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Public Housing & Health: Is there a connection?

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Biographical Statements

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Public Housing & Health: Is there a connection?

Abstract

This paper explores the relationship between public housing and health outcomes among low-income housing residents. While public housing can be dangerous and unhealthy environments to live, the subsidized rent may free up resources for nutritious food and health care. In addition, public housing may be of higher quality than the available alternatives, it may provide easier access to health clinics willing to serve the poor, and it may link residents to social support networks, which can improve mental health and the ability to access higher-quality grocery stores. To test whether there is a "back-door" health benefit to the public housing program, we analyze data from the Fragile Families and Child Wellbeing Study. We minimize the effects of selection into public housing with controls and instrumental variables estimation and find that public housing residence may reduce the mother's probability of smoking. The other results are sensitive to the instrumental variable used, and thus, we conclude that, except with respect to smoking, we are unable to detect a robust health effect of public housing.

Keywords: public housing, health

Introduction

For the past twenty years, researchers have spent considerable effort studying the potential consequences of federal low-income housing policy on the life-chances of poor Americans. Much of this research has focused on the social and economic consequences of public housing for poor families, attempting to understand whether and how public housing influences labor market outcomes, educational attainment of school-age children, criminal activity, and out-of-wedlock births and family formation (see, for example, Reingold, 1997; Ong, 1998; Katz, et al., 2001; Orr, et al., 2003; Reingold, Van Ryzin, and Rhonda, 2001; Newman and Harkness, 2002; Jacob, 2004). One area largely unaddressed by this literature is the connection between low-income housing programs, specifically public housing, and the health outcomes of those that benefit from these subsidies. To address this gap, we estimate the health effects of public housing.

Low-income housing policy and public health have been linked for more than a century, and there is reason to believe they continue to interact. Early housing reform efforts in the United States focused on improving housing code standards designed to improve the safety and health of tenement residents (Dreier, 1997: 242). At the national-level, housing policy in the

United States was partially based on public health concerns. The guarantee of the U.S. Housing Act of 1937 that all Americans are entitled to "decent, safe, and sanitary dwellings" was formulated, in part, to prevent the spread of disease and to improve the health and well-being of all Americans – particularly the poor.

Today, the link between low-income housing policy and health is more nuanced. It is widely believed that crime and deteriorating conditions pose health and safety risks for public housing residents. Consistent with this common conception, research evaluating the effects of demonstration programs, like Moving to Opportunity, which provide housing subsidies to public housing residents to facilitate relocation to low-poverty neighborhoods, finds that *moving out* of public housing is beneficial to health (Acevedo-Garcia, et al., 2004; Leventhal and Brooks-Gunn, 2003; Del Conte and Kling, 2001). However, the health effects of public housing among those who are not a part of these mobility experiments may be very different. These demonstration studies are designed to measure the health effects of moving out of distressed urban public housing to a similarly subsidized unit in a more affluent area. In contrast, the alternative to public housing for most families is either lower quality housing with a similar rent, or similar quality housing with a higher rent.

Given their alternatives, there may be health benefits to the housing program for many families. Public housing may provide higher quality housing than a family can otherwise afford. Housing improvements have been found to reduce a sense of isolation, reduce fear of crime, increase a sense of belonging and feelings of safety, increased involvement in community affairs, greater recognition of neighbors, and improved view of the area as a place to live (Blackman, Harvey, Lawrence, et al. 2001; Ambrose, 2000; Wooden, Delves, and Wadhams, 1996; Halpern, 1995 cited in Thomson, Petticrew, and Douglas, 2003).

Public housing is subsidized so households need not sacrifice their health to pay high, unsubsidized rent. Currie and Yelowitz (2000) find that children who do not live in public housing are more likely to suffer from overcrowding, which, while not a health outcome, has been shown to be related to health (Mann et al, 1992; Galpin et al, 1992; Coggon et al, 1993). Recent findings from a six city study of low-income children indicate that children whose families did not receive any housing assistance had a lower weight-for-age than those in families receiving rent subsidies (Meyers, et al, 2005). Other research has also found that households strapped for rent may economize on food or be unable to purchase an adequate diet, which may have harmful effects on health (Thomson, Petticrew, and Douglas, 2003; Ambrose, 2000).

This evidence is borne out by anecdotal observations from a malnutrition clinic where people who utilize these interventions usually do so because "[t]hey can't get into public housing; they are languishing on long waiting lists for vouchers that would help pay for private apartments. Or they are immigrants ineligible for government [housing] programs. As a result, some find that rent alone soaks up 50 to 75 percent of their earnings. They have no choice. They have to pay the rent…Housing costs contribute to malnutrition, and malnutrition affects school performance and cognitive capacity. It weakens immune systems and makes children susceptible to illness, which diminishes appetites and thereby increases vulnerability to the next infection" (Shipler, 2005).

It is difficult to determine whether health benefits observed among residents are the result of public housing or are also attributable to characteristics which are correlated with public housing residence. That is, families who pursue housing subsidies may be more or less attentive towards their health compared to families who do not pursue subsidies. If this is true, then their

health behaviors and outcomes would be different regardless of whether they lived in public housing or not.

With a few exceptions, the studies described above are not able to account for this type of selection bias because they suffer from limitations inherent in cross-sectional research. In order to address these limitations and build off of these empirical exercises, we use instrumental variables estimation and longitudinal data from the Fragile Families and Child Well-Being Study to estimate the health effects of public housing. These data include a substantial number of public housing residents and nonpublic housing residents, extensive information on the physical and mental health status of parents and children, and a wide-range of socio-economic and background characteristics that capture the life-history of these respondents.

The paper is organized into three sections. First, we identify the likely theoretical explanations that may explain why there may be a relationship between public housing and health. Second, we describe our data, empirical strategy, and results. Third, we summarize our findings and discuss limitations of the analysis.

Theoretical Background

The correlation between public housing residence and the health of residents is likely dominated by selection. That is, public housing is a safety net for families in need financially. Poor families are more likely to be in poor health (Adler et al 1994). Moreover, health problems may be the cause of many families' low incomes if illness has kept the breadwinner(s) from steady work (Smith 1999). These arguments suggest a negative correlation between public housing and health; however, it may also be the case that public housing administrators select their residents from among the healthiest of their applicant pool, which would predict a positive

correlation. The goal of this analysis is to minimize the impact of the connections between public housing and health based on selection in order to focus on the causal relationship.

Public housing can causally affect the health of residents in a number of positive and negative ways. There are four likely reasons we might expect public housing to improve the health of residents. First, public housing may result in an *income effect* where the housing subsidy frees up additional income that can be used to purchase health services, medicine, and food containing higher-nutritional value. The additional income could reduce household food insecurity which has been shown to be associated with adverse health outcomes in children (Cook, et al., 2004). Experimental and quasi-experimental evidence indicates that public housing subsidies have minimal labor supply effects (Reingold, 1997; Ong, 1998; Katz, et al., 2001; Orr, et al., 2003; Reingold, Van Ryzin, and Rhonda, 2001; Newman and Harkness, 2002; Jacob, 2004). This suggests that housing subsidies result in additional income for recipients of these subsidies. Reductions in housing costs should free up substantial resources, given that Edin and Lein (1997:91) find that housing costs consume between 25-27% of the average low-income household's monthly budget.

Second, public housing may have a housing *quality effect* on residents. Little is known about the quality of public housing compared to the private housing stock; however, given that subsidized housing is closely regulated to make sure residents are not exposed to hazards, such as lead, mold, and pest infestation, it is likely that moving into public housing improves the quality of housing for occupants. On the other hand, there is probably wide variation in the quality of public housing units and their maintenance by local public housing authorities, thus the magnitude (and possibly the direction) of this relationship depends on the location of the public housing unit.

Third, public housing may have a *gateway effect* on residents. In particular, subsidized housing is frequently located in close proximity to social service organizations, including local public health clinics and food banks. These organizations select locations that place their services in close proximity to their clients who live in public housing. In addition, low-income housing programs, particularly public housing, frequently engage in outreach efforts designed to provide information to residents about available human services. As a result, living in public housing may provide residents easier access to health-related services.

Finally, public housing may benefit residents through a *network effect.* Poor households living next to each other (as is frequently the case with public housing) are able to share informal information on health professionals and clinics that are willing to serve the poor, as well as pool resources and informal social support (such as car pooling) to access higher-quality, low-price food products from commercial establishments that may be located far from the poorest areas of a locale. Informal information sharing and help-giving could translate into improved health outcomes if these exchanges take place around activities that shape health and health-related issues. Ethnographic evidence establishes the importance of these informal social support systems for public housing residents (Venkatesh, 2000), as well as low-income households in general (Edin and Lein, 1997). While public housing does not appear to have a dramatic influence on informal social support (Reingold, Van Ryzin, and Rhonda, 2001), little is known about the degree to which informal information sharing and help-giving revolve around activities that might shape health outcomes for residents.

In contrast to these theories, there are a number of reasons to believe that public housing worsens the health of its residents. First, some anecdotal evidence suggests that residents of poor neighborhoods lack access to grocery stores that stock fresh fruits, vegetables, and other

perishable goods critical for maintaining positive nutritional status. According to a recent Chicago Department of Public Health Study, “[i]n North Lawndale on the Near Southwest Side, more than a quarter of the residents live half a mile or more from the nearest food store with fresh produce – and nearly 40 percent don't have cars to get there....Access to fresh produce was even more limited in Austin, where there was one large food store for every 19,000 people” (Fuller, 2005).

Second, public housing could have a negative effect on health as a result of neighbors spreading unhealthy behavior. This hypothesized peer effect is closely associated with what has been referred to in the ethnographic literature as ghetto-specific behavior (Hannerz, 1969) that is brought on by isolation from mainstream patterns of behavior due to “massive joblessness, flagrant and open lawlessness, and low-achieving schools,” among other economic and social structural constraints (Wilson, 1987:58). The degree to which family-based public housing per se exacerbates this set of circumstances is unclear, particularly within the realm of health-related behavior; however, this program’s tendency to house poor families next to other poor families likely enhances the degree to which residents adopt physically harmful patterns of daily life learned or absorbed from their immediate physical surroundings.

Lastly, the close association between public housing, youth gangs, and the drug trade may have negative consequences on the health outcomes of residents. If public housing residents are too fearful to walk the streets or to let their children play outside, retreating into the safety of their homes (Anderson, 1990), these strategies for living likely foster sedentary life-styles that may manifest themselves in worse health outcomes. Similarly, the tendency among some inner-city residents to insulate their households from the perceived dangers of the local

community may increase feelings of personal isolation and depression, leading to worse mental health outcomes.

In sum, there are potentially both positive and negative health effects of public housing residence. Public housing may provide an income, a quality, a gateway, and a network effect for residents which could improve their health. However, distance from grocery stores, exposure to peers that engage in unhealthy behavior, and crime associated with public housing may have negative health consequences for residents. Thus, we turn now to evaluate the question empirically.

Fragile Families

For this analysis, we use data from the Fragile Families and Child Wellbeing Study, which follows a birth cohort of approximately 5,000 children born in twenty U.S. cities between 1998 and 2000. The first interview, which we refer to as the baseline interview, occurs in the hospital after the birth of the cohort member. Data are also available from two follow-up interviews – one that takes place approximately one year after the birth and another that occurs 3 years after birth.

There are a variety of health behaviors and health outcomes available across the interview waves. In all waves, the mother reports her overall health status on a five point scale ranging from excellent to poor. While subjective, self-reported health status has been shown to predict mortality, even when controlling for health behaviors and doctor-reported health status (Idler and Kasl, 1995). Consistent with this, we find that mother's reports of her health are highly correlated with other known outcomes and her health behaviors.

At every wave, we also know whether the mother drank alcohol or used drugs over some recent period. In addition, at the baseline interview, we know if the child was born low birth weight, defined as weighing less than 2500 grams, or about 5.5 pounds, at birth. We also know whether the mother smoked cigarettes during the pregnancy.

At the 1-year interview, we have the mother's report of the child's overall health status, and whether she smoked in the past month. There are also two questions about the state of the mother's mental health. She is asked whether she has felt sad or depressed for two weeks or more in a row and whether she has felt worried, tense, or anxious for a period of one month or more. We construct one variable from these two questions. Finally, the mother is asked if she has a serious health condition that limits the amount or kind of work she can do.

At the 3-year interview, there is a more extensive series of questions about the mother's signs of depression. We construct a composite measure from five questions which suggest that the mother might be depressed: in the last year, she 1) felt sad, blue, or depressed for 2 weeks or more in a row; 2) lost interest in most things like hobbies, work, or activities that usually give her pleasure for 2 weeks or more in a row; 3) thought about death – her own, someone else's or death in general in those 2 weeks; 4) felt down on herself, no good, or worthless in those 2 weeks; and 4) felt worried, tense, or anxious for a period of 1 month or more. We also know whether the mother has a limiting health condition. In addition, the mother's weight and height are reported from which we can compute her body mass index (BMI), by dividing weight by height squared.

Each mother is asked whether she lives in a public housing project at each interview wave. When public housing is managed by private real-estate management companies, residents may unknowingly provide an inaccurate response to this survey question. However, we do not

believe this is a serious issue in the Fragile Families data. In particular, we find that respondents that report living in public housing have much lower average housing costs than those who do not report living in public housing.

The mother is also asked "Is the federal, state, or local government helping to pay for your rent?," but this question covers a large number of possible subsidy programs which may have different eligibility requirements. For this reason, we focus on the public housing program only and use this question to control for participation in other housing programs. We are also limited by the fact that none of the waves collect a history of public housing residence. Thus, the length of residence can only be determined if the mother moves into public housing after the baseline interview.

Finally, the Fragile Families data allow us to control for a wide variety of demographic characteristics. Most of the controls are from the baseline interview: the mother's age at baseline, her race, immigrant status, education, and marital status. We also know how long she has lived in her neighborhood, although it is not clear how the mother defines a neighborhood. When examining the effects of public housing at later waves, we also control for the mother's health status at baseline to partially address the selection bias problem.

Empirical Strategy

Because public housing residence is a choice of the household and the program administrators, as discussed above, the effect of public housing on health outcomes and behaviors is challenging to isolate. In particular, public housing residents may have different unobserved characteristics than non-residents. To overcome this challenge, we minimize the

effects of selection into public housing using a rich set of control variables (X_i), and instrumental variable (IV) estimation.

Instrumental Variables

The public housing research literature has made use of three different instrumental variables, and our analysis replicates these variables and compares findings using each. For the first IV, we use exogenous variation in the gender composition of children in households with two children as an instrument. As Currie and Yelowitz (2000) argue, the gender composition of children provides a good opportunity to identify the effects of public housing because households with both a boy and a girl at application receive a larger apartment than households with children of the same gender who can share a bedroom. Thus, theory would predict that families with a boy and a girl should be more likely to reside in public housing. That is, if PH_i represents public housing residence and BG_i indicates two-child households with one boy and one girl, then we expect α_1 in the equation below to be positive.

$$PH_i = \alpha_0 + \alpha_1 BG_i + \alpha_2 X_i + \varepsilon_i \qquad (1)$$

Equation (1) serves as our first stage equation. Thus, BG_i is our instrument for public housing residence in the second stage:

$$PoorHealth_i = \beta_0 + \beta_1 PH_i + \beta_3 X_i + u_i \qquad (2)$$

If we were to estimate equation (2) using ordinary least squares (OLS), β_1 would reflect both a causal effect of public housing on health and a selection effect. That is, if β_1 were positive (indicating worse health), it could be that public housing is harmful or that public housing residents are a poor population at a higher risk of experiencing poor health, and, as mentioned in the previous section, may enter public housing residence because of health problems. By

instrumenting PH_i using the exogenous variation in child gender among families with two children, we remove the effects of selection so that we estimate the causal effect of public housing on health outcomes only.

Table 1 presents the first stage regression described by equation (1) above. In particular, we estimate the effect of having a boy and a girl in the household at the 1-year interview on the probability of moving into public housing between the baseline and 1-year interviews. Since this instrument hinges on family composition when families move into public housing, we do not want to include families who might have lived in public housing for many years. Because we do not know how long mothers have lived in public housing if they moved in before the baseline interview, we limit our analysis to the sample of mothers who did not live in public housing at baseline. Only households with two or three children at the 1-year interview are considered. We include families with three children at the 1-year interview to increase our sample size,[1] and because we do not want to exclude families who might have had a birth subsequent to the move to public housing. In particular, parents with two boys or two girls are more likely to want another child (Pollard and Morgan, 2002), thus we might have disproportionately omitted families who entered public housing with same sex children if we restricted families to having only two children at the first follow-up interview. For families with three children, we use the gender of the two oldest children as the instrument. 51 percent of families in the sample have a boy and a girl at the 1-year interview.

We include households who do not live in public housing at the 1-year interview if their income is below 80 percent of their city's median family income. Families are technically eligible for public housing if their incomes are at or below 50 percent of the area median, but

[1] Excluding families with three children leaves a sample size of 831 and the instrument is only significant at the 15 percent level (F-statistic = 7).

housing authorities are permitted to allocate a fraction of their units to families with incomes between 50 and 80 percent of the median family income of the area.

We find that households with a boy and a girl are significantly more likely to live in public housing. Since in our sample, 14.0 percent of families live in public housing, a marginal effect of 5.8 percentage points translates into a 41 percent (=5.8/14.0) increase in the likelihood of living in public housing. This magnitude is substantially higher than that found by Currie and Yelowitz (2000) who find a 21 percent increase in the likelihood of project participation. However, their analysis looks at gender composition and public housing residence at one point in time. If we replicate their strategy as closely as we can – estimating the effect of having a boy and a girl at the 1-year interview on public housing residence at 1-year, not taking into account when the household moved into public housing, we find a 19 percent increase in the probability of public housing residence. The effect is not significant however.

One limitation of this IV is that the household size requirement severely restricts the sample size. As a result, the F-statistic for the first stage is slightly below the threshold of ten recommended by Stock and Staiger (1997) to avoid weak instrument problems. To help overcome this problem, we re-create the instrument used by Newman and Harkness (2002) – a measure of the public housing supply. They argue that the public housing supply in a city is determined by (1) factors associated with the city's make-up, such as the percent of female headed households, and (2) random geographic variation (Kingsley and Tatain, 1999). As such, the number of non-elderly, non-disabled public housing units per 100 eligible families in a city is endogenous. However, if we regress this number on the characteristics of the city which influence the public housing supply, then the residual should reflect only the random geographic variation. As Newman and Harkness note "[t]his instrument is appealing because households are

more likely to be assisted if they live in places where public housing is more readily available" (2002:27). In addition, this approach allows us to include all available data.

Table 2 presents some details about the construction of this instrument. The first column reports the actual number of public housing units which are designated for families. This number is divided by the number of eligible households in each city and multiplied by 100 in column 2. The instrument, shown in column 3, is the number of units per 100 eligible families, adjusted by the log population, percent in poverty, percent white, percent age 65 or older, percent with a college degree, median rent/median monthly income, and the percent of female headed households. The regression which accomplishes this adjustment is shown in Appendix Table A1. The final column of Table 2 compares the instrument to the percent of families in the Fragile Families data who live in public housing in each city. With a few exceptions, it does appear that higher values of the instrument are related to higher rates of public housing residence in our sample.

If PHS_i represents the adjusted public housing supply, whose construction is described above, then the first stage equation in this case is:

$$PH_i = \alpha_0 + \alpha_1 PHS_i + \alpha_2 X_i + \varepsilon_i \qquad (3)$$

The second stage is described by equation (2) above. The first stage regression results of this instrument are presented in Table 3. As expected, the supply of public housing in a respondent's locale significantly increases the probability that a respondent in the Fragile Families study lives in public housing. This is true for predicting public housing residence at baseline, as well as whether a respondent moved into public housing between baseline and the first year follow-up interview. The magnitudes of these effects can be computed by comparing the probability of living in public housing if one lives in the city with the worst public housing supply (Detroit, in

our case) to the probability if one lives in the city with the best housing supply (Baltimore). Moving from Detroit to Baltimore would increase the probability of living in public housing at baseline by 94 percent, and it would increase the probability of moving into public housing between interview waves by 49 percent. The effect size is likely larger for baseline public housing because the public housing supply is measured in 1998, which is when the baseline interview began. Because public housing demolitions are on-going over this period, there is likely to have been some changes in the supply across time.

The third instrument used in this literature is the extent of public housing demolitions required by Congress over the past decade via the HOPE VI program. Jacob (2004) uses administrative data on demolitions in Chicago to estimate the effect of public housing on educational outcomes. Since we do not have data on demolitions in our cities, we construct a proxy for the probability that demolitions took place in a city – the average age of the housing stock.[2] We know the average year that the housing stock was built in the census tracts where the Fragile Families reside.[3] We construct an average of these census tract variables within each city, using only those census tracts where our sample resides. Table 4 lists the average year built for each city – Detroit has some of the oldest housing and Austin some of the most recently built among the Fragile Families cities.

Let YB_i be the log average year the housing stock was built in a city, then the first stage equation in this case is:

$$PH_i = \alpha_0 + \alpha_1 YB_i + \alpha_2 X_i + \varepsilon_i . \qquad (4)$$

[2] Newer housing stock may attract residents to public housing for reasons unrelated to the demolitions. The housing is likely more appealing if it is newer. In either case, housing age is capturing exogenous variation in public housing residence.

[3] We thank Nancy Reichman and Julian Tietler for collecting this data and sharing it with us.

We show the results of estimating equation (4) in the second to the last column of Table 3. Consistent with the fact that the efforts to replace severely distressed public housing only gained speed in the mid- to late-1990s, housing age does not significantly predict public housing residence at baseline, and thus, we do not show these regressions in Table 3. Newer housing stock does significantly increase the probability of moving into public housing between the baseline and 1-year interviews. If one were to move from Detroit to Austin, they would be 36 percent more likely to move into public housing over this period.

Finally, because both the initial housing supply and the effects of demolitions should predict moving into public housing, we test the inclusion of both instruments in the last column of Table 3. Both instruments individually predict moving into public housing and the first stage is jointly significant as well. We conducted over-identification tests using Hansen's J statistic, which is robust to heteroskedasticity in the errors, for each outcome variable. We report the average J statistic, but for all outcomes, we do not reject that the instruments are valid.

Because public housing supply and housing age are relevant instruments for a sub-sample, we can use them in combination with the gender composition instrument as well. We report first stage regression of three combinations of instruments in Table 5. The over-identification tests in all cases indicate that the instruments are valid. The F-statistic is highest, although still shy of ten, when the gender composition and housing age instruments are used, thus we will use this pair of instruments in the analysis as well.

Sample Description

The validity of the various instruments has been shown above. Now we will provide some descriptive statistics on the specific samples used for each instrument. Table 6 presents the characteristics of the sample used with the gender composition instrument, by public housing

status. The sample includes those households who did not live in public housing at baseline and who have 2 or 3 children at the 1-year interview. If they did not live in public housing at the 1-year interview, then their household income must be 80 percent or less of the median family income. There are 150 families that moved into public housing between the baseline and 1-year interviews. There are 938 families in our comparison group so about 14 percent of those eligible moved into public housing. For this sample, the typical respondent (regardless of public housing status) is in her mid-20s, has one child and was unmarried at the birth of the sampled child. No substantial differences were found between public housing residents and their counterparts in the private real-estate market with respect to immigrant status. However, public housing residents are more likely to be black (64% versus 48%) and less likely to have schooling beyond high school (7% vs. 23%). Among those households living in private housing, 12 percent receive housing subsidies. Those who moved into public housing were much more likely to have had a housing subsidy at baseline than those who did not move in (25% vs. 13%).

At baseline, mothers in the public housing sub-sample report higher rates of fair or poor health (15% versus 9%). This disparity increases dramatically at the 1-year interview (25% versus 16%) and then decreases at the 3-year interview (18% versus 16%). Public housing residents report lower rates of smoking and drinking alcohol, and these differences remain over time, but no differences were found in self-reported drug use. No substantial differences were found in the self-reported health of the child at the 1-year or 3-year interviews.

Table 7 shows the characteristics of the two samples used with the public housing supply and housing age instruments, by their public housing status. The first sample includes those households who either lived in public housing at baseline or had an income no greater than 80 percent of their city's median family income. The second sample includes those households who

did not live in public housing at baseline. If they did not live in public housing at the 1-year interview, then their household income must be no greater than 80 percent of the median family income. For the first sample, almost 17 percent, or 456 families, were in public housing at baseline. For the second sample, around 14 percent, or 323 families, moved into public housing.

The typical respondent (regardless of public housing status) is in her early- to mid-20s with one child and unmarried at the birth of the sampled child. Both groups have a similar length of time living in their current neighborhood. Public housing residents are less likely to have any post-secondary schooling (12% vs. 21 or 22%). At baseline, 72 percent of public housing residents are black and 21 percent are Hispanic compared to 48 percent and 33 percent of non-public housing residents, respectively. Hispanic respondents are predominantly immigrants, and the higher rate of Latinos among non-public housing residents translates into more immigrants among this sub-group. In contrast, these differences in ethnicity and immigration status disappear when looking at a sub-sample of respondents who moved into public housing between the baseline and 1-year interview and their counterparts in the private real-estate market.   Public housing residents at the 1-year interview were more likely to have a housing subsidy at baselin than non-residents. Across the public housing supply sub-samples, indicators for mother's and child's health outcomes and behaviors are very similar within waves. The only noticeable difference is that those who moved into public housing have lower self-reported rates of drinking than their counterparts in the private real-estate market.

Results

The results are presented in Tables 8, 9 and 10 (see Appendix A2 and A3 for selected full models). On each table, we present results from ordinary least squares (OLS) and instrumental

variables estimation. The coefficients in the instrumental variables specifications represent the local average treatment effect (Inbems and Angrist, 1994). That is, they represent the effect of public housing on health for the subgroup of residents affected by the specific instrument used. The families who are on the margin between public housing and the private market are an interesting group to study – they are the ones most likely to be affected by new housing policies. However, because the groups of residents affected are different for each specification, none of the point estimates listed in a given row are strictly comparable. At the same, we are more likely to be persuaded that an observed effect is a true effect if we find consistent results for all of these groups.

In Table 8, we consider the effect of public housing residence at baseline on health behavior and outcomes at baseline. We present the results of OLS and IV estimation using the public housing supply IV. We cannot use the gender composition IV or the housing age IV in this case because neither significantly predicts public housing residence at baseline. In the first column, the effect of public housing residence when using OLS produces a positive but statistically insignificant effect on the mother's health status at birth. Larger values of the dependent variable represent worse health in all of the regressions reported in these three tables. The second column presents the results from instrumenting public housing with the public housing supply indicator. We see that the effect of public housing no longer worsens health, but has the opposite sign, although the effect is also not significant. At baseline, public housing only has a significant negative effect on self-reported rates of smoking during the mother's pregnancy.

Table 9 presents the effects of moving into public housing between the baseline interview and the 1-year interview on health outcomes and behaviors at the 1-year interview. Since we are using data from the 1-year interview, we can utilize all of our possible instruments. In particular,

using the gender composition sample, we use the gender composition instrument alone and with the housing age instrument. Using the public housing supply and housing age sample, we use the public housing supply instrument and the housing age instrument, separately and together. In all specifications, mother's self-reported health status at baseline is included to help control for selection into public housing based on health.

No public housing effects were found for mother's self-reported health status, depression signs, or for child's mother-reported health status at 1-year, regardless of model specification. In contrast, public housing is significantly correlated with lower maternal alcohol consumption. However, this relationship disappears when using any of the instruments. Public housing is also correlated with less drug use among mothers in the public housing supply sample. However, this correlation may be causal; it is significant when the gender composition and housing age IVs are used and the effect is negative in all specifications. In addition, public housing appears to significantly reduce the probability that a mother has a serious limiting health condition when we use the public housing supply and housing age IVs. However, none of the other specifications lead to significant coefficients and the signs and magnitudes of the coefficients are very sensitive to the specification. Lastly, we find that public housing reduces self-reported rates of smoking when using the public housing supply and/or housing age instruments, similar to what we found in Table 8.

Table 10 presents the effect of moving into public housing between the baseline and 1-year interviews on health outcomes and behaviors at the 3-year interview. In other words, these models are designed to estimate a slightly longer term effect of moving into public housing than the previous table. As in Table 9, mother's self-reported health status at baseline is a control in all specifications. Regardless of model specification, we find no public housing effects at the 3-

year interview for mother's overall self-reported physical health status, mental health status, and limiting health condition. Children's self-reported health status is significantly improved by public housing when using the gender composition and housing age instruments; however, this benefit of public housing is not significant for any other specification. As in Table 9, public housing is correlated with lower alcohol and drug use. The relationship does not appear to be causal in the case of alcohol as none of the coefficients in the IV specifications are significant and the size and sign are sensitive to the specification. The effect on drug use is similar across specifications but is never significant with IV estimation. Lastly, even though public housing does not seem to have much effect on the overall health status of mothers, it does have a significant effect on mother's log BMI.[4] In all but one specification, the coefficient is positive, but it is only significant for the gender composition sample with OLS and when using the public housing supply and housing age IVs.

In sum, we find that public housing reduces the probability of maternal smoking. The effect is significant in four of the six possible IV specifications and the coefficient is negative in all six specifications across two waves. There is also weak evidence that public housing may reduce maternal drug use at the 1 and 3 year interviews among mothers who moved into public housing between the baseline and 1-year interviews. Nine of the ten possible IV specifications have negative coefficients, though only one is significant. Otherwise, the effects are highly sensitive to the instrument used.

[4] We use log BMI instead of BMI because BMI has a long right tail so taking the log gives a more normal distribution.

Conclusion

Before concluding, it is appropriate to highlight a number of limitations with the current analysis. First, we rely on self-reported public housing residence, health behaviors, and health outcomes for the three data collection phases. While these variables may be reported with error, we believe this potential problem is not a serious threat to the internal validity of our findings. Respondents who report public housing residency in both samples have substantially lower per-month average housing costs compared to their counterparts in the private real-estate market – by approximately 50%. Moreover, we find a strong relationship between the subjective self-reported health status and other health measures and behaviors within this sample. Both of these checks confirm our expectations.

Second, our measure of public housing residency does not capture exposure to public housing over the life-course. A respondent that has never lived in public housing but moved in during the Fragile Families study period has a much different exposure to the potential causal mechanisms that may link public housing and health compared to a respondent that was raised in public housing, moved-out for ten years, and later re-located to a public housing unit. Unfortunately, the Fragile Families Study did not collect information on exposure to public housing over the life-course.

Third, even though we control for selection bias with an instrumental variable strategy and controls for past health, these approaches are not without potential problems, and public housing residents in our sample may have different unobserved characteristics than non-residents (such as exposure to public housing over the life-course). The only way to completely eliminate this potential internal validity threat is with a controlled random assignment experiment.

Finally, the Fragile Families Study collected data from twenty cities. While these cities represent a diverse range of urban environments, varying by region, size, density, economic diversity, and size/type of public housing program, it is unclear whether the public housing effects in this analysis can tell us anything about the connection between public housing and health outside of these sampled cities.

These limitations need to be weighed against the strengths of the Fragile Family Study, including its large sample and multi-city research sites, a rich set of socio-economic and demographic control variables, data on parents and children, longitudinal indicators of health, and an indicator for public housing status. These strengths allow us to build-off of the existing literature and provide the necessary ingredients to conduct a systematic and comprehensive secondary analysis of public housing and health.

Overall, the majority of possible effects of public housing on health in the Fragile Families and Child Well-Being Study are not detectable. The only exception is maternal smoking; public housing appears to significantly reduce the probability that a mother smoked during pregnancy and in the month prior to the 1-year interview. When we detect public housing effects on the other health outcomes and behaviors, they are sensitive to the instrumental variable used.

Perhaps the income, quality, gateway, and network effects are being countervailed by lack of access to adequate grocery stores, peer effects, and crime. It is also possible there is little connection between public housing and health, and the anecdotal and cross-sectional findings in the literature (including the descriptive statistics in this analysis) linking public housing and health are spurious. However, it would be premature and perhaps inappropriate to conclude there is no connection between public housing and health based on the results of this single

study. Prior to making this conclusion, it is necessary to replicate these findings with other data and research strategies, improving on this effort and overcoming some of the shortcomings.

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Table 1: First stage results of child gender composition as an instrument
Sample: 2 or 3 children & income < 80% of MFI at 1-year; not public housing resident at baseline
Dependent Variable: Moved into Public Housing between baseline and 1-year

Boy and girl at 1-year (51% of families)	0.058**
	(0.021)
Mother's age at birth	-0.005*
	(0.002)
Black	0.108**
	(0.032)
Hispanic	0.039
	(0.035)
Other Race	-0.034
	(0.070)
Mother is immigrant	0.021
	(0.033)
Mother has some college	-0.093**
	(0.026)
Unmarried at birth	-0.013
	(0.030)
Number of children at 1-year	0.035*
	(0.014)
Mother's health fair/poor at birth of child	0.082*
	(0.035)
Housing subsidy at baseline	0.151**
	(0.031)
Housing subsidy at 1-year	-0.222**
	(0.036)
Constant	0.138*
	(0.065)
Total observations	1044
F statistic	9.49
Percent in public housing	14.0%
Effect size[a]	41%

Ordinary least squares. Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at
[a]Effect size = the increased probability of public housing residence if had one girl and one boy instead of children of the same gender.

Notes: When we included observations with missing control variables, the missing indicators were insignificant, but their inclusion resulted in worse overall fit, thus we drop all observations with missing variables. Likewise, when we included city and state dummy variables and income controls, we found that these variables were not significant and their inclusion resulted in worse overall fit.

Table 2: Public housing supply instrument

	Public housing units for families	Public housing units per 100 eligible families	Instrument	Percent of FF sample with income < 80% of MFI in public housing at baseline
Baltimore, MD	7,057	12.09	4.85	20%
New York, NY	72,128	9.44	3.35	23%
Norfolk, VA	2,941	8.66	2.78	22%
Newark, NJ	3,685	9.62	1.78	23%
Richmond, VA	3,237	9.82	1.38	16%
Nashville, TN	3,534	3.96	1.35	8%
Corpus Christi, TX	1,344	4.86	0.95	21%
Jacksonville, FL	2,156	1.94	0.79	15%
Indianapolis, IN	1,410	1.45	0.44	29%
San Antonio, TX	4,180	2.61	0.18	10%
Chicago, IL	17,938	4.19	0.03	26%
Austin, TX	1,062	1.02	-0.16	5%
Oakland, CA	1,939	6.02	-0.96	10%
Pittsburgh, PA	4,873	8.27	-1.44	15%
Toledo, OH	1,622	3.16	-1.58	14%
San Jose, CA	0	0.00	-1.63	11%
Boston, MA	3,853	3.90	-2.40	16%
Milwaukee, WI	1,899	2.07	-2.75	9%
Philadelphia, PA	12,459	5.11	-3.35	31%
Detroit, MI	2,227	1.60	-3.61	18%

Source: Public Housing units are from "A Picture of Subsidized Housing 1998" from HUD. Eligible families estimated using 2000 Census data.

Table 3: First stage results of public housing supply and housing age as instruments

Sample:	Income < 80% of MFI at baseline	Income < 80% of MFI at 1-year; not public housing resident at baseline		
Dependent Variable:	Public Housing Resident at baseline	Moved into Public Housing between baseline and 1-year		
Public housing supply	0.019**	0.008**		0.008*
	(0.003)	(0.003)		(0.003)
Log average year housing built			0.097*	0.083+
			(0.043)	(0.043)
Mother's age at birth	-0.001	-0.005**	-0.005**	-0.005**
	(0.001)	(0.001)	(0.001)	(0.001)
Black	0.182**	0.089**	0.098**	0.097**
	(0.023)	(0.022)	(0.022)	(0.022)
Hispanic	0.090**	0.058*	0.055*	0.055*
	(0.026)	(0.024)	(0.024)	(0.024)
Other Race	0.099*	0.055	0.051	0.055
	(0.047)	(0.044)	(0.044)	(0.044)
Mother is immigrant	-0.091**	-0.001	0.003	0.003
	(0.023)	(0.022)	(0.022)	(0.022)
Mother has some college	-0.066**	-0.059**	-0.059**	-0.060**
	(0.019)	(0.018)	(0.018)	(0.018)
Unmarried at birth	0.056*	-0.020	-0.022	-0.021
	(0.023)	(0.022)	(0.022)	(0.022)
Number of children at baseline	0.022**	0.020**	0.019**	0.020**
	(0.006)	(0.006)	(0.006)	(0.006)
Number of months in neighborhood at baseline	-0.000			
	(0.000)			
Housing subsidy at baseline	-0.233**	0.131**	0.132**	0.131**
	(0.025)	(0.024)	(0.024)	(0.024)
Housing subsidy at 1-year		0.023	0.023	0.024
		(0.024)	(0.024)	(0.024)
Mother's health fair/poor at birth of child		-0.204**	-0.202**	-0.201**
		(0.025)	(0.026)	(0.025)
Constant	0.062	0.203**	-0.196	-0.136
	(0.044)	(0.043)	(0.180)	(0.182)
Total observations	2455		2300	
F statistic	24.52	11.74	11.52	11.13
Average Hansen's J statistic (overidentification test)				1.305
Percent in public housing	17.1%		13.9%	
Effect size of public housing supply[a]	94%	49%		49%
Effect size of year built[b]			36%	30%

Ordinary least squares. Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%.

[a]Effect size = increased probability of public housing residence if move from the city with the worst public housing supply to the best.

[b]Effect size = increased probability of public housing residence if move from the city with the oldest housing supply to the youngest (the least likely to have demolitions).

Notes: When we included observations with missing control variables, the missing indicators were insignificant, but their inclusion resulted in worse overall fit, thus we drop all observations with missing variables. Likewise, when we included city and state dummy variables and income controls, we found that these variables were not significant and their inclusion resulted in worse overall fit.

Table 4: Year built instrument

	Average Year Housing Built in Census Tract with Low-Income Families
Detroit, MI	1947
Boston, MA	1947
Philadelphia, PA	1948
Pittsburgh, PA	1949
Oakland, CA	1949
Baltimore, MD	1949
Indianapolis, IN	1949
Newark, NJ	1951
Chicago, IL	1953
New York, NY	1954
Milwaukee, WI	1954
Toledo, OH	1955
Corpus Christi, TX	1965
Richmond, VA	1966
San Jose, CA	1970
Nashville, TN	1972
Norfolk, VA	1973
San Antonio, TX	1975
Jacksonville, FL	1976
Austin, TX	1977

Source: Census tract measures taken from Summary Files 1 and 3 of the 2000 Census.

Table 5: First stage results of child gender composition, public housing supply, and housing age as instruments
Sample: 2 or 3 children & income < 80% of MFI at 1-year; not public housing resident at baseline
Dependent Variable: Moved into Public Housing between baseline and 1-year

Boy and girl at 1-year	0.057**	0.058**	0.057**
	(0.021)	(0.021)	(0.021)
Public housing supply	0.008+		0.007
	(0.005)		(0.005)
Log Average year housing built		0.152*	0.138*
		(0.063)	(0.064)
Mother's age at birth	-0.005*	-0.005*	-0.005*
	(0.002)	(0.002)	(0.002)
Black	0.108**	0.127**	0.125**
	(0.032)	(0.033)	(0.033)
Hispanic	0.036	0.035	0.033
	(0.035)	(0.035)	(0.035)
Other Race	-0.033	-0.038	-0.036
	(0.070)	(0.069)	(0.069)
Mother is immigrant	0.026	0.028	0.031
	(0.033)	(0.033)	(0.033)
Mother has some college	-0.096**	-0.096**	-0.099**
	(0.026)	(0.026)	(0.026)
Unmarried at birth	-0.011	-0.014	-0.013
	(0.030)	(0.030)	(0.030)
Number of children at 1-year	0.036**	0.035*	0.036**
	(0.014)	(0.014)	(0.014)
Mother's health fair/poor at birth of child	0.086*	0.085*	0.088*
	(0.035)	(0.035)	(0.035)
Housing subsidy at baseline	0.149**	0.149**	0.147**
	(0.031)	(0.031)	(0.031)
Housing subsidy at 1-year	-0.221**	-0.217**	-0.217**
	(0.036)	(0.036)	(0.036)
Constant	0.140*	-0.485+	-0.425
	(0.065)	(0.267)	(0.270)
Total observations		1044	
F statistic	9.04	9.24	8.76
Average Hansen's J statistic (overidentification test)	0.9087	0.9889	2.0336
Percent in public housing		14.0%	
Effect size of boy+girl[a]	41%	41%	41%
Effect size of public housing supply[b]	48%		42%
Effect size of year built[c]		55%	50%

Ordinary least squares. Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%.

[a]Effect size = increased probability of public housing residence if girl+boy instead of children of same gender.

[b]Effect size = increased probability of public housing residence if move from the city with the worst public housing supply to the best.

[c]Effect size = increased probability of public housing residence if move from the city with the oldest housing supply to the youngest (the least likely to have demolitions).

Notes: When we included observations with missing control variables, the missing indicators were insignificant, but their inclusion resulted in worse overall fit, thus we drop all observations with missing variables. Likewise, when we included city and state dummy variables and income controls, we found that these variables were not significant and their inclusion resulted in worse overall fit.

Table 6: Descriptive statistics for gender composition sub-sample with 2-3 children at 1-year interview

	Moved into Public Housing between baseline and 1-year	80% of MFI but did not move into Public Housing at 1 year
DEMOGRAPHIC CHARACTERISTICS		
Mother's age at birth	23.7	25.0
Black	64%	48%
Hispanic	29%	35%
Other Race	1%	3%
Mother is immigrant	16%	18%
Mother has some college	7%	23%
Unmarried at birth	87%	84%
Number of other children at baseline	1.3	1.1
OTHER HOUSING SUBSIDY CONTROLS		
Housing subsidy at baseline	25%	13%
Housing subsidy at 1-year	0%	12%
PREVIOUS HEALTH CONTROL		
Mother has fair/poor health at birth of child	15%	9%
DEPENDENT VARIABLES		
1-year Interview		
Child has fair/poor health	5%	5%
Mother has fair/poor health	25%	16%
Mother drank alcohol in past month	21%	26%
Mother smoked cigarettes in past month	25%	30%
Mother used drugs in past month	2%	2%
Mother has more than 1 sign of depression[a]	11%	10%
Mother has limiting health condition	11%	8%
3-year Interview		
Child has fair/poor health	3%	2%
Mother has fair/poor health	18%	16%
Mother drank alcohol in past year	41%	48%
Mother used drugs in past year	5%	7%
Mother has more than 1 sign of depression[b]	25%	22%
Mother has limiting health condition	11%	9%
Mother's BMI	29.8	28.1
Number of observations	150	938

[a]This variable is the sum of two possible depression signs that the mother indicated at the 1-year interview: 1) that she has been sad, depressed for 2+ weeks, 2) that she has been anxious, worried for 1+ month(s).

[b]This variable is the sum of five possible depression signs that the mother indicated at the 3-year interview: she has 1) felt sad, blue, or depressed for 2+ weeks, 2) lost interest in hobbies, work, or activities that usually give her pleasure in those 2+ weeks, 3) felt down on herself, no good, or worthless in those 2+ weeks, 4) thought about death -- her own, someone else's or death in general in those 2+ weeks, and 5) felt worried, tense, or anxious for 1+ month(s).

Table 7: Descriptive statistics for public housing supply and housing age sub-sample

	Public Housing Resident at baseline	80% of MFI but not in Public Housing at baseline	Moved into Public Housing between baseline and 1-year	80% of MFI but did not move into Public Housing at 1 year
DEMOGRAPHIC CHARACTERISTICS				
Mother's age at birth	23.6	24.1	23.2	24.3
Black	72%	48%	58%	48%
Hispanic	21%	33%	33%	34%
Other Race	2%	3%	3%	3%
Mother is immigrant	7%	19%	18%	20%
Mother has some college	12%	21%	12%	22%
Unmarried at birth	94%	86%	87%	86%
Number of other children at baseline	1.2	1.0	1.1	0.9
Number of months in current neighborhood	44.9	44.5		
OTHER HOUSING SUBSIDY CONTROLS				
Housing subsidy at baseline	0%	12%	18%	10%
Housing subsidy at 1-year			0%	11%
PREVIOUS HEALTH CONTROL				
Mother has fair/poor health at birth of child			11%	9%
DEPENDENT VARIABLES				
Baseline Interview				
Low birth weight (<2500 g)	12%	12%		
Mother has fair/poor health	10%	9%		
Mother drank alcohol during pregnancy	12%	10%		
Mother smoked during pregnancy	23%	23%		
Mother used drugs during pregnancy	7%	6%		
1-year Interview				
Child has fair/poor health			3%	4%
Mother has fair/poor health			21%	17%
Mother drank alcohol in past month			21%	28%
Mother smoked cigarettes in past month			28%	29%
Mother used drugs in past month			2%	3%
Mother has more than 1 sign of depression[a]			7%	11%
Mother has limiting health condition			10%	8%
3-year Interview				
Child has fair/poor health			3%	3%
Mother has fair/poor health			19%	17%
Mother drank alcohol in past year			39%	48%
Mother used drugs in past year			8%	7%
Mother has more than 1 sign of depression[a]			25%	23%
Mother has limiting health condition			9%	9%
Mother's BMI			28.7	27.8
Number of observations	456	2241	323	2036

[a]This variable is the sum of two possible depression signs that the mother indicated at the 1-year interview: 1) that she has been sad, depressed for 2+ weeks, 2) that she has been anxious, worried for 1+ month(s).

[b]This variable is the sum of five possible depression signs that the mother indicated at the 3-year interview: she has 1) felt sad, blue, or depressed for 2+ weeks, 2) lost interest in hobbies, work, or activities that usually give her pleasure in those 2+ weeks, 3) felt down on herself, no good, or worthless in those 2+ weeks, 4) thought about death -- her own, someone else's or death in general in those 2+ weeks, and 5) felt worried, tense, or anxious for 1+ month(s).

Table 8: The effect of public housing residence at baseline on health outcomes and behavior at baseline
Coefficient on public housing residence is reported

Model:	OLS	Public housing supply IV
Dependent Variable:		
Mother's health status at birth of child	0.020	-0.619
	(0.045)	(0.376)
N	2451	2451
Low birth weight	-0.002	0.122
	(0.013)	(0.171)
N	2441	2441
Mother drank alcohol during pregnancy	0.001	0.040
	(0.017)	(0.190)
N	2451	2451
Mother smoked during pregnancy	-0.005	-0.478*
	(0.023)	(0.178)
N	2449	2449
Mother used drugs during pregnancy	0.000	0.231
	(0.010)	(0.414)
N	2450	2450

Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%

Controls: Mother's age at birth, race, immigrant status, education, marital status at birth, number of children at baseline, number of years in neighborhood, housing subsidy at baseline.

Notes: When we included observations with missing control variables, the missing indicators were insignificant, but their inclusion resulted in worse overall fit, thus we drop all observations with missing variables. Likewise, when we included city and state dummy variables and income controls, we found that these variables were not significant and their inclusion resulted in worse overall fit. We fit a linear regression model for the instrumental variables estimations. When we fit a probit model for the IV, the models often did not converge.

Table 9: The effect of moving into public housing before 1-year interview on health outcomes and behavior at 1-year
Coefficient on public housing residence is reported

Model:	OLS	IV	IV	OLS	IV	IV	IV
Instrument(s):		Gender Composition	Gender Composition & Housing Age		Public Housing Supply	Housing Age	Public Housing Supply & Housing Age
Dependent Variable:							
Mother's health status	0.090	0.654	0.771	0.030	1.842	-1.686	0.474
	(0.099)	(1.119)	(0.629)	(0.059)	(1.168)	(1.838)	(0.735)
N	1044	1044	1044	2300	2300	2300	2300
Child's health status	0.023	0.935	0.142	0.031	-1.526	-0.138	-0.946
	(0.068)	(0.919)	(0.588)	(0.038)	(1.158)	(0.931)	(0.837)
N	1039	1039	1039	2276	2276	2276	2276
Mother drank alcohol in past month	-0.063	0.622	0.380	-0.056*	0.629	0.392	0.536
	(0.042)	(0.539)	(0.311)	(0.026)	(0.464)	(0.530)	(0.396)
N	1044	1044	1044	2299	2299	2299	2299
Mother smoked in past month	-0.065	-0.023	-0.428	0.003	-0.957+	-1.032+	-0.986**
	(0.044)	(0.495)	(0.339)	(0.037)	(0.491)	(0.519)	(0.347)
N	1044	1044	1044	2300	2300	2300	2300
Mother used drugs in past month	-0.008	-0.185	-0.203*	-0.008*	-0.176	-0.239	-0.200
	(0.006)	(0.129)	(0.088)	(0.004)	(0.188)	(0.278)	(0.193)
N	842	1044	1044	2223	2298	2298	2298
Mother's number of depression signs	0.055	0.950	0.875	0.015	-1.543	0.370	-0.801
	(0.061)	(0.936)	(0.605)	(0.041)	(0.974)	(0.943)	(0.748)
N	1044	1044	1044	2300	2300	2300	2300
Mother has limiting health condition	0.033	0.420	0.110	0.016	-0.313	-0.755+	-0.484*
	(0.026)	(0.261)	(0.134)	(0.017)	(0.294)	(0.426)	(0.217)
N	1044	1044	1044	2300	2300	2300	2300

Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%

Controls: Mother's age at birth, race, immigrant status, education, marital status at birth, number of children at baseline, housing subsidy at baseline and 1-year, and mother's health status at baseline.

Notes: When we included observations with missing control variables, the missing indicators were insignificant, but their inclusion resulted in worse overall fit, thus we drop all observations with missing variables. Likewise, when we included city and state dummy variables and income controls, we found that these variables were not significant and their inclusion resulted in worse overall fit. We fit a linear regression model for the instrumental variables estimations. When we fit a probit model for the IV, the models often did not converge.

Table 10: The effect of moving into public housing before 1-year interview on health outcomes and behavior at 3-years
Coefficient on public housing residence is reported

Model:	OLS	IV	IV	OLS	IV	IV	IV
Instrument(s):		Gender Composition	Gender Composition & Housing Age		Public Housing Supply	Housing Age	Public Housing Supply & Housing Age
Dependent Variable:							
Mother's health status	-0.057	-0.090	-0.262	0.016	-1.530	0.996	-0.999
	(0.094)	(1.240)	(1.124)	(0.040)	(1.196)	(1.682)	(1.003)
N	938	938	938	2054	2054	2054	2054
Child's health status	-0.047	-2.289	-1.959+	0.003	0.646	-1.017	0.287
	(0.084)	(1.503)	(1.069)	(0.039)	(0.809)	(1.305)	(0.623)
N	929	929	929	2022	2022	2022	2022
Mother drank alcohol in past year	-0.096	0.418	0.673	-0.097**	-0.142	2.182	0.307
	(0.059)	(0.668)	(0.507)	(0.037)	(0.632)	(2.074)	(0.639)
N	936	936	936	2048	2048	2048	2048
Mother used drugs in past year	-0.042**	-0.354	-0.074	-0.003	-0.232	0.171	-0.144
	(0.012)	(0.395)	(0.245)	(0.017)	(0.419)	(0.859)	(0.401)
N	941	941	941	2058	2058	2058	2058
Mother's number of depression signs	0.071	0.187	0.902	0.049	-3.307	1.545	-2.242
	(0.139)	(1.858)	(1.031)	(0.115)	(2.366)	(2.310)	(1.852)
N	941	941	941	2058	2058	2058	2058
Mother has limiting health condition	0.025	0.386	0.036	0.008	-0.276	-0.510	-0.323
	(0.026)	(0.435)	(0.288)	(0.014)	(0.260)	(0.745)	(0.244)
N	938	938	938	2049	2049	2049	2049
Mother's log BMI	0.053*	-0.167	0.266	0.017	0.284+	0.301	0.287*
	(0.020)	(0.399)	(0.220)	(0.016)	(0.149)	(0.263)	(0.132)
N	895	895	895	1947	1947	1947	1947

Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%

Controls: Mother's age at birth, race, immigrant status, education, marital status at birth, number of children at baseline, housing subsidy at baseline, 1-year, and 3-year, public housing residence at 3-year, and mother's health status at baseline.

Notes: When we included observations with missing control variables, the missing indicators were insignificant, but their inclusion resulted in worse overall fit, thus we drop all observations with missing variables. Likewise, when we included city and state dummy variables and income controls, we found that these variables were not significant and their inclusion resulted in worse overall fit. We fit a linear regression model for the instrumental variables estimations. When we fit a probit model for the IV, the models often did not converge.

Table A1: Construction of the public housing supply instrument
Dependent Variable: Public housing per 100 eligible families (mean=4.99)

	Mean	Coefficient (SE)
Log Population	13.4	-0.449
		(0.845)
Percent in Poverty	18.8	0.341
		(.228)
Percent White	50.7	-0.091
		(0.086)
Percent Age 65+	11.2	0.807
		(0.428)
Percent with College Degree	23.8	-0.050
		(0.130)
Median Rent/Median Monthly Income*100	20.1	0.383
		(0.493)
Percent Female Headed Households	18.7	-0.425
		(0.425)
N	20	

Ordinary least squares. Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%.

Table A2: Coefficients on control variables for gender composition sub-sample

Dependent Variable:	Child's HS at 1-year			Child's HS at 3-years		
	OLS	IV1	IV2	OLS	IV1	IV2
Public Housing at baseline	0.023	0.935	0.142	-0.047	-2.289	-1.959+
	(0.068)	(0.919)	(0.588)	(0.084)	(1.503)	(1.069)
Mother's age at birth	0.005	0.009	0.006	0.003	-0.003	-0.002
	(0.005)	(0.007)	(0.005)	(0.005)	(0.007)	(0.006)
Black	-0.027	-0.123	-0.039	-0.129+	0.050	0.024
	(0.096)	(0.130)	(0.104)	(0.067)	(0.128)	(0.106)
Hispanic	0.027	-0.007	0.023	-0.069	0.000	-0.010
	(0.095)	(0.096)	(0.090)	(0.072)	(0.073)	(0.069)
Other Race	0.048	0.085	0.053	-0.159	-0.217	-0.208
	(0.228)	(0.250)	(0.220)	(0.187)	(0.272)	(0.254)
Mother is immigrant	0.385**	0.366**	0.383**	0.347**	0.359**	0.357**
	(0.081)	(0.083)	(0.074)	(0.080)	(0.114)	(0.103)
Mother has some college	-0.144*	-0.054	-0.132*	-0.044	-0.218	-0.192+
	(0.051)	(0.096)	(0.066)	(0.071)	(0.149)	(0.108)
Unmarried at birth	0.071	0.084	0.072	0.058	0.001	0.009
	(0.089)	(0.088)	(0.085)	(0.089)	(0.110)	(0.094)
Number of children at 1-year	-0.021	-0.055	-0.026	0.047	0.115+	0.105*
	(0.026)	(0.051)	(0.038)	(0.036)	(0.063)	(0.048)
Mother has fair/poor health at baseline	0.624**	0.550**	0.615**	0.513**	0.644**	0.625**
	(0.124)	(0.129)	(0.120)	(0.086)	(0.169)	(0.142)
Housing subsidy at baseline	-0.027	-0.167	-0.045	-0.035	0.203	0.168
	(0.063)	(0.175)	(0.119)	(0.062)	(0.197)	(0.147)
Housing subsidy at 1-year	0.034	0.238	0.061	-0.083	-0.513	-0.450*
	(0.098)	(0.239)	(0.168)	(0.110)	(0.334)	(0.229)
Housing subsidy at 3-year				0.077	0.137	0.129
				(0.094)	(0.113)	(0.099)
Public Housing at 3-year				0.066	0.805	0.697+
				(0.071)	(0.538)	(0.362)
Constant	1.343**	1.187**	1.323**	1.411**	1.648**	1.613**
	(0.146)	(0.225)	(0.151)	(0.122)	(0.252)	(0.183)
N	1039	1039	1039	929	929	929

Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%

Notes: When we included observations with missing control variables, the missing indicators were insignificant, but their inclusion resulted in worse overall fit, thus we drop all observations with missing variables. Likewise, when we included city and state dummy variables and income controls, we found that these variables were not significant and their inclusion resulted in worse overall fit. We fit a linear regression model for the instrumental variables estimations. When we fit a probit model for the IV, the models often did not converge.

Table A3: Coefficients on control variables for public housing supply sub-sample

Dependent Variable:	Low birth weight		Child's HS at 1-year			Child's HS at 3-years		
	OLS	IV	OLS	IV	IV	OLS	IV	IV
Public Housing at baseline	-0.002	0.122	0.031	-1.526	-0.946	0.003	0.646	0.287
	(0.013)	(0.171)	(0.038)	(1.158)	(0.837)	(0.039)	(0.809)	(0.623)
Mother's age at birth	0.005**	0.005**	0.003	-0.004	-0.001	0.005	0.007	0.006
	(0.002)	(0.002)	(0.004)	(0.008)	(0.006)	(0.004)	(0.005)	(0.005)
Black	0.012	-0.011	0.053	0.188	0.137+	-0.023	-0.053	-0.036
	(0.022)	(0.033)	(0.035)	(0.114)	(0.080)	(0.047)	(0.055)	(0.045)
Hispanic	-0.053*	-0.064*	0.127**	0.217*	0.183**	0.032	0.009	0.022
	(0.019)	(0.024)	(0.039)	(0.078)	(0.052)	(0.052)	(0.056)	(0.048)
Other Race	-0.004	-0.014	-0.064	0.015	-0.014	-0.153	-0.185	-0.167
	(0.039)	(0.041)	(0.089)	(0.095)	(0.082)	(0.110)	(0.120)	(0.108)
Mother is immigrant	-0.031+	-0.019	0.297**	0.297**	0.297**	0.245**	0.249**	0.247**
	(0.016)	(0.028)	(0.058)	(0.055)	(0.052)	(0.051)	(0.050)	(0.048)
Mother has some college	-0.042*	-0.035*	-0.108**	-0.196**	-0.163**	-0.089+	-0.069	-0.080+
	(0.016)	(0.016)	(0.032)	(0.058)	(0.041)	(0.049)	(0.051)	(0.048)
Unmarried at birth	0.038*	0.032+	0.060	0.027	0.040	0.022	0.042	0.031
	(0.017)	(0.017)	(0.065)	(0.094)	(0.077)	(0.062)	(0.053)	(0.054)
Number of children at 1-year	-0.004	-0.006	0.034*	0.064+	0.053*	0.042+	0.031	0.037
	(0.004)	(0.006)	(0.013)	(0.034)	(0.026)	(0.022)	(0.029)	(0.026)
Number of months in neighborhood at baseline	-0.000	-0.000						
	(0.000)	(0.000)						
Mother has fair/poor health at baseline			0.552**	0.593**	0.577**	0.460**	0.459**	0.460**
			(0.080)	(0.108)	(0.092)	(0.082)	(0.093)	(0.084)
Housing subsidy at baseline	0.058*	0.087	-0.027	0.182	0.104	-0.097	-0.163	-0.126
	(0.026)	(0.052)	(0.054)	(0.196)	(0.143)	(0.075)	(0.109)	(0.085)
Housing subsidy at 1-year			0.011	-0.311	-0.191	-0.006	0.135	0.057
			(0.070)	(0.282)	(0.207)	(0.118)	(0.203)	(0.149)
Housing subsidy at 3-year						0.006	-0.037	-0.013
						(0.078)	(0.076)	(0.072)
Public Housing at 3-year						0.119**	-0.095	0.025
						(0.036)	(0.266)	(0.207)
Constant	-0.017	-0.024	1.250**	1.566**	1.448**	1.334**	1.236**	1.290**
	(0.046)	(0.046)	(0.112)	(0.266)	(0.200)	(0.107)	(0.158)	(0.148)
N	2441	2441	2276	2276	2276	2022	2022	2022

Standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1%