point in their lives (Coker et al. 2009; Fertig and Reingold 2008).

Controversy has emerged over whether people who are doubled up with family or friends or live in inadequate, unsanitary or dangerous housing should be considered homeless (Gould and Williams 2011; Lee, Tyler and Wright 2010). These groups have not generally been

considered homeless in most studies, or until the recent past, by HUD. Studies focusing on housing insecurity (i.e., housing hardships that are short of, or precursors to, homelessness) have variously used measures of eviction; frequent moves; difficulty paying rent, mortgage, or utilities; spending more than 50% of household income on housing; living in overcrowded conditions; or having had to move in with others because of financial constraints (Gilman, Kawachi, Fitzmaurice and Buka 2003; Kushel et al. 2005; Pavao et al. 2007; Phinney et al. 2007). The majority of homeless people, as traditionally defined, have periods of housing insecurity prior to becoming homeless; likewise, many people who are formerly homeless return to situations that continue to be insecure (Reid, Vittinghoff and Kushel 2008; Sosin 2003).

While the definition of homelessness has been relatively consistent across existing studies, the federal government has recently expanded the official definition in order to recognize and serve individuals and families who previously were not considered homeless but are considered close to meeting those conditions. In particular, as described in the Federal Register (2010), the 2009 Homeless Emergency Assistance and Rapid Transition to Housing (HEARTH) Act expanded the definition of homelessness to include the "imminently homeless." There are now several broad categories under which one can qualify for homeless assistance (C.F.R. 2010). One category is consistent with prior definitions as an "individual or family that lacks a fixed, regular and adequate nighttime residence," which is to include places that are uninhabitable for humans, emergency shelters and motels or hotels that are provided through social service agencies. Another category is defined as "individuals or families who will imminently lose their primary nighttime residence," within a 14-day period, wherein evidence of eviction is provided and the individual or family has no other resources and no other residence has been identified. A third category is defined as unaccompanied youth under the age of 25 or families with children

who qualify as homeless under other federal statutes (e.g., Runaway and Homeless Youth Act, Head Start Act, Violence Against Women Act, Public Health Service Act, Food and Nutrition Act of 2008, Children Nutrition Act of 1966, Section 725 of the McKinney Vento Act). Under this definition, individuals or parents must meet criteria including not being named on a lease within the last 60 days and having had at least two moves within the last 60 days. In general, the HEARTH Act expanded the concept of homelessness to include experiences such as eviction, residential instability, and not having one's own home.

The economics of homelessness

In order to understand the dramatic rise in homelessness in the 1980s, O'Flaherty (1996) formulated a microeconomic theory of homelessness in which high-priced housing markets lead landlords to disinvest in (or poorly maintain) low-priced rental units. Consumers at the lowest end of the income distribution, therefore, must choose between very low quality housing at a certain price, or homelessness. Under severe income constraints and holding preferences constant, a rational consumer would be indifferent between spending a substantial proportion of his/her income on very low quality housing or being homeless. Homelessness, then, would be dependent on the housing markets faced by individuals at the bottom of the income distribution.

In studies based on O'Flaherty's framework, Quigley, Raphael and Smolensky (2001) found that the demand for the lowest-quality housing does indeed explain much of the variation in rates of homelessness, and Early (2005) found that families with children, younger heads of household, and alcohol or drug problems and who face higher rental prices for low-quality housing are all at increased risk of being homeless. In a theoretical article that touches upon the issue, Glomm and John (2002) developed a two-period model of the housing market that predicted homelessness in the first period as a function of low income and borrowing constraints

and found that homelessness leads to reduced labor productivity in the second period. Although the main focus of this analysis was on how homelessness might affect productivity, their model suggests that exogenous income parameters can lead to persistent homelessness.

Together, the intriguing arguments and observations in the small economics literature on homelessness, along with well-established bi-directional associations between income and health, point to the question of whether and to what extent adverse health shocks lead families into homelessness. Three recent studies have specifically considered this question. All were based on longitudinal population-based data, allowing transitions to homelessness to be observed. Fertig and Reingold (2008) found that, among mothers with young children in the Fragile Families and Child Wellbeing urban birth cohort study, both poor overall health status (self-reported) and depression (using a standard screener) were positively associated with later homelessness controlling for a host of individual and contextual variables. Phinney et al. (2007), using data from a representative panel study of mothers receiving cash assistance in February 1997, found that both mental and physical health problems were positively associated with later homelessness among mothers on welfare. Neither of these studies explicitly addressed the potential endogeneity of health. That is, they did not isolate the effects of health shocks. Exploiting data on infant health shocks that are arguably exogenous, Curtis et al. (2010), using survey data from the Fragile Families birth cohort study augmented with information from the mothers' and infants' medical records (from the birth hospitalization), found that poor child health increases the likelihood of both overcrowding and homelessness three years later and that it may also increase the likelihood of having inadequate utilities and generally poor housing quality.

Contribution of this study

In this study, we exploit an exogenous life shock—the birth of a child with a severe health condition that is considered by the medical community to be random in the population—to investigate the effect of a health shock on homelessness. Like Curtis et al., we use survey data from the Fragile Families and Child Wellbeing birth cohort study augmented with information from hospital medical records that are used to create measures of infant health shocks. Although child health may not affect the family's income as directly as adult health could, since most children do not work, poor child health has been shown to affect a variety of family resources (see Reichman, Corman and Noonan 2008 for a synthesis). Children in poor health require greater financial and time resources than their non-disabled peers, which can limit their parents' ability to maintain employment; indeed, numerous studies have found adverse effects of poor child health on parents' labor supply (e.g., Corman, Noonan and Reichman 2005; Gould 2004; Noonan, Reichman and Corman 2005; Powers 2003). In addition, studies have found that poor child health makes it less likely that the father will live with the child (Reichman, Corman and Noonan 2004) and more likely that he becomes incarcerated (Corman et al. 2011). The labor supply and household structure consequences of poor child health can have negative financial ramifications for the child's household. However, the effects may be offset, at least to some extent, by increased access to public support. Reichman, Corman and Noonan (2006) found that families with young children in poor health are more likely than those with healthy children to receive Temporary Assistance for Needy Families (TANF), Supplemental Security Income (SSI), and housing subsidies one year after the child is born. The effect on SSI receipt is relatively automatic, since SSI eligibility requires that a household member has a disability.

We expand upon the Curtis et al. study in two major ways. First, we explicitly test O'Flaherty's hypothesis that homelessness results from a conjunction of bad circumstances

occurring when individual circumstances and market conditions collide. As such, we consider not only the effects of infant health shocks in an at-risk urban sample, but also the interactive effects between infant health shocks and fair market rents, availability of subsidized housing, and state welfare generosity. The Curtis et al. study was not based on this particular theoretical framework and thus did not consider such interactions or otherwise attempt to test O'Flaherty's hypothesis. Second, we focus specifically on homelessness, both as it has traditionally been defined and using a more contemporary measure based on the expanded conceptualization under the HEARTH Act, which includes doubling up without paying rent and other measures of housing insecurity. In contrast, Curtis et al. considered only traditional, and relatively rare, measures of homelessness—(1) homelessness in the past year, per previous federal guidelines as described earlier, and (2) a slightly broader measure that also includes eviction—as two pieces of a broad analysis of seventeen different housing outcomes spanning the domains of quality, crowding, and stability.

Data

We use data from the Fragile Families and Child Wellbeing (FFCWB) survey, which follows a cohort of parents and their newborn children in 20 large U.S. cities (in 15 states). The study randomly sampled births in 75 hospitals between 1998 and 2000. By design, approximately three quarters of the mothers in the sample were unmarried. Face-to-face interviews were conducted with 4,898 mothers while they were still in the hospital after giving birth (see Reichman et al., 2001 for a description of the research design). The postpartum (baseline) response rate was 86 percent among eligible mothers. Follow-up interviews were conducted over the telephone approximately one and three years after the birth of the focal child. Eighty nine percent of the mothers who completed postpartum interviews were re-interviewed

when their children were between 12 and 18 months old ("one year"), and 86 percent of mothers who completed baseline interviews were re-interviewed when their children were between 30 and 50 months old ("three years").

As part of an "add on" study to the core FFCWB survey, data from medical records (from the birth hospitalization) of the mother and child were collected using a detailed instrument based on the U.S. Standard Certificate of Live Birth. The availability of medical record data depended, for the most part, on administrative processes of hospitals rather than decisions on the part of survey respondents to make their records available. Medical record data, which were needed for the analyses, were available for 3,684 (75%) of the 4,898 births in the FFCWB sample.

The FFCWB data are well suited for analyzing the effects of infant health shocks on homelessness. They were collected as part of a longitudinal birth cohort study, and include: (1) detailed data on the child's health at birth from hospital medical records, allowing us to construct measures of infant health that are present at birth and considered by the medical community to be random in the population; (2) survey questions about homelessness, living arrangements, and residential instability at follow-up waves; (3) detailed covariates including the mother's prenatal mental and physical health, housing problems and living arrangements prior to the birth of the child, and the poverty rate in the census tract in which the mother resided at the time of the birth (from the 2000 U.S. Census); (4) city and state of birth, which allow us to alternatively control for these factors or explore interactive effects of poor infant health by housing market conditions and public assistance generosity. In addition, the oversampling of nonmarital births resulted in a relatively socioeconomically disadvantaged sample that may be particularly susceptible to the effects of adverse life events.

Sample, Measures, and Descriptive Analysis

All analyses are limited to cases for which medical record data, which are needed to characterize infant health shocks, are available and to mothers who completed the three year interview. Of the 3,684 cases with medical record data, 3192 mothers completed the three year interview. Of those, 28 had missing data on key analysis variables, leaving us an analysis sample of 3164 cases. In the sections that follow, we describe the measures we use in our analyses, present summary statistics (in Table 1), and point out many salient characteristics of the sample.

Outcome Measures

We consider four different homelessness-related outcomes--a traditional measure of homelessness, two measures of housing instability thought to be precursors to homelessness, and a combined measure that incorporates the first three components and approximates the broadened conceptualization of homelessness as reflected by the HEARTH Act. Below we describe how each of these four measures was constructed for our study.

Homeless (3% of sample)

This measure is designed to characterize homelessness as it is traditionally defined-- lack of a fixed, regular, and adequate nighttime residence, or residence in a temporary accommodation (shelter, transitional housing, or welfare hotel) or in a public or private space not intended for residence (e.g., car or abandoned building). In the three year follow-up interview, the mothers were asked two questions that were used to create a measure of homelessness that is consistent with what has been used in much of the literature. First, the mother was asked about where she currently lived. Several response choices, including living in a temporary shelter or being homeless, were read to the mother until she indicated that a given choice represented her current situation. Second, the mother was asked whether she had stayed at a shelter, in an

abandoned building, an automobile, or any other place not meant for regular housing, even for one night, in the past 12 months. If she responded affirmatively to the second question or if she responded that she currently lived in a shelter or was homeless for the first question, she was coded as homeless.

Evicted or multiple moves (6% of sample)

This measure includes either (1) an affirmative response to the following question in the three year interview, "Were you evicted from your home or apartment for not paying the rent or mortgage?," or (2) situations in which the mother moved three or more times between the one and three year interviews (or four or more times if the mother did not complete the one year interview), based on the following questions in the three year interview: "Have you moved since date of last interview?" "How many times?" The three-move cutoff was based on findings by Wood et al. (1990) and Weinreb et al. (1998) that moving more than once per year is a risk factor for homelessness.

Doubled up and not paying rent (6% of sample)

As discussed above, the mother was asked at three years where she currently lived. Several response choices were read to her until she indicated that a given choice represented her current situation. The mother was coded as doubling up and not paying rent if she indicated that she (1) currently lives with family or friends and is not paying rent or (2) lives in a house or condominium owned by another family member and pays no rent, and, based on the household roster, is living with an adult other than a spouse or a partner.

Combined measure (13% of sample)

This measure combines the other three measures and approximates the expanded definition of homelessness under the HEARTH Act. That is, it includes not only the conventional

definition of homelessness, but also the potential precursors to homelessness characterized by the second and third measures--eviction or residential instability and doubling up and not paying rent.

Infant Health Shocks

With our goal of isolating causal effects of health shocks on homelessness and related outcomes, we consider four different measures of poor infant health, each of which has distinct advantages and disadvantages. These measures have successfully been used to study the effects of life shocks on crime (Corman et al. 2011), housing quality and conditions (Curtis et al. 2010), social capital (Schultz et al. 2009), and other outcomes. We compare estimates across models using the four different measures of poor infant health, four different homelessness-related outcomes, and alternate sets of covariates. In addition, we estimate a number of auxiliary models to explore the exogeneity of the various measures of poor infant health.

The ideal measure of poor infant health would: (1) characterize a health shock that was both present at birth and unlikely a function of parental behaviors, and (2) capture conditions that are strongly associated with long-term morbidity (as opposed to brief, one time, episodes). We relied on the coding of specific health conditions by an outside pediatric consultant who was directed to classify each infant health condition listed in the infants' medical record or reported by the mother at one year according to degree of severity (in terms of expected significant long-term morbidity) and likelihood, according to the medical community, of having been caused by parental behavior (see Appendix Table 1 for more detail). Our goal was to capture severe conditions that are for the most part random (e.g., Down Syndrome, congenital heart malformations), given that the pregnancy resulted in a live birth. To the extent that we have been

successful, we can be confident that our measures of poor infant health represent true shocks (i.e., are exogenous).

The first measure, *severe infant health condition,* includes any condition that is severe, chronic, unlikely caused by parents' prenatal behavior, and in the case of one year maternal reports, likely present at birth. This measure best meets our "gold standard," but captures conditions that are relatively rare (2% of the children in our sample).

The second measure of poor infant health, *severe infant health condition or VLBW,* is measured as *severe infant health condition* and/or was very low birthweight (VLBW; <1500 grams). Very low birthweight is associated with a number of serious and long-term child health conditions (Reichman 2005). Reports of birthweight came from the medical records for over 99% of the sample. For the remaining cases, birthweight was ascertained from maternal baseline reports. The advantage of this measure is that we gain a few additional analysis cases with poor infant health (3% of the children in our sample are characterized as having poor infant health under this definition). The disadvantage is that the VLBW component may not be truly exogenous, as birthweight is inversely associated with poverty (Reichman 2005). All but three of the VLBW infants also had moderately severe infant health conditions, which are defined as conditions not considered to be related to maternal behavior that may or may not have long-term health consequences.

The third measure, *moderate or severe infant health condition,* includes any abnormal condition that meets the criteria for *severe infant health condition* or is less severe but still considered random (not a function of parental behavior). The disadvantage of this measure, which characterizes 20% of the sample, is that it is very broad; that is, it includes conditions that may or may not have poor long-term prognoses (examples are hydrocephaly and cleft palate).

The fourth measure of poor infant health is *low birthweight* (< 2500 grams). The advantages of this measure are that it is widely used, well measured, and comparable across studies (Reichman 2005). A disadvantage is that it is not very specific because few moderately low birthweight children, those weighing between 1500 and 2500 grams (the majority of low birthweight children), have severe health problems (Reichman 2005). Another distinct disadvantage is that because low birthweight is strongly associated with poverty, it is likely endogenous. Ten percent of the infants in our analysis sample, which is relatively socioeconomically disadvantaged due to the oversampling of non-marital births in the FFCWB study and the strong association between non-marital childbearing and poverty in the U.S. (Ellwood and Jencks 2004), were *low birthweight,* compared to 7.6% in the U.S. as a whole in 2000 (Martin et al. 2002). We include this measure strictly for comparison purposes.

As there is neither a standard for measurement nor a consistent reporting of child disability (Reichman, Corman and Noonan 2008), it is difficult to provide a good national comparison for our coded measures of poor infant health. Our rates are generally consistent with the range of 6 to 18% of children in the U.S. that have special health care needs as reported by Stein (2005). It is not unexpected that our strictest measure (severe infant health condition) is lower than this range, since that measure includes only very serious conditions and excludes conditions known to be related to maternal behaviors. Likewise, it is not unexpected that our broadest measure (severe or moderate infant health condition) is slightly higher than the upper-bound estimate, since it is defined to include conditions that are not necessarily disabling in the long run.

Covariates

In order to clearly establish the temporal ordering of events, all covariates (unless specified otherwise) are measured either at the time of the birth or before the focal child was born. We include a large set of sociodemographic characteristics—maternal age (years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other, with non-Hispanic white as the reference category), nativity (foreign born), education (less than high school graduate, high school graduate, some college, and college graduate, with less than high school as the reference category); parents' relationship status (married, cohabiting, and neither married nor cohabiting, with neither married nor cohabiting as the reference category); the number of children the mother had at the time of the focal child's birth; whether the birth was covered by Medicaid or other public insurance (a proxy for poverty); whether the mother had worked within the 2-year period preceding the child's birth; and the percentage of households in the mother's census tract with household income below the federal poverty line. The three last measures are included to capture different dimensions of poverty not easily characterized in a single measure.

The composition of the sample reflects the oversampling of non-marital births in the Fragile Families and Child Wellbeing study and the strong association between non-marital childbearing and both minority status and poverty in the U.S. By design, only about one quarter (24%) of the mothers in the sample were married. Nearly half (48%) are non-Hispanic black, 28% are Hispanic, over one third have less than a high school education, and 65% had Medicaid-financed births. The mean age of the mothers when their children were born was 25 years (Table 1).

The mother's health was characterized by two different variables based on health history information in the mother's medical record from the birth hospitalization. The first is whether the mother had documentation of any pre-existing physical health condition (including chronic lung

disease, cardiac problems, chronic diabetes, and pre-existing hypertension) in her medical record, 20% of the sample had at least one of these conditions. The second is whether the mother had a pre-existing diagnosed mental illness. Specifically, the mother was coded as having a mental illness if there was any documentation of a diagnosed mental disorder (e.g. depression, anxiety, bipolar disorder, schizophrenia, anorexia, suicidality, or mental retardation) in her record. Eleven percent of the mothers in our sample had documentation of a pre-existing diagnosed mental illness in their charts.

In all multivariate models, we include controls for multiple birth as well the gender (male) and age (in months) of the focal child at the time of the three year interview. We also include indicators for not having completed the one year interview and for missing data on census tract poverty, both of which may be related to housing instability. Survey non-response is often related to locating difficulties, and not having data on census tract poverty generally results from not having good address data. Certain specifications also include indicators for the mother's city of residence, in order to control for housing markets or other city- or state-level characteristics that may be associated with both infant health and housing instability. Eight cities with small numbers of observations (<100) were aggregated into a single city indicator.

Finally, in some models, we control for the mother's housing conditions and living arrangements prior to the birth of the focal child, to some extent allowing us to capture changes in, rather than levels of, housing instability. The first is a general measure of homelessness or poor housing quality based on information abstracted from the mother's prenatal medical record and recorded in a checklist of situational risk factors for the pregnancy. Two percent of the mothers in our sample had documentation of prenatal homelessness or poor housing quality in their charts. The second is a measure of the mother's living arrangement during pregnancy. At

the time of the birth, the mother was asked who if anyone (other than the baby's father) provided her with a place to live during her pregnancy. We created a dummy variable for whether she lived with any adult (other than the baby's father) during the pregnancy; one third of the mothers in our sample were coded as such.

Analyses

Before turning to the multivariate analyses, we describe preliminary analyses we conducted to explore the representativeness of our analysis sample and validate our measures of infant health. We also lay out our expectations, based on the literature described earlier, in terms of directions of estimated effects as well as relative magnitudes across measures of poor infant health and outcomes.

Preliminary analyses

To assess the representativeness of the sample, we compared characteristics of the mothers included in our sample to those (from the full survey sample of 4,898) who were not included and found that the two groups were very similar in terms of marital status, education, and Medicaid birth. That is, those in the sample and those not included because of missing data items (particularly those from medical records) were very similar in terms of observed socioeconomic disadvantage (results not shown).

We also considered whether attrition from the study differed by poor infant health and how those patterns might impact our estimated effects of poor infant health on homelessness and related outcomes. From baseline medical record data (needed to assess poor infant health), we compared the health status of children in our sample with children whose mothers did not complete the requisite subsequent interviews. We found that children who remained in our sample were significantly less likely than those who did not participate in any of the follow-up

interviews to have a severe health condition, severe health condition or very low birthweight, and a moderate or severe health condition (results not shown). Given that we may be losing some children with poor health due to housing problems, this finding suggests that adverse effects of poor infant health on homelessness and housing instability, should we find any, would be underestimates.

To explore the exogeneity of poor infant health, we compared sociodemographic characteristics of mothers of healthy children to those of unhealthy children using each of the four measures of poor infant health. These results are presented in Appendix Table 2. If the measures of poor infant health are indeed random, they should be unrelated to most maternal characteristics. As indicated earlier, we expect that low birthweight, which is included strictly for comparison purposes, is not random. For race/ethnicity, education, and relationship status, we tested for differences in distributions using chi-square tests. For the other measures, we tested for differences in means.

Virtually without exception, we find that our coded measures of infant health shocks are unrelated to maternal characteristics. That is, the measures of severe infant health condition, severe infant health condition or VLBW, and moderate or severe infant health condition are not significantly associated with maternal race/ethnicity, relationship status, education, Medicaid birth, number of children, immigrant status, or employment. Of the 24 relevant comparisons, the only significant differences were for maternal age, with mothers of unhealthy children (defined any of the three ways) being slightly older than those with healthy children, and census tract poverty, with mothers of children with moderate or severe conditions being slightly less likely than mothers of healthy children to live in a poor census tract. In contrast and as expected, low birthweight is significantly and strongly associated with race/ethnicity, maternal education,

relationship status, immigrant status, Medicaid birth, and number of children. Overall, these results provide convincing evidence that our coded measures of poor infant health have large exogenous components.

Expected effects

Based on the theory and empirical literature discussed earlier, we hypothesize that poor infant health will increase homelessness (as traditionally defined) and that the magnitude will increase with severity of the health shock. For low birthweight, the infant health measure for which there is clear evidence of non-randomness, the expected relative magnitude will depend on the extent to which confounding by unobserved factors remains. Assuming we have controlled for most relevant factors, the estimated effect of low birthweight on homelessness should be most similar to that of moderate or severe health condition, since as discussed earlier most low birthweight infants do not have severe health problems.

Given the lack of previous research incorporating the broader conceptualization of homelessness, we do not have prior expectations vis-à-vis the relative magnitudes of estimated effects across outcomes, or even the expected direction in certain cases. Residential instability and doubling up without paying rent are considered precursors to, or risk factors for, homelessness; as such, we would generally expect health shocks to increase the likelihood of experiencing these situations, with the same general pattern across measures of infant health as for the traditional measure of homelessness. However, it is important to consider the expected effects for the various outcomes in light of the relevant competing risks. For the traditional measure of homelessness, the competing risk is not having experienced homelessness (but potentially having experienced residential instability or doubling up without paying rent). For the expanded (combined) measure of homelessness, the competing risk is having lived

independently (that is, not having experienced any of the unfavorable housing situations). For residential instability and doubling up without paying rent, the competing risks are not experiencing those situations, but possibly having experienced one or more of the others. For example, for residential instability, the competing risk includes having lived independently, having doubled up without paying rent, or having experienced homelessness, but not having experienced eviction or multiple moves.

Overall, we have clear expectations for the direction of the effects of infant health shocks on both the traditional and combined measures of homelessness (i.e., health shocks will increase these situations). However, for residential instability and doubling up, our expectations regarding relative magnitudes, and even direction, of the effects are ambiguous by virtue of the heterogeneous nature of the competing risks. Nevertheless, it is useful to have estimates for the individual components of the combined measure of homelessness to understand how and why the estimated effects for the traditional and combined measures of homelessness may differ. The issue of competing risks aside, the relative magnitudes across the four outcomes will depend on which transitions are affected most. That is, the shock could push individuals with unstable housing (eviction or frequent moves, doubling up without paying rent) into homelessness and/or those with stable housing into an unstable situation or homelessness. As such, the relative magnitudes across outcomes would depend on which group (the already vulnerable or the less vulnerable) is more strongly affected.

The expected effects for doubling up are further complicated by the fact that this arrangement requires not only the need or desire for co-residence on the part of the visiting family, but also the availability of friends or relatives who are willing to host them. Taking in a family with a young child can be a large sacrifice for the host family (including potential loss of

public assistance) and may be even more of a sacrifice when the child has health problems. Having a child in poor health, therefore, would be expected to increase the neediness of the child's family but decrease their chance of getting support in the form of a free place to live. As such, the net effect for this outcome will depend on the strength of these countervailing forces.

An additional consideration is that while doubling up without paying rent is considered an undesirable situation under the HEARTH Act from the standpoint of service provision because it is often a precursor to homelessness, it may not always represent an unfavorable situation for families. Extended families are often formed as a result of hardship (Angel & Tienda 1982; Hogan, Hao and Parish 1990) and for most people independent residence is the preferred arrangement (Cohen and Casper 2002; Ruggles 1996). However, some studies have found favorable effects of living in multigenerational households for children (e.g., Deleire and Kalil 2002). The advantages and disadvantages of living in extended-family households are complex and no doubt vary across family members and situations. The results pertaining to this outcome will be considered in light of this complexity.

Multivariate analyses

Table 2 presents the estimated effects of each of the four measures of poor infant health on each of the four housing outcomes. The figures in each cell are from a separate probit model that includes all variables classified as maternal or child characteristics in Table 1, plus city indicators and corresponding baseline controls for the particular outcome (see table note). In each cell, the probit coefficient of the effect of poor infant health is on the top; the standard error of the probit coefficient, corrected for city clustering of observations using the Huber-White method, is in parentheses; and the marginal effect is in brackets (full multivariate results based on the severe infant health condition measure are presented later in Table 3).

For the most severe measure of poor infant health (severe infant health condition) and for the severe outcome (homeless, as traditionally defined), the shock has a strong and significant positive impact -- the marginal effect is six percentage points which represents a very large increase relative to the sample mean of .03 for this outcome. The other two measures of health shocks (severe infant health condition or VLBW, moderate or severe infant health condition) have positive and significant effects as well. As expected, the magnitude decreases with decreasing severity of the shock, with marginal effects of .03 and .01, respectively. The marginal effect of low birthweight is twice as high as that of moderate or severe infant health condition (as discussed earlier, we expected the two to be of the same general order of magnitude), suggesting that some unobserved heterogeneity vis-à-vis that outcome remains even with the extensive set of controls.

The health shocks do not have significant effects on either measure of "pre-homelessness" (eviction or multiple moves, doubling up without paying rent), although the estimated effects for eviction/multiple moves are positive and, for the two most severe measures have p-values over 1. The estimated effects for doubling up are negative but not at all significant, perhaps reflecting opposing effects of increased need and decreased availability discussed earlier. In both cases, the estimates decrease in magnitude as the health shock becomes less severe (from the first row to the third row), as expected.

The estimated effects of poor infant health on the last outcome, which combines the other three outcomes into a single expanded measure of homelessness, are of smaller magnitude (relative to the relevant sample mean) than for those on homelessness as traditionally defined. They also exhibit the expected decline with severity of the shock, and moderate or severe health condition is no longer statistically significant. Notably, the "bottom line" inferences vis-à-vis the

effects of infant health shocks on homelessness are the same whether the traditional or expanded measure of homelessness is used.

Table 3 presents the full multivariate results (with the exception of the estimates for city indicators, which are included in all models) that correspond to the first row in Table 2. That is, the estimates pertain to severe infant health condition and each of the four outcomes. The child's age, which is equivalent to the length of time between the baseline and three year interviews, is positively associated with both homelessness and eviction or multiple moves and negatively associated with doubling up and not paying rent.

Maternal age is negatively associated with residential instability as characterized by eviction or multiple moves. We find that compared to non-Hispanic white mothers, non-Hispanic black mothers are more likely to become homeless but less likely to experience eviction or multiple moves, and that Hispanics are less likely to experience eviction or multiple moves and are more likely to double up without paying rent. We caution against reading too much into the estimate for other non-white non-Hispanic for homelessness as it is based on very small cell sizes. Immigrant mothers are less likely than native-born mothers to experience homelessness. Education is negatively related to eviction or multiple moves, and poverty, as proxied by Medicaid birth, is positively associated with both homelessness and eviction or multiple moves. Mothers who were employed prior to the birth are more likely than those who were not employed to experience eviction or multiple moves and less likely to double up without paying rent. Mothers who were married or cohabiting at the time of the birth of the focal child were much less likely than their non-married non-cohabiting counterparts to double up without paying rent. As expected, mothers who did not complete the one year interview (perhaps due to locating difficulties) were more likely to experience all of the homelessness-related situations.

Prenatal mental illness is positively associated with the combined measure of homelessness, suggesting that long-term struggles with mental health issues may generally erode the ability to remain stably housed over time. The measures of poor housing quality and doubling up during pregnancy are positively and significantly associated with the relevant outcomes. The city indicators were jointly highly significant for all housing outcomes and for all infant health measures (estimates not shown), suggesting that residential location is indeed an important predictor of homelessness. We explore city- and state-level characteristics in further detail below.

The roles of housing markets and public assistance

O'Flaherty's framework would predict that the adverse effect of a family health shock on homelessness is stronger for individuals living in areas with high housing costs, relatively low housing subsidies, and low cash assistance generosity. In general, we would expect weaker interactive effects with public supports than with housing prices because while everyone confronts housing markets, public assistance only benefits those who know about it, apply for it, and are eligible. In addition, we expect weaker interactive effects for cash assistance than for housing assistance, as the latter is more directly related to housing, and as for our main models, we expect stronger effects for more severe measures of infant health shocks. In Table 4, we present estimates from models that separately interact the two coded measures of poor infant health (severe infant health condition and moderate or severe infant health condition) with measures capturing each of the three potentially important contextual factors (all measured at baseline), for both the traditional and expanded homelessness outcomes.

First, we consider interactions between poor infant health and rental costs, measured using the Department of Housing and Urban Development's (HUD) Fair Market Rents (FMRs).

FMRs are gross rental estimates compiled by HUD to set the payment standard for their Housing Choice Voucher program and, therefore, are appropriate for capturing costs at the low end of the market. We used MSA level FMRs for a 2 bedroom unit and defined high and low rent according to the distribution of rents in the data. FMRs in our sample are significantly higher than the national average as a result of the sampling frame of the study (selection was made from U.S. cities with at least 200,000 people). The national average FMR for a 2-bedroom unit in 2000 was $443 (HUD 2011) compared to $728 in the FFCWB baseline cities. We define high rent as $800 or more per month and low rent as less than $800.

Second, we consider interactive effect of housing subsidies, for which we used a measure constructed by Curtis (2007) and applied by Curtis and Waldfogel (2009) and Curtis (2011) that characterizes the availability of subsidized housing at the MSA level as the total number of subsidized units available per household with income at or below 50% of the area median income. It includes project-based assistance (public housing), tenant-based assistance (certificates and Section 8 vouchers) and the number of low-income housing tax credit units. We classified women living in cities with .025 or fewer housing subsidies per poor family as having low availability of subsidized housing and women living in cities with at least .025 housing subsidies per poor family as having high availability of subsidized housing. Estimates were insensitive to the cutoff used.

Third, we consider interactive effects by state cash assistance policy. By design, the cities in the original Fragile Families sampling frame were located in states that varied widely in terms of cash assistance generosity through their TANF programs (Reichman et al. 2001). Reichman et al. classified the Fragile Families cities as having a high, moderate or low level of TANF generosity based on the dollar value of the benefit plus the value of the benefit relative to

housing costs. We use that same classification but dichotomize into moderate or low (which we call low) versus high generosity.

The estimates in Table 4 are from 12 different probit models that include all of the same covariates as in Table 3 (but not city indicators) plus variables that capture interactive effects of infant health by high/low fair market rents (top panel), by high/low availability of subsidized housing (middle panel), and by high/low state TANF generosity (bottom panel). The estimates in panel 1 are for the following variables: high rent city and poor health, high rent city and good health, and low rent city and good health—all relative to low rent city and poor health. Those in the second panel are for corresponding measures of availability of subsidized housing (with low availability of subsidized housing and poor health as the reference category), and those in the third panel are for corresponding measures for state TANF generosity (with low generosity and poor health as the reference category). We are interested in whether the effects of severe infant health condition (first set of columns) and moderate or severe infant health condition (second set of columns) on the traditional and broad measures of homelessness are stronger for families confronting high housing costs, low availability of housing assistance, and low generosity of cash assistance. Thus, the estimates of particular interest are those in the first row of each panel. Note that by interacting our measures of infant health shocks with these variables, cell sizes become small (particularly for the severe health condition measure). Therefore, not too much should be read into lack of statistical significance at conventional levels and magnitudes and patterns should also be considered.

Of all models in Table 4, those in the first panel represent the strongest test of the O'Flaherty scenario, which posits that homelessness results from a combination of adverse individual circumstances and housing markets. We find that the effect of having a child in poor

health in a high-rent city (compared to having a child in poor health in a lower-rent city) is positive, large in magnitude, and statistically significant for the traditional measure of homelessness, regardless of which measure of poor infant health is used. That is, high rents appear to strongly exacerbate the effects of poor infant health. The effect is weaker when using the broader measure of poor infant health than when using the more severe measure, as expected. In examining the interaction of high rents and poor infant health on the combined measure of homelessness, results depend on the measure of poor infant health used. Mothers of children with a severe health condition who were born in a high rent city are significantly more likely to experience the broader measure of homelessness compared to mothers of children with a severe health condition who were born in a lower rent city. However, mothers of children with a moderate or severe health condition who were born in a high rent city are not significantly more likely to experience the broader measure of homelessness, largely because they are significantly less likely to double up without paying rent (result not shown). As potential host families' space is likely to be tighter in higher rent areas, it is not surprising that higher rents are associated with decreased likelihood of doubling up without paying rent, given poor infant health. We found a weaker negative and statistically insignificant corresponding association for doubling up without paying rent when using severe infant health condition (not shown), which suggests that families and friends may be less likely to turn away those having infant health shocks when the shock is more severe, all else equal.

The interactions of poor infant health with public assistance are less straightforward than those with housing markets. Given poor child health, housing and cash assistance have small and statistically insignificant associations with the traditional measure of homelessness and the sign is not always negative as would be expected if the supports served to buffer the effects of the

shock. However, for the combined measure of homelessness, we find that the estimated effect of having a child with a severe health condition in a city with relatively high availability of public housing subsidies (compared to having a child in poor health in a less generous city) is negative and substantial in magnitude, with a p-value above 1. The pattern is similar, but weaker as expected, for cash assistance. In analyses not shown, we found that the interactive effect between severe infant health condition and high housing subsidies on the combined measure of homelessness is driven by the doubling up component; that is, given a severe health condition, high benefits decrease the likelihood of doubling up and not paying rent (even when using living independently as the reference category). These results suggest that public assistance does have a buffering effect—to the extent that living independently is the more favorable arrangement. The corresponding interactive effects for both types of assistance when using the broader measure of poor infant health, are non-existent (i.e., they are insignificant with very small magnitudes and inconsistent signs), reflecting the weak effects of the broader health measure on doubling up that we found in Table 2. On a more minor note, the significant effects in the last rows of Panel 2 and 3 are a function of the reference categories used and reflect a generalized pattern of strong health effects controlling for MSA or state level characteristic.

Overall, the results of these analyses support O'Flaherty's hypothesized scenario of homelessness resulting from a conjunction of difficult circumstances in which high-priced housing markets and adverse individual circumstances collide. These results underscore the importance of housing markets in contributing to homelessness and suggest that public assistance, particularly housing subsidies, have a potentially buffering effect by decreasing the likelihood of doubling up without paying rent.

Specification checks

Our analyses rely on the assumption that infant health shocks cause homelessness rather than the other way around. As "falsification tests," we estimated effects of poor infant health on the mother's pre-delivery housing situation. The logic is that a shock that takes place at the time of the birth cannot possibly affect the mother's housing situation or living arrangements prior to the shock; finding significant associations would indicate spurious correlation. We estimated separate models estimating each of the baseline housing controls (poor baseline quality housing, lived with anyone during the pregnancy) using each of the three measures of poor infant health and controlling for all of the covariates in Table 1 except city indicators, baseline housing controls, and the age of the child at the time of the three year interview (results not shown). We found no evidence that any of the three measures of poor infant health is associated with the pre-delivery housing conditions or baseline living arrangements, further supporting our assumption that we have been successful at characterizing poor infant health as an exogenous shock.

We assessed the sensitivity of our estimates by estimating models corresponding to those in Table 2 that alternately excluded the cities with fewer than 100 cases, excluded city indicators, excluded the measures of baseline housing, and included the following measures of individual-level safety nets at baseline (which could theoretically be mediators): whether the father visited the mother and/or child in the hospital at the time of the birth, whether the mother could borrow $200 from a family member, whether the mother would have a place to live with a family member if necessary, and whether the mother had family that would help with child care. The estimated effects of poor infant health on the various housing outcomes were not appreciably changed in these alternate specifications. In fact, for the models that excluded the cities with fewer than 100 cases, the marginal effects of severe infant health condition and severe infant health condition or very low birthweight were stronger for both homelessness and the combined

measure of homelessness than in the Table 2 specifications. Overall, the estimated effects of poor infant health were remarkably robust.

Finally, we restricted the sample to mothers who participated in all three interviews and found the marginal effects of severe infant health condition and severe infant health condition or very low birthweight to be somewhat smaller than those in Table 2 for homelessness and the combined measure of homelessness, although they were less precisely estimated due to the much smaller samples.

Conclusion

This study exploited an exogenous health shock—the birth of a child with a severe health condition that is considered by the medical community to be random in the population—to investigate the effect of that shock on the probability of homelessness during the child's first three years of life. We found strong and robust evidence that this shock substantially increases the likelihood that the family experiences homelessness, particularly in cities with high fair market rents. Because homelessness is often a transient state and there are conceptual ambiguities in its measurement, we considered four different homelessness-related outcomes--a traditional measure of homelessness, two measures of housing instability thought to be precursors to homelessness (eviction or frequent residential moves, doubling up without paying rent), and a combined measure that incorporates the first three components and approximates the broadened conceptualization of homelessness under the 2009 HEARTH Act for determining eligibility for homeless assistance.

As far as we know, this is the first study to explicitly test O'Flaherty's hypothesis that homelessness results from a conjunction of adverse circumstances in which housing markets and individual characteristics collide, perhaps because longitudinal population-based datasets that

include measures of homelessness and have sufficient sample sizes are rare. As such, it makes an important contribution to the small literature on the economics of homelessness. By focusing on a life shock that has been shown to have adverse effects on employment, we find indirect evidence that that income shocks are a key factor affecting homelessness. That said, this study was based on one specific type of life shock and the findings may or may not be generalizable to other types of unexpected adverse life events. Therefore, the findings need to be complemented with those from studies of other types of shocks.

Overall, the estimated effects of poor infant health on the expanded measure of homelessness were of smaller magnitude than those on homelessness as traditionally defined, but the "bottom line" inferences vis-à-vis the average effects of infant health shocks on homelessness are the same regardless of which measure is used (the choice of measure was more consequential in analyses of interactive effects by MSA- and state-level factors, however). We found the shocks to have positive but weak effects on eviction or frequent residential moves and no aggregate effects on doubling up without paying rent, suggesting that the shocks are more likely to drive individuals with unstable housing situations into homelessness than to drive individuals from stable to unstable housing situations. Future research, which would require detailed histories that include both shocks and transitions between various housing situations, is needed to elucidate the pathways.

Aside from the primary results on the effects of a life shock on homelessness and the interactions of the shock with housing markets, the findings from this study add to a growing body of evidence that housing markets are an important contributor to homelessness and suggest that homelessness is a difficult problem to address through public policy. Indeed, we found no evidence that generosity of public assistance through housing subsidies or cash assistance buffers

the adverse effects of severe infant health shocks on homelessness as traditionally defined, perhaps because the homeless or potentially homeless are a relatively disconnected group or that we did not consider the most relevant geographic unit (e.g., some cities may provide more benefits to TANF recipients than the official state levels, or, since subsidized housing is likely concentrated in cities within MSAs, cities may be more appropriate unit for studying the role of housing generosity). We did find some evidence that infant health shocks reduce doubling up without paying rent in high generosity areas, which may represent a step in preventing homelessness since that situation is considered a precursor to homelessness. A more intensive examination of this association is warranted, however. First, the finding needs to be validated, as we have taken a relatively broad "first look" in this regard. Second, it is important to understand the role that public support may play in setting the conditions for private support that is offered in the form of a place to live. According to He et al. (2008), many federal assistance programs, including SSI, the food stamp program, and Section 8—the Housing Choice Voucher Program, impose substantial implicit taxes on shared housing; as such, it is possible that families and friends who would otherwise be willing to provide a place to live to those confronting shocks may be dissuaded from doing so. As doubling up, even without paying rent, is not an unambiguously unfavorable situation, it is possible that some families experiencing health shocks would benefit from this arrangement without conferring offsetting decrements in well-being to their host families.

Table 1: Sample Characteristics (N=3164)

Housing outcomes (measured at 3 years)	
Homeless	.03
Evicted or multiple moves	.06
Doubled up and not paying rent	.06
Combined measure	.13
Child characteristics	
Severe infant health condition	.02
Severe infant health condition or very low birthweight (< 1500 grams)	.03
Moderate or severe infant health condition	.20
Low birthweight (<2500 grams)	.10
Male	.52
Multiple birth	.02
Age at time of 3 year interview, months	35.84
	(2.57)
Maternal characteristics	
Age, years	25.08
	(6.07)
Non-Hispanic white*	.20
Non-Hispanic black	.48
Hispanic	.28
Other race/ethnicity	.04
Immigrant	.15
< High school graduate*	.36
High school graduate	.30
Some college	.24
College graduate	.10
Medicaid birth	.65
Census tract poverty rate, mean	.19
	(.13)
Missing census tract	.03
Employed	.80
Married	.24
Cohabiting	.37
Neither married nor cohabiting*	.39
Number of children, mean	1.16
	(1.35)
Physical health condition	.20
Diagnosed mental illness	.11
Did not complete 1-year interview	.05
Baseline housing controls	
Poor housing quality (from prenatal medical record)	.02
Doubled up during pregnancy	.33
Missing doubled up during pregnancy	.02

Notes: All figures are proportions unless indicated otherwise. Standard deviations in parentheses. All characteristics other than housing outcomes and the child's age are measured at or before the birth of the focal child. * Reference category in multivariate models.

Table 2: Estimated Effects of Poor Infant Health on Housing Outcomes Using Alternative Measures of Poor Infant Health and Alternative Outcomes (N=3164)

	Homeless	Evicted or multiple moves	Doubled up and not paying rent	Combined measure
	Coefficient (Standard Error) [Marginal Effect]			
Severe infant health condition	.68***	.31	-.17	.36**
	(.24)	(.29)	(.30)	(.17)
	[.06]	[.03]	[-.01]	[.08]
Severe infant health condition or very low birthweight	.45**	.23	-.11	.31**
	(.20)	(.21)	(.20)	(.14)
	[.03]	[.02]	[-.01]	[.07]
Moderate or severe infant health condition	.19*	.05	-.08	.06
	(.11)	(.12)	(.09)	(.06)
	[.01]	[.00]	[-.01]	[.01]
Low birthweight	. 34***	. 18	. 07	. 17*
	(.12)	(.13)	(.09)	(.09)
	[.02]	[.02]	[.01]	[.03]

Note: Each cell presents results from a separate probit model that includes all variables classified as maternal or child characteristics in Table 1 plus city indicators and corresponding baseline controls for the particular outcome. For corresponding baseline controls, the models of predicting homelessness included poor baseline housing quality, those predicting doubling up and not paying rent included doubling up during pregnancy and missing on that measure, and those predicting the combined measured included both poor baseline housing quality and the measures of doubling up during pregnancy. There was no corresponding baseline control for evicted or multiple moves available in the data; none was therefore included.
*p < .10; **p < .05; ***p<.01.

Table 3: Multivariate Probit Estimates of Effects of Severe Infant Health Condition on Housing Outcomes (N = 3164)

	Homeless	Evicted or multiple moves	Doubled up and not paying rent	Combined measure
	Coefficient (Standard Error) [Marginal Effect]			
Child characteristics				
Severe infant health condition	.68*** (.24) [.06]	.31 (.29) [.03]	-.17 (.30) [-.01]	.36** (.17) [.08]
Male	-.18 (.12) [-.01]	-.06 (.06) [-.01]	.09 (.07) [.01]	.00 (.06) [.00]
Multiple birth	.36 (.32) [.02]	.36 (.28) [.04]	-.26 (.34) [-.02]	.18 (.28) [.04]
Age, months	.04*** (.01) [.00]	.04*** (.01) [.00]	-.03* (.01) [-.00]	.01* (.01) [.00]
Maternal characteristics				
Age, years	.01 (.01) [.00]	-.02*** (.01) [-.00]	-.01 (.01) [-.00]	-.02** (.01) [-.00]
Non-Hispanic black	.30* (.16) [.01]	-.30** (.12) [-.02]	-.01 (.12) [-.00]	-.09 (.11) [-.02]
Hispanic	.07 (.18) [.00]	-.30** (.13) [-.02]	.12* (.07) [.01]	-.12 (.10) [-.02]
Other non-white non-Hispanic	.69*** (.25) [.06]	-.21 (.31) [-.01]	.28 (.24) [.03]	.14 (.21) [.03]
Immigrant	-.57** (.25) [-.02]	-.21 (.16) [-.01]	-.09 (.16) [-.01]	-.25* (.15) [-.04]
High school graduate	-.07 (.14) [-.00]	-.27*** (.08) [-.02]	.11 (.08) [.01]	-.08 (.08) [-.01]
Some college	-.24 (.17) [-.01]	-.30*** (.10) [-.02]	.13 (.11) [.01]	-.13* (.07) [-.02]
College graduate	-.49 (.34) [-.01]	-.37 (.35) [-.02]	.02 (.22) [.00]	-.30 (.23) [-.05]
Medicaid birth	.22**	.38***	-.04	.19**

	(.10)	(.09)	(.12)	(.09)
	[.01]	[.03]	[-.00]	[.03]
Census tract poverty rate	.28	.01	-.02	-.17
	(.46)	(.24)	(.27)	(.24)
	[.01]	[.00]	[-.00]	[-.03]
Missing census tract	-.29	.42**	.16	.27**
	(.47)	(.17)	(.23)	(.11)
	[-.01]	[.05]	[.02]	[.06]
Employed	.09	.15*	-.34***	-.12**
	(.14)	(.09)	(.09)	(.06)
	[.00]	[.01]	[-.03]	[-.02]
Married	-.30	-.17	-.55***	-.41***
	(.24)	(.19)	(.14)	(.13)
	[-.01]	[-.01]	[-.04]	[-.06]
Cohabiting	-.04	.07	-.24**	-.12
	(.09)	(.08)	(.10)	(.08)
	[-.00]	[.01]	[-.02]	[-.02]
Number of children	-.00	-.02	-.05	-.03**
	(.04)	(.03)	(.04)	(.02)
	[-.00]	[-.00]	[-.00]	[-.01]
Physical health condition	-.01	.03	-.01	-.01
	(.06)	(.09)	(.08)	(.05)
	[-.00]	[.00]	[-.00]	[-.00]
Diagnosed mental illness	.14	.13	.00	.12*
	(.18)	(.08)	(.11)	(.07)
	[.01]	[.01]	[.00]	[.02]
Did not complete 1-year interview	.31**	.67***	.24**	.54***
	(.15)	(.12)	(.12)	(.12)
	[.02]	[.09]	[.02]	[.13]
Baseline housing controls				
Poor housing quality at baseline	.52**			.22
	(.25)			(.19)
	[.04]			[.05]
Doubled up during pregnancy			.39***	.24***
			(.12)	(.08)
			[.04]	[.05]
Missing data on baseline living arrangements			.57	.48***
			(.37)	(.18)
			[.08]	[.11]

Models include indicators for mother's baseline city of residence (estimates not shown).
*p < .10; **p < .05; ***p<.01.

Notes: Each set of figures is from a different probit model that includes all of the same covariates as in Table 3 but not city indicators.

Table 4: Interactions Between Poor Infant Health and Selected MSA- and State-Level Characteristics (N=3164)

Measure of Poor Infant Health:	**Severe Infant Health Condition**		**Moderate or Severe Infant Health Condition**	
Outcome:	**Homeless**	**Combined measure**	**Homeless**	**Combined measure**
	Coefficient (Standard Error) [Marginal Effect]			
Fair market rent for 2-bedroom rental unit in MSA				
Reference category: Low rent and poor health				
High rent and poor health	1.55***	1.01**	.52***	-.04
	(.51)	(.44)	(.14)	(.11)
	[.27]	[.27]	[.04]	[-.01]
High rent and good health	.32	.06	.27**	-.06
	(.41)	(.30)	(.12)	(.12)
	[.02]	[.01]	[.01]	[-.01]
Low rent and good health	-.02	.14	-.08	-.01
	(.40)	(.29)	(.14)	(.07)
	[-.00]	[.02]	[-.00]	[-.00]
Availability of subsidized housing in MSA				
Reference category: Low availability and poor health				
High availability and poor health	-.04	-.42	.14	.02
	(.48)	(.41)	(.19)	(.13)
	[-.00]	[-.05]	[.01]	[.00]
High availability and good health	-.58	-.46*	.09	.07
	(.40)	(.26)	(.11)	(.09)
	[-.02]	[-.06]	[.00]	[.01]
Low availability and good health	-.87**	-.56*	-.25*	-.05
	(.39)	(.29)	(.14)	(.07)
	[-.05]	[-.09]	[-.01]	[-.01]
State TANF generosity				
Reference category: Low generosity and poor health				
High generosity and poor health	.01	-.14	.10	-.02
	(.50)	(.41)	(.19)	(.12)
	[.00]	[-.02]	[.01]	[-.00]
High generosity and good health	-.60	-.34	.02	.01
	(.40)	(.28)	(.13)	(.09)
	[-.03]	[-.05]	[.00]	[.00]
Low generosity and good health	-.81**	-.38	-.22	-.04
	(.39)	(.32)	(.15)	(.08)
	[-.05]	[-.06]	[-.01]	[-.01]

Notes: Each set of figures is from a different probit model that includes all of the same covariates as in Table 3 but not city indicators.

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Appendix Table 1: Coding of Measures of Poor Infant Health

The coding of abnormal conditions in the FFCWB data was designed to identify cases that were at least moderately severe, unlikely caused by prenatal behavior, had a poor long term prognosis, and were present at birth. A pediatric consultant was directed to glean information from the medical records (augmented with 1-year maternal reports) and to assign all infant conditions a number between 1 and 16 according to the grid below. After giving the consultant the grid and clear instructions, the investigators had no further input into how particular conditions were coded. If a child had multiple conditions, each condition was assigned a separate number.

Very Severe Infant Health Condition was coded as a one (yes) if the child had a health condition in cell #1. Examples of conditions in cell #1 are microcephalus, renal agenesis, total blindness, and Down Syndrome.

Severe Infant Health Condition was coded as a one (yes) if the child had a condition in cell #1 or the child was very low birthweight (less than 1500 grams).

Any Infant Health Condition was coded as a one (yes) if the child had a condition in either cell #1 or cell #2. Examples of conditions in cell #2, which are considered random at birth but may or may not have long-term health consequences, are malformed genitalia, hydrocephalus, cleft palate, shoulder dystocia, pneumomediastinum, and webbed fingers or toes.

Example of high severity conditions considered possibly related to parents behavior are cerebral palsy (cell 5) and not related to prenatal behavior are fetal alcohol syndrome (cell 9). These conditions are not coded as ones in the above measures.

	Severity			
	High	Medium	Low	Unknown
Not Behavior Related	1	2	3	4
Possibly Behavior Related	5	6	7	8
Likely Behavior Related	9	10	11	12
Not Enough Information To Determine if Behavior Related	13	14	15	16

Appendix Table 2. Maternal Sociodemographic Characteristics by Poor Infant Health Using Alternate Definitions of Poor Infant Health

	Severe infant health condition		Severe infant health condition or very low birthweight		Moderate or severe infant health condition		Low birthweight	
	No N=3107	Yes N=57	No N=3055	Yes N=109	No N=2531	Yes N=633	No N=2845	Yes N=319
Age, years	25.1	26.4*	25.0	26.2*	25.0	25.5**	25.1	25.6*
Immigrant	.15	.16	.16	.11	.16	.15	.16	.08***
Medicaid birth	.65	.61	.65	.69	.65	.65	.64	.76***
Census tract poverty rate, mean	.19	.16	.19	.18	.19	.18**	.19	.20
Employed	.80	.75	.80	.75	.80	.82	.80	.80
Number of children	1.2	1.2	1.2	1.3	1.2	1.1	1.1	1.4***
Race/Ethnicity								
White	.20	.22	.21	.18	.20	.23	.20	.19***
Non-Hispanic black	.49	.42	.48	.50	.48	.48	.47	.63
Hispanic	.27	.32	.27	.30	.28	.26	.29	.16
Other race/ethnicity	.04	.04	.04	.02	.04	.03	.04	.02
Education								
< High school graduate	.36	.35	.36	.33	.36	.33	.35	.38*
High school graduate	.30	.28	.30	.30	.30	.31	.30	.34
Some college	.24	.30	.24	.28	.24	.25	.25	.20
College graduate	.10	.07	.10	.09	.10	.11	.10	.08
Relationship Status								
Married	.24	.26	.24	.20	.24	.22	.25	.15***
Cohabiting	.37	.37	.37	.35	.36	.40	.37	.35
Neither married nor cohabiting	.39	.37	.39	.45	.40	.38	.38	.50

Notes: *p < .10; **p < .05; ***p<.01 from chi-square tests for differences in distributions (for race/ethnicity, education, and relationship status) or from t-tests for differences in means (for the other measures) by poor infant health.