The Impacts of the Food Stamp Program on Mortality

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Selected Paper prepared for presentation at the 2018 Agricultural & Applied Economics Association Annual Meeting, Washington, D.C., August 5-August 7

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May 2018

Working paper

Abstract

This study examines the effect of food stamps on health. Specifically, we use the county-level rollout of the Food Stamp Program from 1961 to 1975 as a source of variation in access to food stamps in order to examine food stamps' single-year and multi-year effects on various county-year level mortality rates using fixed effects models. We consider aggregate mortality rates, subgroup rates for sex, race groups, and age groups, and rates for specific causes of death to examine the mechanisms through which food stamps affect health. We find mixed results for the entire 1969 to 1978 county sample that indicate small or zero overall effects of access to food stamps on mortality rates. However, among subsamples of poorer counties, we find that food stamps tend to reduce most mortality rates over time.

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Introduction

In the United States, a significant number of households are food insecure, meaning their access to adequate food for healthy living is limited by a lack of resources. 12.7 percent of households experienced food insecurity in 2015, and 5.0 percent of households had very low food security. Though down from the recessionary high in 2011 of 14.9 percent, food insecurity is still a significant problem in the United States (Coleman-Jensen et al. 2016).

Food and nutrition assistance is provided to low-income people at risk of food insecurity in the United States through 15 programs administered by the Food and Nutrition Service, an agency of the United States Department of Agriculture (USDA). The largest of these programs is the Supplemental Nutrition Assistance Program (SNAP), formerly named the Food Stamp Program (FSP). SNAP issues food stamp benefits based on household size, income, assets and expenses that are redeemable for food, excluding alcohol and hot or prepared foods intended for consumption outside the home. The USDA estimates that SNAP benefits will cost more than $70 billion in fiscal year 2017 and that a monthly average of 44.5 million participants will receive these benefits (USDA 2016). Clearly, SNAP is an economically important program and has the potential to have large effects, intended and unintended.

SNAP is likely to affect the health of food stamp recipients in some way through its intended goals of improving nutrition and reducing food insecurity, but there are other possible channels through which the program might improve or even possibly harm health. Food assistance programs target low-income people, who are generally at higher risk of inadequate nutrition. SNAP provides monthly in-kind benefits that can only be used to purchase food as

opposed to cash assistance. People receiving these benefits are likely to be made more food secure than if they did not participate because they are provided with benefits that can be spent on a baseline level of nutrition. More recent studies that address the selection of more food insecure households into food assistance programs confirm that SNAP does reduce food insecurity (Gregory, Rabbitt, and Ribar 2015). Previous studies have consistently found negative associations between food insecurity and health, so it is reasonable to expect that SNAP might impact health through this channel (Gundersen and Ziliak 2015).

Economic theory suggests that households that already purchase food prior to receiving benefits would change their purchasing behavior and reduce the amount of non-benefit income that they spend on food after receiving food assistance benefits. These benefits free up a portion of income that was previously needed for food to be spent on any kind of goods. Therefore, we might expect that real households would treat food assistance benefits like cash income especially if they are "inframarginal," meaning that they spend more on food than the amount in benefits that they receive. Estimates of the proportion of SNAP recipients that are inframarginal are high, ranging from 70 to 90 percent (Bartfield et al. 2015). Theory suggests that an increase in income leads consumers to increase their consumption of normal goods, and prior research indicates that food in general is a normal good (Hoynes, McGranahan, and Schanzenbach 2015). Therefore, some of the effect of SNAP benefits on health may be due to "virtual income" effects, not because these benefits can only be spent on food. The positive association between income and health has been well-documented in the literature, and prior research has overall estimated positive effects of income on infant, child, and adult health outcomes, although these effects are weaker and somewhat more mixed for adults (Evans, Wolfe, and Adler 2012). If households do

treat benefits like income transfers, it makes sense that these in-kind transfers would impact their health the same way that more income would.

Still, it is possible that SNAP might negatively impact health in some ways. Although economic theory predicts that inframarginal households would treat SNAP benefits like a virtual income increase, recent studies derive mixed results about whether households disproportionately consume food out of SNAP benefits (Hoynes and Schanzenbach 2009; Hastings and Shapiro 2017). Therefore, SNAP may lead to unhealthy weight gain among beneficiaries if they use food stamps to purchase more unhealthy foods instead of switching to a healthier diet. Krueger et al. (2004) identify some other potential mechanisms through which SNAP might negatively impact health. First, benefits may disincentivize labor force participation, leading participants to forgo accompanying "healthy worker" benefits that promote health such as employer-provided health insurance, social networks that support healthy activities, physical activity depending on the type of work, and a reliable income. SNAP recipients may also experience stigma or shame from not meeting social ideals of financial independence, leading to greater stress, risky coping behaviors like smoking or drinking, or differential treatment from other people that could ultimately lead to lower health. Further, if people value their time more after receiving an increase in virtual income, they may spend more on processed food that is convenient but less healthy instead of cheaper, healthier foods they must prepare themselves. Finally, receiving food stamps – which are provided once a month – may lead to uneven food consumption across time, which may itself have adverse effects on health or on how people report their health (Wilde and Ranney 2000). Because food stamps could affect health positively, negatively, or both, empirical work is needed to determine SNAP's overall effect on health.

One way to measure the impact of a policy change on health is to examine how it affects mortality rates, or the number of people who die in a given population in some time period scaled to the size of that population. Mortality rates are not perfect measures of health, especially when health effects are not expected to be relatively large. However, they have the advantage of being an objective measure of health and easily available relative. Despite this availability, few studies have looked at the relationship between SNAP and mortality rates, and none we identify examine this relationship using a causal framework.

In order to fill this gap in the literature and provide more empirical evidence on the effects of food stamps on health, we examine the effect of the implementation of the FSP on mortality rates. Specifically, we use the county rollout of the FSP as a source of variation in the availability of food stamps in order to examine the program's effect on overall county-year-level mortality rates and different rates broken down by sex, race group, age group, and cause of death. We find mixed results for the entire 1969 to 1978 county sample that indicate small or zero overall effects of access to food stamps on mortality rates. Using subsamples of poorer counties, we find that the FSP tends to reduce most mortality rates over time in the counties that are most likely to benefit from food stamps.

The Introduction of the Food Stamp Program

The pilot food stamp programs that became the FSP began in 1961. Like SNAP benefits are now, the early FSP benefits were federally funded and jointly administered by the federal and state governments. However, food stamps had to be purchased by households at a cost below the stamps' redeemable value until 1977. From 1961 to 1963, the pilot programs were expanded from eight initial counties to 43 counties and cities (USDA FNS 2017). The passage of the Food

Stamp Act of 1964 secured funding for three years to give local areas outside of the pilot program areas the option to initiate the FSP. From 1964 on, new counties implemented the program at a steady rate, and participation and benefits paid out grew rapidly (Berry 1984). Funding for the program was renewed over the following years, and 1973 amendments to the act required all counties to implement the FSP by 1975.

In the years of its rollout, the FSP was relatively popular among the American public, partially due to growing national concern for the problem of hunger. "Congressmen wanted to reap the good will and publicity that accompanied the opening of a new project" (Berry 1984). The growth of the FSP was therefore governed not by the demand for the program, but first and foremost by federal funding limits. Counties could not join the program until the USDA selected them to do so, and there were always waiting lists during the rollout period (Berry 1984).

The fact that local and national political decision-making was involved in the FSP's implementation raises concerns that the variation afforded by the rollout may be biased. For instance, there may have been more political pressure to join the FSP in areas where more constituents were poor, non-white, and elderly, as these groups benefited more from the program. These population characteristics are correlated with health outcomes, so estimates of the effects of early adoption of the program could be biased towards more negative health outcomes. Hoynes and Schanzenbach (2009) address this possibility by estimating a model in which various 1960 county characteristics are the determinants of the amount of time before a county began the program. While they do find that counties with a higher percentage of black, young, old, and/or poor residents are more likely to implement the program sooner, they also find that county characteristics explain only a small portion of the variation in time to adoption. Almond, Hoynes, and Schanzenbach (2011) argue that "much of the variation in the

implementation of [the] FSP appears to be idiosyncratic," and that trends in adoption that are correlated with adoption time of the program can be controlled for with interactions of the relevant county characteristics with time trends. Controlling for other transfer payments, especially those related to the newly created and growing anti-poverty initiatives of the 1960s, disentangles other programs' effects from those of the FSP. Therefore, given that the proper controls are included, the FSP rollout is an ideal source of variation for studying the effects of access to food stamps, especially compared to studies that ignore selection into the program by comparing food stamp recipients with eligible non-recipients.

Literature Review

Despite food stamps' economic importance and the possible mechanisms through which they might affect health, relatively few studies have attempted to estimate their health effects due to the large degree of selection into food stamp participation. SNAP recipients differ from non-recipients in that they are on average more likely to be female, younger, parents of more children, Hispanic or Black, non-citizens, poor, and/or uninsured (Bitler 2015). They also tend to be less healthy as measured by disability days per year, diagnosis with a serious health condition, recent experiencing of several health conditions, hospitalizations, and smoking behavior, and prior studies examine the negative associations between food assistance programs and health (Bitler 2015). These studies do not indicate that the program causes poor health. Rather, it is more likely that poor health may negatively affect people's income, leading them to be eligible for and to participate in food assistance programs, or it may be the case that those people who tend to experience more financial hardship are also likely to experience health problems and participate in food assistance programs. Either way, a convincing study on the

health effects of food stamps needs to identify a source of plausibly exogenous variation in benefits or access to the program. This is the primary obstacle impeding research in this area.

Still, some studies have estimated the causal effects of food assistance programs on health. A series of papers identify the effects of exposure to the FSP in early life on health outcomes using variation in the date that each county implemented the FSP over 1961 to 1975. Almond, Hoynes, and Schanzenbach (2011) find that pregnancies exposed to the FSP in their last three months result in increased birth weights and small improvements in neonatal mortality on average. Hoynes, Schanzenbach, and Almond (2016) use panel data to link county of residence from before birth through early childhood to exposure to the FSP during its rollout period so they can examine its effects of health and economic outcomes throughout life. They find that access to the FSP in this period of life leads to a reduction in the incidence of metabolic conditions like obesity, high blood pressure, heart disease, and diabetes as well as an increase in self-reported health status and economic self-sufficiency for females. Currie and Moretti (2008) use the county rollout of the FSP across the state of California and find that exposure to the FSP at the beginning of pregnancy was associated with a reduction in average birth weight instead of an increase, but this was largely driven by the FSP increasing the number of first births among teens, especially in Los Angeles. Hoynes, Page, and Stevens (2011) use a similar method to examine the county-level rollout of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), another food assistance program, to estimate its effect on infant health outcomes. They find that WIC exposure leads to an increase in average birth weight and a decrease in the proportion of low birth weight deliveries.

A relatively small body of work investigates the effects of food stamps on adult health outcomes or health outcomes in general as opposed to those of children with somewhat more

mixed results. Even fewer of the studies within this body of work use methods that begin to account for the unobserved factors that likely affect both participation in food assistance programs and health outcomes. Nicholas (2011) focuses on the effect of food stamps on Medicare spending on diabetes by using longitudinal survey data and controlling for time-invariant unobservable characteristics. She finds that receiving food stamps has no significant effect on Medicare spending, outpatient utilization, diabetes hospitalizations, or blood sugar levels. Yen, Bruce, and Jahns (2012) focus on the effect of SNAP participation on self-assessed health using data from Tennessee and an instrumental variables strategy using household distance from SNAP program office as an instrument. They find that SNAP appears to have a negative effect on self-assessed health, at least among their sample within the state. Gregory and Deb (2015) use a similar approach but instead use a nationally representative sample of non-elderly adults, employ methods that account for unobservable geographic characteristics, consider a variety of health and health care utilization outcomes, and use SNAP policy variables as instruments. They find that participation in SNAP consistently improves self-assessed health, increases the probability of reporting excellent or very good health, reduces sick days spent in bed, reduces emergency and diagnostic office-based doctor visits and outpatient visits, and increases checkups. These studies' mixed findings indicate that more work is needed to clarify the relationship between food stamps and adult health, perhaps work using a different source of variation in SNAP benefits or access.

A growing literature has focused on the effects of food stamps on obesity, partially due to concern about rising obesity rates. Obesity is an "oracle condition" for many costly health conditions, so its relationship with food stamps reveals part of SNAP's relationship with overall health. Since SNAP tends to increase food expenditure, it could theoretically increase or

decrease obesity rates, depending on how it increases food expenditure. Empirical work on the relationship between income and obesity generally estimates an inverse relationship between income and obesity, so we might expect that food-purchasing assistance would not increase obesity if people treat it as an increase in income (Gundersen 2015). The literature examining SNAP and obesity has derived mixed results. Overall, the majority of these studies suggest that food stamps have no effect on obesity, while fewer suggest that it has negative effects, and even fewer find positive effects (Gundersen 2015).

Mortality is one important measurement of health, especially on an aggregate level. Information about different causes and rates of death for different population subgroups is a valuable indicator of health outcomes taken to their most extreme, and it is a more objective measure than others like self-assessed health status. It is not clear that food assistance programs would greatly affect mortality rates, but given that prior work has measured large health impacts of SNAP, it is possible that food stamps may affect mortality rates to a lesser extent through these effects on health.

Only two studies we identify consider the potential relationship between food stamps and mortality, and no studies use methods that account for unobserved third factors that affect risk of death and selection into food stamp receipt. Krueger et al. (2004) examine 1990-1994 data from the National Health Interview Survey merged with mortality files using a switching probit model to adjust for observed and unobserved characteristics correlated with selection into the FSP and mortality. They estimate large positive average treatment effects of participation – participation in the FSP predicts a 28 percent increase in the risk of death for a randomly drawn individual from the eligible population. However, they also estimate large negative treatment effects on those treated – those who choose to participate in the FSP are predicted to have a 21 percent

lower risk of death than if they did not participate. Conrad et al. (2017) also use data from the National Health Interview Survey merged with mortality files, but they examine the period from 2000-2009 and are also able to estimate the relationship between food stamps and mortality from several specific causes. They find that both white and black SNAP participants had higher risks of death overall and from cardiovascular disease. They also find that SNAP participants of all races had higher diabetes mortality than eligible nonparticipants. The specific causes of death they isolate are closely related to poor nutrition, making these findings even more interesting. Still, the findings from both of these studies are not surprising, given that those who are the most disadvantaged face higher mortality rates and are more likely to participate in SNAP. To determine for sure whether low-income people face higher or lower risks of death due to food stamps, empirical work that makes use of exogenous variation in food stamp access or benefits is needed.

Data

We construct our dataset for our analyses by combining data from four sources. The dataset includes information on 2,855 counties and other local areas over the ten years from 1969 to 1978 for a total of 25,752 county-year-level observations. To construct the policy variables of interest, we use information on the month and year that the FSP began in most counties in the United States. This information originally came from several USDA year-end reports on county food stamp participation, but we received it directly from Hilary Hoynes who has used it in prior analyses of the FSP's county rollout (Almond, Hoynes, and Schanzenbach 2011; Hoynes,

Schanzenbach, and Almond 2016). The dates of program implementation span from May 1961 to March 1975.[1]

I use mortality rates at the county-year level gathered from the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) system. Specifically, we gather mortality rates from the Compressed Mortality File for the years 1968-1978. We collect aggregate mortality rates describing the number of deaths for all people from all causes as well as mortality rates for sex, race, and age subgroups of the population. Race group rates are divided into white, black, and an "other race" group. Age group rates are divided into narrow age ranges, but the broader ranges we gather information on are 0 to 19, 20 to 64, and 65 or more years old. We do obtain more narrow age-specific rates for neonatal and infant deaths in the first 28 days or year of life, respectively. We also collect cause-specific mortality rates for ten causes of death: malignant neoplasms, diabetes mellitus, major cardiovascular diseases, stroke, pneumonia and influenza, chronic liver disease and cirrhosis of the liver, motor vehicle accidents, other accidents, suicide, and homicide and legal intervention.[2] We collect both simple crude mortality rates as well as age-adjusted mortality rates using the 1968 to 1978 US population as the standard population, except for those age-specific mortality rates for which age-adjusted rates are not available. The CDC WONDER also provides the number of deaths and the population used to construct each mortality rate.

I use information on annual county economic characteristics as well as pre-treatment county characteristics in 1960. We gather the first set of county-year-level information from the

[1] These dates are not available for Alaska due to inconsistencies between FSP service areas and local areas during that time period, and they are not available for ten other local areas spread between several states. These dates are available for other kinds of local areas, including Washington, D.C. and most independent cities in Virginia.
[2] These ten cause-specific mortality rates include deaths falling under the ICD-8 codes 140-209, 250, 390-448, 432-434 and 436, 470-486, 571, E810-E823, E800-E807 and E825-E949, E950-E959, and E960-E978, respectively.

Bureau of Economic Analysis Regional Economic Accounts, which includes population, personal income, and non-food stamp government transfers, including breakdowns into retirement and disability insurance, medical benefits, income maintenance benefits, unemployment insurance compensation, veterans' benefits, education training assistance, and other transfers. This information is available beginning in 1969 and is adjusted to real, per capita dollar amounts. We gather the second set of county-level information for the year 1960 from the National Historic Geographic Information System, which includes the log of the population and the percentages of the population in each county that is under five years old, that is 65 years old or older, that is nonwhite, that live in rural non-farm areas[3], and that have income under the poverty line.

Summary statistics for the years 1968 to 1978 are presented in Tables 1.A. and 1.B. These statistics are weighted by the mean county population over the sample period or the relevant mean subpopulation for subgroup mortality rates. The mortality rates represent the number of deaths per 100,000 people except for the infant and neonatal rates which represent the number of deaths per 1,000 live births. Dollar amounts are per capita and are adjusted to 1960 dollars. Personal income is listed in dollars, while transfer controls are listed in thousands of dollars. We also consider high-poverty and very-high-poverty county subsamples – those counties with 1960 poverty rates in the highest quartile and decile, respectively – and therefore present similar summary statistics for these subsamples in these years in Table 6.

Methodology

[3] Ideally, we would use the percentage of the population in each county living in all rural areas, farm and non-farm, but we do not currently have access to that information.

I investigate the effect of the implementation of the FSP on various county-level mortality rates primarily by estimating models of the form:

$$MRATE_{ct} = \beta_0 + \beta_1 FSP_{ct} + \beta_2 X_{ct} + \beta_3 X1960_c * t + CFE_c + YFE_t + \epsilon_{ct}.$$

The left-hand side $MRATE_{ct}$ represents one of several annual county-level mortality rates we consider. The right-hand side of the model as shown here includes in order an intercept term, one of several variables we construct that indicate whether a county has or has not implemented the FSP in a given year, annual county control variables, pre-treatment county characteristics interacted with a linear time trend, county fixed effects, year fixed effects, and a county-year error term. County fixed effects account for the time-invariant characteristics of each county that are potential determinants of county mortality rates, and year fixed effects account for the factors common across counties in each year that affect mortality rates. All specifications we consider use county and year fixed effects and weight counties by their 1968 to 1978 average county population or corresponding subpopulation[4]. For example, observations are weighted by the average total county population for the aggregate and cause-specific mortality rates, by the number of women for female mortality rates, and so forth.

I use information about the timing of FSP adoption in each county to construct FSP_{ct} as the rough percentage of the year that the FSP was in operation. To clarify, if the FSP was implemented before or after year t, $FSP_{ct} = 1$ or 0, respectively. If it was implemented during year t, $0 < FSP_{ct} \leq 1$. We include the month that the FSP was implemented in the calculation of FSP_{ct} during its implementation year; for example, adoption in April 1970 would result in a

[4] We use average subpopulations instead of subpopulations as weights because fixed effects regressions require that analytic weights be constant within the panel.

value of 0.75 for that year.[5] In 1969, just over 60 percent of counties weighted by population had implemented the FSP, so there is still a substantial amount of variation in the treatment during the sample period.

In our primary specifications, we use as the dependent variable the aggregate crude mortality rate as well as sex-, race group-, age group-, and cause-specific crude rates as described in the previous section. We consider multiple mortality rates in order to explore the different mechanisms through which the availability of food stamps could affect aggregate health. We use the log of real county personal income per capita and the real per capita amounts of the government transfers described in the previous section as time-variant economic controls. We include interactions of each of the county demographic characteristics we describe in the section above with linear time trends to control for possible county health outcome trends that would be picked up in mortality rates and that might be correlated with counties' FSP implementation. Because adult health effects of the FSP are unlikely to occur immediately with its implementation, we estimate models using multiple lagged values of FSP_{ct}. The estimates of the coefficient on FSP_{ct} in these models can be interpreted as the effect of a county having the FSP in place for one, two, three, four, or five or more years on mortality rates. However, these estimates should be treated cautiously as unobserved migration of treated and untreated people into and out of the county between the year it begins the FSP and the year of the mortality rate will increasingly cloud the conclusions that can be drawn about the program's mortality effects as the length of the lag on the FSP variable increases.

[5] We try specifications with three differently calculated versions that do not yield qualitatively different results:
1) Calculating FSP_{ct} the same way except not including the month of its implementation in the percentage.
2) $FSP_{ct} = 1$ if it has been in operation for a full year or longer and 0 otherwise.
3) $FSP_{ct} = 1$ if it is in operation at all during year t and 0 otherwise.

In addition to these primary models, we also estimate models that include indicator variables for the length of time that the FSP has been in effect in each county in any given year. These models take the similar form:

$$MRATE_{ct} = \beta_0 + \sum_{i=1}^{11} \beta_{1i} FSPL_{cti} + \beta_2 X_{ct} + \beta_3 X1960_c * t + CFE_c + YFE_t + \epsilon_{ct}.$$

Here, the left-hand and right-hand side variables are the same except for the second term on the right, which represents the 11 indicator variables we include which represent 11 intervals of time the FSP may have been in operation in a county: 0-1 years, 1-2 years, 2-3 years, 3-4 years, 4-5 years, 5-6 years, 6-7 years, 7-8 years, 8-9 years, 9-10 years, or more than 10 years. Each of these indicators exclude the lower bound and include the upper bound, so they are mutually exclusive, and an indicator is equal to 1 only if the FSP was implemented in the relevant time frame. For example, if the FSP was implemented in May of the current year under, we consider the FSP in effect for 8 of the 12 months or two-thirds of the year. $\frac{2}{3}$ falls between 0 and 1, so the first indicator is equal to 1 and all others are equal to 0.

Because we exclude the indicator for not having the FSP at all during the current year, we can interpret the coefficient estimates on each of these indicators as the effect on a given mortality rate of a county having the FSP for less than one year, one to two years, two to three years, and so on relative to not having adopted the FSP. Our primary models allow us to estimate the mortality effects of having the FSP for X years or more as opposed to having it for $X - 1$ years or less, but these secondary models allow us to more precisely estimate the possibly non-linear mortality effects of having the FSP for about one year, about two years, and so on up to more than ten years. In this way, we can more carefully trace the effects of the FSP's

introduction over time, although it is still important to treat effects further away from the program's introduction with more caution.

I also estimate several variations of these models. In order to determine the effects of the program on those who are more likely to use and benefit from food stamps, we estimate the previous sets of models for county subsamples we term high-poverty – those with poverty rates in the highest pre-treatment 1960 quartile – and very-high-poverty – those with poverty rates in the highest pre-treatment 1960 decile. For those rates that are not broken down by age, we use age-adjusted rates as the dependent variable. We examine the sensitivity to including state-year fixed effects in order to control for possible time-varying factors common to geographically and politically similar groups of counties, and we estimate models excluding observations with mortality rates with a numerator of 20 or fewer deaths in order to eliminate unreliable mortality rates that are potentially over- or under-inflated. We alter the controls we use by including different subsets of controls, excluding the interactions of 1960 characteristics with time trends, and including different variables such as total transfers instead of categorized transfers and levels instead of log amounts.

Results and Discussion

Full Sample

Tables 2.A. through 2.D. present the results of estimating our primary model separately for each crude county-level mortality rate we consider as the dependent variable. Table 2.A. displays the results for the aggregate rate and rates broken down by sex and race group, 2.B. displays the results for the rates of different age groups, and 2.C. and 2.D. display the results for rates from different causes of death. These tables do not consider lagged values of the FSP

treatment variable, meaning that the coefficients on the treatment variable can be interpreted as the contemporaneous mortality effect of access to the FSP.

I find that on average, access to food stamps slightly increases most mortality rates in the same period. Overall, access to food stamps for a full year predicts an increase in the number of deaths of all people from all causes of about 3.4 per 100,000. However, these effects are frequently statistically insignificant. It may be the case that these mortality effects are too close to zero to reject the null hypotheses that there are no mortality effects. Alternatively, it may be the case that – despite the inclusion of interactions of time trends with relevant county pre-treatment characteristics – contemporaneous mortality effects are biased upwards by the fact that counties with poorer, more non-white, and/or more elderly residents are more likely to both have higher mortality rates and to adopt the program sooner as documented in Hoynes and Schanzenbach (2009). If food stamps only improve aggregate mortality rates after several years, the inclusion of more of these high-mortality counties as "treated" when the treatment has not been fully realized would lead to estimating spuriously higher mortality effects of food stamps. Additionally, given the heterogeneity of the counties in the sample, these weak effects may indicate that the program's effects vary across counties. We explore this possibility below using subsamples based on county poverty level.

The results from several of these contemporaneous specifications stand out. Notably, we find evidence that food stamps reduce infant and neonatal mortality rates. Specifically, access to food stamps for an entire year reduces the number of infant and neonatal deaths by 0.67 and 0.47 per 1,000 live births. These results at least partially drive a similar reduction of about 3.2 deaths per 100,000 0-19-year-olds. Given that malnutrition is particularly harmful for newborns and younger children, these findings make sense. The fact that these mortality effects are immediate

for newborns is consistent with the importance of prenatal nutrition to child health at birth and even throughout life (Tiehen and Jacknowitz 2008; Haeck and Lefebvre 2016). These results also confirm the findings of Almond, Hoynes, and Schanzenbach (2011) that the introduction of the FSP improves infant health outcomes.

However, focusing on contemporaneous mortality effects presents only a small – and probably misleading – part of the overall picture of the relationship between food stamps and mortality. It is also important to consider the mortality effects of the FSP being in place for longer periods because it is likely that access to food stamps would have effects on health over time. Tables 3 and 4 present the primary results of the models in which the FSP treatment variable is lagged one through five years. The coefficients on the lagged treatment variable in these tables can be interpreted as the effect of access to the FSP for at least one, two, three, four, or five years. Table 3 presents the full results for the aggregate crude mortality rate, while Table 4 presents abbreviated results for each of the crude mortality rates we consider. Table 4 is divided into 4.A. which shows the contemporaneous and lagged effects of FSP access on each mortality rate in terms of changes in deaths per 100,000 of the relevant population or per 1,000 live births for infant and neonatal rates and 4.B. which shows these same effects in terms of percentages of the relevant mean county mortality rate from 1968 to 1978.

I find that the effects of a county participating in the FSP for a year or more on the aggregate crude mortality rate are statistically indistinguishable from zero. Statistical insignificance aside, the estimates we derive in the five lagged specifications do not appear to be economically significant either. It appears that the FSP does not have large overall effects on mortality, even when considering specifications that allow the treatment more time to affect

aggregate health. It is possible that the FSP still affects aggregate health in some other way, but that is not reflected in an effect on mortality rates for the full sample.

Overall, the estimates on the lagged FSP treatment coefficients follow similar patterns for other subgroup mortality rates we examine in Table 4.A. and 4.B. In those specifications where the FSP has been in operation for three, four, or five or more years, these estimates tend to become statistically insignificant and closer to zero, which may reflect the fact that it becomes more difficult to accurately measure the impact of the FSP with longer lags on the treatment variable. If more time passes between the time of program implementation and the year the mortality rate is measured, it is possible to pick up more of the delayed health effects of the program, but it is also possible for confounding factors like unobserved migration of differently treated people to muddy the estimates of those effects. Therefore, we argue that the estimates on specifications where the treatment variable is lagged for fewer years are more credible than those where the treatment variable is lagged for more years.

Notable exceptions include the specifications using young, elderly, diabetes, and suicide mortality rates. As discussed previously, FSP implementation predicts lower contemporaneous mortality rates for newborns and those aged 0-19. It also predicts lower mortality rates for these groups when the FSP has been in operation for one or more years or for two or more years. FSP implementation predicts a relatively strong contemporaneous increase in the mortality rate of those aged 65 or older of 34.9 deaths per 100,000. This estimate falls with lagged treatment variables and is negative when the treatment variable is lagged three or more years. These effects are difficult to estimate due to more variability in the higher elderly mortality rate, which is to be expected. Interestingly, the FSP being in operation for one or more years or two or more years does not change the contemporaneous effect it has on increasing deaths from diabetes.

Conrad et al. (2017) find that higher diabetes mortality in particular is strongly associated with participation in SNAP, so it may be worthwhile to further examine diabetes as a mechanism through which food stamps affect health. Higher contemporaneous suicide rates are strongly predicted by implementation of the FSP, but again this may be because the program was more likely to be adopted earlier in areas of economic hardship, which is correlated with suicide rates. This effect consistently falls when greater lags of the treatment variable are used, and the effect of the FSP being in operation for 5 or more years is actually strongly negative, perhaps because of the program's role as part of a safety net that would mitigate economic hardship.

Table 5 presents selected estimates from the second set of models we consider that use a set of 11 dummy variables collectively indicating the length of time the FSP has been in operation in a county. These coefficient estimates can be interpreted as the average effect on each mortality rate of a county having access to food stamps for about 1 year, 2 years, 3 years, and so on up to more than 10 years, relative to not having access to food stamps. Unlike the previous estimates from Tables 2-4, these estimates allow us to more closely look at the specific, possibly non-linear mortality effects of the FSP over time.

Overall, these estimates are consistent with those presented in the other tables for the full sample of counties, but they do trace out the effects of the FSP over time differently for certain mortality rates. The effects on aggregate, female, male, white, adult, and elderly mortality rates are mostly weakly positive over time but not statistically significant. It is likely that these effects are too small for the full sample to accurately detect or measure given. The effect of having implemented the FSP on mortality of those aged under 20 is consistently negative, and this negative effect strengthens over time according to these estimates. This effect appears to be partially driven by a reduction in infant mortality, which makes sense given younger childrens'

greater sensitivity to food insecurity. Interestingly, the effects on black mortality rates are positive, meaning that black mortality rates tend to increase on average after the implementation of the FSP. These effects are further discussed below in the context of the poverty-based county subsamples.

Subsamples

Given the intentions of the FSP to provide nutrition assistance to low-income people, it is likely that these people would see the largest improvements in health outcomes from the implementation of the program since they are the most likely to suffer from food insecurity. Therefore, we consider separately the effects of the FSP on the mortality outcomes of poorer counties by estimating fixed effects models for high-poverty (HP) counties and very-high-poverty (VHP) counties, or those counties with 1960 poverty rates above the 75th percentile and 90th percentile, respectively. Table 6 presents the summary statistics for these subsamples. Overall, these poorer counties have higher mortality rates compared to the full sample except for those for the elderly and those due to liver disease and malignant neoplasms. The people in these poorer counties have about 60% of the per capita personal income of the full sample and on average live in more rural areas and are less likely to be white.

Table 7 presents abbreviated estimates of the mortality effects of the FSP being in place for any part of the year and for at least one, two, three, four, or five years in HP counties only (as Table 4 did for the full sample). Table 7 is divided into 7.A. which shows the effects of FSP access on each mortality rate in terms of changes in deaths per 100,000 or per 1,000 live births and 7.B. which shows these same effects in terms of percentages of the relevant mean mortality

rate. Table 8 presents these same estimates for the subsample of VHP counties and is similarly divided into 8.A. and 8.B.

These results indicate overall that the FSP has a more positive effect on the aggregate health of poor counties and that this positive effect becomes stronger for poorer counties. Although the contemporaneous relationship between FSP implementation and mortality are sometimes more strongly positive for these samples, the estimates of the mortality effects of access to food stamps tend to fall the longer the period of operation considered. For instance, in those HP counties where the FSP has been in operation for one or more years, the aggregate mortality rate is on average 4.6 deaths per 100,000 higher, again reflecting the possibility that the first adopters of the FSP needed it the most and may have had the highest mortality rates. In the specification where the FSP treatment variable is lagged five periods, this effect falls to a decline in the aggregate rate of 13.6 deaths per 100,000, or about 1.4% of the mean mortality rate in HP counties. In VHP counties, this effect falls to a decline in the aggregate rate of 23.2 deaths per 100,000, or about 2.4% of the mean mortality rate. FSP access appears to reduce mortality rates more for VHP counties than HP counties and more for HP counties than for all counties, which is consistent with the idea that food stamps would disproportionately benefit low-income people.

Similar patterns in which FSP access reduces subgroup mortality rates more for VHP counties than for HP counties and much more than all counties in full sample exist for most of the other subgroup mortality rates and are particularly strong for female, black, and elderly rates. In these counties, the estimated effect of the FSP being in operation for five or more years is to reduce female rates by 1.8% in HP counties and 3.1% in VHP counties, black mortality rates by 3.5% in HP counties and 4.3% in VHP counties, and elderly mortality rates by 2.0% in HP counties and 4.0% in VHP counties. The FSP appears to reduce several cause-specific deaths

over time in these HP and VHP counties more relative to the full sample, including deaths from cardiovascular diseases, pneumonia and flu, and suicides. Interestingly, younger subgroup mortality rates in these counties do not seem to be reduced by the operation of the FSP for any amount of time. It is possible that most of the mortality effect for these groups is driven by effects on children and newborns in middle-income counties, though this requires further investigation.

Table 9 presents selected estimates from the second set of models we consider that use a set of dummy variables indicating the length of time the FSP has been in operation for both HP and VHP subsamples. As with Table 5, these coefficient estimates can be interpreted as the average effect on each mortality rate of a county having access to food stamps for about 1 year, 2 years, 3 years, and so on up to more than 10 years, relative to not having access to food stamps.

When the effects are separated by years since implementation in this way, it appears again that access to the FSP tends to reduce mortality rates over time in HP counties and to do so even more in VHP counties. This is evident for aggregate rates and most subgroup rates, as well as for mortality due to cardiovascular disease whose mortality effects roughly follows aggregate mortality effects over time. However, access to the FSP in HP and VHP counties especially leads to reductions in black and elderly mortality rates. The effect on black mortality rates grows fairly consistently over time to a reduction of about 158 deaths per 100,000 for HP counties that have had the FSP for more than 10 years and a reduction of about 193 deaths for VHP counties that have had it more than 10 years, while the effect on elderly mortality rates grows to a reduction of about 495 deaths for HP counties and about 539 deaths for VHP counties after the FSP has been in place for more than 10 years. These effects seem large, but given that they are estimated for the poorest counties with the highest mortality rates, it is possible that access to

food stamps would result in large reductions in deaths of the most vulnerable groups in these counties.

In the full sample, access to the FSP appears to raise black mortality rates as shown in Table 5, while FSP access appears to lower black mortality rates in the HP and VHP subsamples as shown in Table 9. It may be the case that the effects of the FSP on mortality differ based on the income level of those receiving food stamps. Food stamps are more likely to result in additional food spending and improved nutrition for those households that have less income because these households are more likely to receive more in food stamps than what they would otherwise spend on food. Households that have more income and are therefore more likely to be inframarginal are also more likely to treat food stamps as additional free income and may not increase their food spending. Therefore, it is possible that this effect is showing up in these results and are larger for black households for some reason: Black households in the HP and VHP samples are on average poorer and spend more on food when they receive food stamps, while black households in the full sample are on average less poor and may spend more on other, possibly health-damaging goods when they receive food stamps, leading to average mortality increases for the full sample.

Other Specifications

I consider several other major model specifications whose estimates we do not present as they are consistent with those of the models we focus on here. We estimate models that include combinations of the following as the independent variables of interest: the length of time the FSP has been in operation in a county, the square of that length-of-operation variable, and an indicator variable for current operation of the FSP in a county. Including these combinations

allows us to look at other linear and non-linear ways the FSP may affect mortality. We also estimate these non-linear effects more directly using semiparametric fixed-effects models. In addition to these more major changes, we also consider several minor model alterations to examine the sensitivity of our results. We use age-adjusted mortality rates instead of crude mortality rates where possible for non-age-specific rates, but we find that their use barely alters any model's results or their interpretation. We also try specifications that include state-year fixed effects, exclude 1977 and 1978 to account for major changes made to the FSP in 1977, exclude demographic-trend interactions, and use a total transfer variable instead of multiple categorized transfer controls. We also consider samples that exclude counties with unreliable mortality rates of 20 deaths or fewer. On the whole, these variations in our models do not qualitatively alter our results, besides the specifications that exclude demographic-trend interactions which demonstrate the importance of controlling for county characteristics correlated with the treatment effect.

Conclusion

In this study, we use the variation afforded by the rollout of the FSP to examine the effect of food stamps' availability on various county-year level mortality rates over time. We consider mortality rates broken down by population subgroup and by cause of death in order to examine the different mechanisms through which food stamps might affect aggregate health. We find mixed results using the entire county sample that indicate overall small or nonexistent effects of access to food stamps on mortality rates, with the important exceptions of newborn and youth mortality rates. To examine the mortality effects on those low-income people who are most likely to benefit from food stamps, we consider subsamples restricted to those counties in the

highest quartile and decile of pre-treatment poverty rates. Among these subsamples, we find that the FSP tends to reduce many mortality rates after the program has been in operation in a county for several years.

The county rollout of the FSP represents an underexploited source of variation in access to food stamps benefits, which has been uniform across much of the program's tenure. Although the program's structure and rules have changed since its introduction as the FSP, today SNAP offers similar in-kind benefits and is similarly important in terms of economic size and potential impact. Exploring the various health effects of the FSP informs an important dimension of our understanding of the costs and benefits of SNAP, which is essential for developing effective food assistance policy.

Tables

Table 1.A. Summary Statistics: Mortality Rates

VARIABLES	N	mean	sd	min	max
*Crude mortality rates**					
Aggregate	33,781	916.2	221.1	0	3,292
Female	33,781	791.9	187.9	0	2,910
Male	33,781	1,047	274.8	0	4,918
Black	33,099	942.1	282.5	0	250,000
Other race	33,770	433.4	356.3	0	66,667
White	33,781	921.7	235.3	0	5,199
Age 0-19	33,781	139.6	44.64	0	1,754
Age 20-64	33,781	530.2	132.2	0	4,478
Age 65+	33,781	5,664	668.6	0	19,876
Infant*	33,781	17.71	7.479	0	500
Neonatal*	33,781	12.95	5.817	0	500
Major cardiovascular diseases	33,781	476.6	139.1	0	2,062
Diabetes mellitus	33,616	17.52	8.618	0	275.1
Chronic liver disease and cirrhosis	33,264	15.22	8.908	0	423.3
Malignant neoplasms	33,781	167.9	43.34	0	1,042
Pneumonia and influenza	33,704	28.95	13.64	0	483.9
Stroke	33,759	57.33	26.49	0	1,031
Motor vehicle accidents	33,781	24.73	13.25	0	885.0
Other accidents	33,770	27.36	11.79	0	840.3
Homicide and legal intervention	31,471	9.629	7.905	0	547.9
Suicide	33,528	11.98	5.540	0	470.0
Age-adjusted mortality rates					
Aggregate	33,781	920.6	119.7	0	3,732
Female	33,781	704.5	100.7	0	7,899
Male	33,781	1,202	162.4	0	7,206
Black	33,099	1,199	290.2	0	43,250
Other race	33,770	616.3	495.2	0	27,381
White	33,781	891.7	104.7	0	8,265
Major cardiovascular diseases	33,781	479.4	79.25	0	2,010
Diabetes mellitus	33,616	17.78	7.643	0	300.9
Chronic liver disease and cirrhosis	33,264	15.20	8.093	0	526.6
Malignant neoplasms	33,781	167.9	23.04	0	1,264
Pneumonia and influenza	33,704	29.02	11.46	0	497.1
Stroke	33,759	58.02	20.44	0	882.6
Motor vehicle accidents	33,781	25.24	14.27	0	1,053
Other accidents	33,770	27.61	11.73	0	829.2
Homicide and legal intervention	31,471	9.692	8.016	0	593.4
Suicide	33,528	12.01	5.508	0	415.4

Table 1.B. Summary Statistics: Treatment and Control Variables

VARIABLES	N	mean	sd	min	max
Treatment variable					
% of the year the FSP was in operation	33,781	0.818	0.372	0	1
Income and transfer controls (1960 dollars, per capita)					
Personal income	30,430	3,460	764.1	925.8	11,108
Retirement and disability insurance**	30,411	0.168	0.0554	0.00930	0.526
Medical benefits**	30,227	0.0700	0.0434	0.00533	0.420
Unemployment insurance compensation**	26,925	0.0243	0.0189	0	0.253
Veterans' benefits**	30,115	0.0307	0.00877	0	0.172
Education and training assistance**	22,842	0.00599	0.00427	0	0.0878
Income maintenance benefits, excluding food stamps**	25,789	0.0401	0.0297	0	0.187
Other transfers**	27,229	0.000788	0.00478	0	0.388
1960 county characteristics					
% under poverty line	33,462	21.51	13.25	2.200	81.60
% rural	33,462	22.88	21.00	0	100
% under age 5	33,462	11.43	1.527	5.595	20.37
% age 65 and older	33,462	9.110	2.719	1.030	24.87
% non-white	33,462	10.83	12.32	0	83.51

Notes:
Summary statistics are weighted by the average county population from 1968 to 1978, except for mortality rate summary statistics, which are weighted by the average relevant county subpopulation from 1968 to 1978 (e.g., aggregate rates are weighted by the average total population, female rates are weighted by the average female population, and so forth).
*Mortality rates are per 100,000 people, except for infant and neonatal rates, which are per 1,000 live births.
**Transfer controls are in thousands of 1960 dollars.

Table 2.A. Impacts of FSP Implementation on Contemporaneous Crude Mortality Rates: Aggregate, by Sex, and by Race Group

VARIABLES	Aggregate	Female	Male	Black	Other race	White
% of the year the FSP was in operation	3.359	3.051	3.476	6.111	4.942	2.605
	(2.429)	(2.382)	(3.340)	(7.058)	(10.35)	(2.649)
Log personal income	28.80	47.97*	4.760	112.0**	35.16	0.374
	(18.97)	(19.44)	(23.77)	(36.81)	(73.05)	(23.40)
Retirement and disability insurance	968.7***	924.7***	1,019***	489.7	45.26	977.3***
	(109.9)	(103.5)	(134.9)	(252.2)	(346.9)	(122.7)
Medical benefits	91.76	107.4	81.37	-136.1	303.8	198.1
	(155.2)	(164.0)	(191.8)	(271.6)	(233.4)	(187.1)
Income maintenance benefits,	-3.545	-128.2	160.5	761.9**	-487.7	-188.2
excluding food stamps	(147.8)	(166.2)	(165.5)	(243.0)	(454.4)	(179.9)
Unemployment insurance	-148.4*	-129.7	-170.5	-107.1	-622.3	-203.5**
compensation	(72.40)	(74.73)	(91.03)	(219.2)	(554.5)	(75.46)
Veterans' benefits	1,550***	1,572***	1,554***	463.0	3,933*	1,765***
	(310.4)	(298.9)	(402.6)	(689.8)	(1,799)	(355.1)
Education and training assistance	-1,154	-869.5	-1,487	-1,790***	-15.27	-1,442
	(696.9)	(466.8)	(1,002)	(508.4)	(844.1)	(1,094)
Other transfers	-76.59	-49.62	-110.7	-2,211	864.5**	-144.9
	(166.6)	(201.4)	(223.0)	(1,213)	(331.4)	(141.6)
% under age 5 * t	0.930**	0.708*	1.180**	-0.762	-1.922*	0.588
	(0.336)	(0.327)	(0.410)	(0.604)	(0.804)	(0.451)
% age 65 and older * t	-1.872***	-1.343***	-2.472***	0.394	-1.400*	-2.311***
	(0.184)	(0.189)	(0.228)	(0.445)	(0.652)	(0.214)
% non-white * t	-0.0394	-0.0254	-0.0565	0.161*	0.0403	0.0104
	(0.0260)	(0.0253)	(0.0335)	(0.0763)	(0.0573)	(0.0419)
% under poverty line * t	-0.214***	-0.231***	-0.197***	-0.0782	0.0138	-0.239***
	(0.0305)	(0.0293)	(0.0394)	(0.0982)	(0.0877)	(0.0400)
% rural * t	-0.0747***	-0.0694***	-0.0764**	0.0316	-0.0163	-0.0932***
	(0.0192)	(0.0187)	(0.0247)	(0.0568)	(0.126)	(0.0206)
Log population * t	-0.744*	-0.699	-0.839*	2.244	-0.0107	-0.870*
	(0.339)	(0.389)	(0.398)	(1.450)	(1.282)	(0.404)
Constant	780.5***	466.3*	1,149***	-239.1	415.7	1,101***
	(187.4)	(202.6)	(220.0)	(349.8)	(731.6)	(235.4)
Observations	18,341	18,341	18,341	18,321	18,341	18,341
R-squared	0.422	0.207	0.382	0.120	0.051	0.350
Number of counties	2,528	2,528	2,528	2,523	2,528	2,528

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Here and in other regression results tables, "% of the year the FSP was in operation" ranges from 0 to 1, while other "%" variables interacted with 1960 linear time trends range from 0 to 100. Transfer controls are in thousands of 1960 dollars per capita, while personal income is in 1960 dollars per capita prior to taking its log.

Table 2.B. Impacts of FSP Implementation on Contemporaneous Crude Mortality Rates: by Age

VARIABLES	0-19	20-64	65+	Infant**	Neonatal**
% of the year the FSP was in operation	-3.240**	3.936	34.90**	-0.674*	-0.466*
	(1.160)	(2.280)	(13.32)	(0.276)	(0.220)
Log personal income	48.13***	12.51	159.2	1.624	1.153
	(7.163)	(15.76)	(112.9)	(1.858)	(1.478)
Retirement and disability insurance	26.07	149.6*	-311.0	1.653	3.084
	(23.80)	(65.45)	(392.7)	(4.344)	(3.627)
Medical benefits	-120.6*	-130.5	-19.50	-6.600	-3.604
	(53.64)	(81.81)	(719.4)	(8.023)	(5.590)
Income maintenance benefits,	-67.11	284.6*	191.5	-6.558	-9.560
excluding food stamps	(56.13)	(126.7)	(1,284)	(9.611)	(7.924)
Unemployment insurance	-89.78***	-30.03	-1,060*	0.915	-1.038
compensation	(26.00)	(57.61)	(472.6)	(6.985)	(5.674)
Veterans' benefits	-313.4*	987.4***	-2,008	-3.557	-23.69
	(128.2)	(238.8)	(1,985)	(20.02)	(16.82)
Education and training assistance	-121.9	-722.2	-4,487*	7.558	-5.887
	(180.0)	(435.8)	(1,780)	(35.55)	(32.45)
Other transfers	38.77	121.7	-1,138	3.055	0.445
	(127.6)	(191.2)	(1,339)	(17.90)	(8.486)
% under age 5 * t	0.0580	0.484*	4.002*	0.00803	-0.00144
	(0.0936)	(0.241)	(2.010)	(0.0201)	(0.0165)
% age 65 and older * t	-0.0699	-0.817***	2.555*	0.00792	-0.00226
	(0.0585)	(0.126)	(1.051)	(0.0164)	(0.0128)
% non-white * t	-0.0281**	-0.209***	0.104	-0.00460	-0.00112
	(0.0104)	(0.0472)	(0.164)	(0.00284)	(0.00221)
% under poverty line * t	-0.0762***	-0.128**	-0.258	-0.00359	-0.000584
	(0.0108)	(0.0407)	(0.177)	(0.00239)	(0.00190)
% rural * t	-0.000170	-0.00757	-0.535***	0.00164	0.00113
	(0.00687)	(0.0162)	(0.117)	(0.00238)	(0.00182)
Log population * t	0.183*	-0.244	-1.439	0.0726	0.0605*
	(0.0848)	(0.319)	(2.475)	(0.0403)	(0.0307)
Constant	-209.8***	537.4***	4,472***	-0.511	0.628
	(63.57)	(154.0)	(1,228)	(21.44)	(16.61)
Observations	18,341	18,341	18,341	18,341	18,341
R-squared	0.339	0.559	0.478	0.203	0.213
Number of counties	2,528	2,528	2,528	2,528	2,528

**Infant and neonatal rates are in deaths per 1,000 live births.

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Table 2.C. Impacts of FSP Implementation on Contemporaneous Crude Mortality Rates: by Cause of Death

VARIABLES	Cardiovascular	Diabetes	Liver	Neoplasms	Pneumonia and flu
% of the year the FSP was in operation	2.946	0.436*	-0.306	0.444	-0.563
	(1.670)	(0.201)	(0.306)	(0.686)	(0.328)
Log personal income	-13.79	-0.0796	2.236	-8.886	2.071
	(13.40)	(1.530)	(1.813)	(5.166)	(2.358)
Retirement and disability insurance	578.4***	14.59*	21.87***	233.3***	-4.844
	(71.52)	(6.152)	(6.318)	(26.80)	(9.036)
Medical benefits	26.54	8.233	-20.93*	17.80	-5.343
	(78.57)	(12.48)	(10.61)	(33.01)	(23.39)
Income maintenance benefits, excluding food stamps	12.51	-21.04	40.51**	-22.34	-23.81
	(101.1)	(21.92)	(13.69)	(33.85)	(19.38)
Unemployment insurance compensation	-126.2*	-11.51*	-4.341	13.45	-26.58***
	(60.29)	(5.453)	(5.998)	(16.38)	(7.976)
Veterans' benefits	1,243***	34.18	70.97*	351.1***	18.86
	(244.5)	(20.16)	(28.13)	(67.26)	(41.92)
Education and training assistance	-126.4	-52.52	-153.6*	-317.9**	-36.26
	(183.3)	(35.13)	(67.57)	(116.7)	(48.43)
Other transfers	-234.0*	3.973	-3.410	37.12	8.403
	(97.44)	(13.30)	(19.01)	(62.70)	(27.04)
% under age 5 * t	0.537*	0.00249	0.0764*	0.173*	0.0457
	(0.231)	(0.0178)	(0.0332)	(0.0692)	(0.0365)
% age 65 and older * t	-1.449***	-0.0557***	-0.00357	-0.149***	0.0157
	(0.130)	(0.0103)	(0.0111)	(0.0399)	(0.0214)
% non-white * t	-0.0340	-0.00174	-0.00238	0.0243*	-0.00645
	(0.0178)	(0.00243)	(0.00328)	(0.00968)	(0.00376)
% under poverty line * t	-0.0970***	-0.00479*	0.00193	-0.0366***	-0.0199***
	(0.0179)	(0.00219)	(0.00278)	(0.00942)	(0.00428)
% rural * t	-0.0495***	-0.00173	0.00196	-0.000499	-0.00524*
	(0.0140)	(0.00139)	(0.00148)	(0.00491)	(0.00226)
Log population * t	-0.387	-0.0200	-0.0475*	-0.0955	-0.127***
	(0.345)	(0.0212)	(0.0224)	(0.0742)	(0.0333)
Constant	658.5***	26.07	-9.587	205.7***	33.80
	(146.2)	(14.89)	(15.17)	(45.82)	(21.94)
Observations	18,341	18,341	18,337	18,341	18,341
R-squared	0.432	0.074	0.084	0.191	0.151
Number of counties	2,528	2,528	2,527	2,528	2,528

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Table 2.D. Impacts of FSP Implementation on Contemporaneous Crude Mortality Rates: by Cause of Death

VARIABLES	Stroke	Motor vehicle accidents	Other accidents	Homicide and LI	Suicide
% of the year the FSP was in operation	0.365	0.323	0.218	0.446	0.741***
	(0.490)	(0.279)	(0.324)	(0.269)	(0.216)
Log personal income	-4.414	11.06***	4.523	4.244**	0.169
	(3.189)	(1.884)	(2.439)	(1.488)	(1.122)
Retirement and disability insurance	68.27***	-3.519	1.120	-27.05***	13.67
	(16.07)	(6.109)	(11.63)	(6.350)	(7.323)
Medical benefits	27.22	-1.364	19.76*	26.04	7.243
	(19.32)	(7.926)	(9.755)	(14.92)	(4.873)
Income maintenance benefits,	8.024	-19.29	-9.272	16.36	13.10
excluding food stamps	(24.17)	(10.78)	(19.79)	(23.66)	(12.83)
Unemployment insurance	-4.053	0.712	27.12*	5.338	9.384
compensation	(12.64)	(7.539)	(12.81)	(9.935)	(6.686)
Veterans' benefits	22.24	-87.82**	21.70	-15.85	37.40
	(55.83)	(29.96)	(34.67)	(28.15)	(21.44)
Education and training assistance	83.81	27.82	63.45*	-48.79*	103.0
	(69.89)	(25.54)	(31.46)	(21.56)	(65.01)
Other transfers	-56.52	15.41	4.277	54.42*	-3.384
	(29.62)	(43.97)	(29.22)	(25.06)	(16.37)
% under age 5 * t	0.0911	-0.0254	-0.0513	-0.0216	0.0188
	(0.0532)	(0.0256)	(0.0396)	(0.0164)	(0.0217)
% age 65 and older * t	-0.188***	-0.0501***	-0.0846***	-0.0165	-0.0202
	(0.0353)	(0.0150)	(0.0204)	(0.0104)	(0.0114)
% non-white * t	0.00199	-0.00603	-0.00519	-0.00782**	0.000891
	(0.00486)	(0.00352)	(0.00392)	(0.00280)	(0.00211)
% under poverty line * t	-0.0289***	-0.0108**	-0.00756	0.00804***	-0.000691
	(0.00549)	(0.00369)	(0.00480)	(0.00232)	(0.00262)
% rural * t	-0.0125***	-0.00131	-0.00222	-0.00190	-0.00321
	(0.00372)	(0.00190)	(0.00272)	(0.00144)	(0.00183)
Log population * t	-0.200*	0.160***	-0.0489	0.110**	-0.0789
	(0.0789)	(0.0251)	(0.0745)	(0.0350)	(0.0543)
Constant	123.8***	-67.95***	13.41	-34.43*	15.74
	(31.23)	(16.00)	(24.53)	(14.53)	(11.75)
Observations	18,341	18,341	18,341	17,988	18,341
R-squared	0.118	0.136	0.072	0.111	0.030
Number of counties	2,528	2,528	2,528	2,458	2,528

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Table 3. Impact of Multi-Year FSP Operation on Aggregate Crude Mortality Rates

	FSP has been in operation for:					
VARIABLES	**0+ years**	**1+ year**	**2+ years**	**3+ years**	**4+ years**	**5+ years**
% of the year the FSP was in	3.359	0.832	-0.404	-1.426	-0.434	-0.0500
operation (lagged 0-5 years)	(2.429)	(2.440)	(2.595)	(2.454)	(2.397)	(2.356)
Log personal income	28.80	27.85	26.97	26.03	26.98	27.28
	(18.97)	(18.89)	(18.67)	(18.50)	(18.70)	(18.94)
Retirement and disability	968.7***	963.8***	960.9***	959.1***	961.6***	961.9***
insurance	(109.9)	(109.8)	(109.5)	(109.2)	(109.4)	(109.8)
Medical benefits	91.76	97.16	104.7	108.0	102.2	102.0
	(155.2)	(152.4)	(148.8)	(150.1)	(155.0)	(157.3)
Income maintenance benefits,	-3.545	-12.48	-20.97	-25.85	-18.01	-17.71
excluding food stamps	(147.8)	(146.8)	(146.0)	(146.9)	(148.8)	(148.9)
Unemployment insurance	-148.4*	-150.5*	-152.7*	-151.6*	-151.4*	-152.0*
compensation	(72.40)	(72.09)	(72.14)	(72.65)	(73.32)	(73.01)
Veterans' benefits	1,550***	1,565***	1,569***	1,565***	1,566***	1,568***
	(310.4)	(311.8)	(312.4)	(313.1)	(313.6)	(314.3)
Education and training	-1,154	-1,153	-1,146	-1,138	-1,145	-1,148
assistance	(696.9)	(695.4)	(693.1)	(691.2)	(693.8)	(698.4)
Other transfers	-76.59	-68.68	-66.09	-68.11	-67.87	-66.73
	(166.6)	(165.4)	(164.5)	(164.5)	(165.9)	(165.9)
% under age 5 * t	0.930**	0.924**	0.920**	0.912**	0.919**	0.921**
	(0.336)	(0.336)	(0.335)	(0.333)	(0.333)	(0.335)
% age 65 and older * t	-1.872***	-1.868***	-1.869***	-1.875***	-1.871***	-1.868***
	(0.184)	(0.184)	(0.182)	(0.181)	(0.180)	(0.182)
% non-white * t	-0.0394	-0.0418	-0.0428	-0.0429	-0.0425	-0.0425
	(0.0260)	(0.0259)	(0.0259)	(0.0261)	(0.0261)	(0.0262)
% under poverty line * t	-0.214***	-0.212***	-0.212***	-0.212***	-0.212***	-0.212***
	(0.0305)	(0.0303)	(0.0303)	(0.0304)	(0.0304)	(0.0303)
% rural * t	-0.0747***	-0.0748***	-0.0747***	-0.0750***	-0.0749***	-0.0748***
	(0.0192)	(0.0192)	(0.0193)	(0.0193)	(0.0191)	(0.0191)
Log population * t	-0.744*	-0.767*	-0.785*	-0.809*	-0.786*	-0.779*
	(0.339)	(0.338)	(0.336)	(0.334)	(0.328)	(0.334)
Constant	780.5***	792.9***	803.6***	816.2***	803.8***	799.9***
	(187.4)	(186.2)	(182.8)	(179.7)	(181.1)	(185.0)
Observations	18,341	18,341	18,341	18,341	18,341	18,341
R-squared	0.422	0.421	0.421	0.422	0.421	0.421
Number of counties	2,528	2,528	2,528	2,528	2,528	2,528

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Lagged treatment variables beyond 5 years are also considered, but their results are excluded here and in the tables below for brevity and because they generally do not vary from the patterns displayed up to a lag of 5 years.

Table 4.A. Impact of Multi-Year FSP Operation on Different Crude Mortality Rates: Changes in Deaths per 100,000

	FSP has been in operation for:					
CRUDE RATE	**0+ years**	**1+ years**	**2+ years**	**3+ years**	**4+ years**	**5+ years**
Aggregate	3.359	0.832	-0.404	-1.426	-0.434	-0.0500
	(2.429)	(2.440)	(2.595)	(2.454)	(2.397)	(2.356)
Female	3.051	1.896	0.387	-1.058	0.0486	0.434
	(2.382)	(2.542)	(2.715)	(2.464)	(2.392)	(2.447)
Male	3.476	-0.397	-1.268	-1.819	-0.916	-0.537
	(3.340)	(3.108)	(3.158)	(3.063)	(2.994)	(2.827)
Black	6.111	-0.711	-5.095	-0.243	4.375	2.096
	(7.058)	(7.074)	(6.915)	(6.148)	(5.443)	(5.276)
Other race	4.942	-17.63	-33.71	-23.16	-6.157	3.527
	(10.35)	(12.80)	(18.89)	(15.79)	(9.844)	(8.509)
White	2.605	1.015	0.717	-0.463	0.143	0.877
	(2.649)	(2.667)	(2.832)	(2.644)	(2.470)	(2.444)
Age 0-19	-3.240**	-2.510*	-1.523	-0.572	-0.0582	0.349
	(1.160)	(1.089)	(0.891)	(0.827)	(0.858)	(0.970)
Age 20-64	3.936	1.914	0.517	-0.884	-0.450	-0.833
	(2.280)	(2.019)	(1.927)	(1.807)	(1.847)	(1.866)
Age 65+	34.90**	21.27	7.190	-9.552	-8.025	-3.729
	(13.32)	(13.25)	(14.82)	(15.00)	(16.15)	(18.44)
Infant**	-0.674*	-0.622*	-0.401*	-0.0509	0.253	0.467**
	(0.276)	(0.263)	(0.188)	(0.142)	(0.157)	(0.177)
Neonatal**	-0.466*	-0.454*	-0.272	-0.0717	0.141	0.355*
	(0.220)	(0.202)	(0.155)	(0.133)	(0.144)	(0.148)
Cardiovascular	2.946	1.283	-0.0335	-0.769	0.729	0.918
	(1.670)	(1.728)	(1.792)	(1.717)	(1.903)	(1.950)
Diabetes	0.436*	0.414*	0.372	0.263	0.0889	0.0419
	(0.201)	(0.198)	(0.190)	(0.178)	(0.202)	(0.247)
Liver	-0.306	-0.0774	0.205	0.171	0.105	-0.00774
	(0.306)	(0.244)	(0.186)	(0.166)	(0.195)	(0.213)
Neoplasms	0.444	0.188	0.516	0.395	-0.0888	-0.616
	(0.686)	(0.680)	(0.700)	(0.630)	(0.601)	(0.590)
Pneumonia and flu	-0.563	-0.386	-0.602	-0.609	-0.0225	0.337
	(0.328)	(0.338)	(0.337)	(0.312)	(0.298)	(0.301)
Stroke	0.365	0.700	0.724	0.487	0.365	0.307
	(0.490)	(0.454)	(0.449)	(0.420)	(0.377)	(0.375)
Motor vehicle accidents	0.323	0.361	0.389	0.274	-0.344	-0.597*
	(0.279)	(0.268)	(0.244)	(0.219)	(0.220)	(0.232)
Other accidents	0.218	0.478	0.572	0.712*	0.449	-0.0339
	(0.324)	(0.330)	(0.319)	(0.309)	(0.277)	(0.328)
Homicide and LI	0.446	0.443	0.155	-0.0739	-0.0286	0.0211
	(0.269)	(0.236)	(0.209)	(0.197)	(0.189)	(0.161)
Suicide	0.741***	0.522*	0.376	0.188	-0.189	-0.419**
	(0.216)	(0.227)	(0.234)	(0.202)	(0.167)	(0.156)

**Infant and neonatal rates are in deaths per 1,000 live births.
Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

Table 4.B. Impact of Multi-Year FSP Operation on Different Crude Mortality Rates: Changes in Deaths as Percentages of Mean Mortality Rates

	FSP has been in operation for:						
CRUDE RATE	**0+ years**	**1+ years**	**2+ years**	**3+ years**	**4+ years**	**5+ years**	**Mean Mortality Rate***
Aggregate	0.37%	0.09%	-0.04%	-0.16%	-0.05%	-0.01%	916.2
Female	0.39%	0.24%	0.05%	-0.13%	0.01%	0.05%	791.9
Male	0.33%	-0.04%	-0.12%	-0.17%	-0.09%	-0.05%	1,047
Black	0.65%	-0.08%	-0.54%	-0.03%	0.46%	0.22%	942.1
Other race	1.14%	-4.07%	-7.78%	-5.34%	-1.42%	0.81%	433.4
White	0.28%	0.11%	0.08%	-0.05%	0.02%	0.10%	921.7
Age 0-19	-2.32%**	-1.8%*	-1.09%	-0.41%	-0.04%	0.25%	139.6
Age 20-64	0.74%	0.36%	0.10%	-0.17%	-0.08%	-0.16%	530.2
Age 65+	0.62%**	0.38%	0.13%	-0.17%	-0.14%	-0.07%	5,664
Infant**	-3.81%*	-3.51%*	-2.26%*	-0.29%	1.43%	2.64%**	17.71
Neonatal**	-3.6%*	-3.51%*	-2.10%	-0.55%	1.09%	2.74%*	12.95
Cardiovascular	0.62%	0.27%	-0.01%	-0.16%	0.15%	0.19%	476.6
Diabetes	2.49%*	2.36%*	2.12%	1.50%	0.51%	0.24%	17.52
Liver	-2.01%	-0.51%	1.35%	1.12%	0.69%	-0.05%	15.22
Neoplasms	0.26%	0.11%	0.31%	0.24%	-0.05%	-0.37%	167.9
Pneumonia and flu	-1.94%	-1.33%	-2.08%	-2.10%	-0.08%	1.16%	28.95
Stroke	0.64%	1.22%	1.26%	0.85%	0.64%	0.54%	57.33
Motor vehicle accidents	1.31%	1.46%	1.57%	1.11%	-1.39%	-2.41%*	24.73
Other accidents	0.80%	1.75%	2.09%	2.6%*	1.64%	-0.12%	27.36
Homicide and LI	4.63%	4.60%	1.61%	-0.77%	-0.30%	0.22%	9.629
Suicide	6.19%***	4.36%*	3.14%	1.57%	-1.58%	-3.5%**	11.98

*The mean mortality rate is the average mortality rate for the relevant subpopulation in each county and year in the 1968-1978 sample, weighted by the relevant subpopulation.

**Infant and neonatal rates are in deaths per 1,000 live births.

Robust standard errors omitted

*** p<0.001, ** p<0.01, * p<0.05

Table 5. Impact of FSP Operation for X Years on Selected Crude Mortality Rates

	FSP has been in operation for:										
CRUDE RATE	**≤ 1 year**	**1-2 years**	**2-3 years**	**3-4 years**	**4-5 years**	**5-6 years**	**6-7 years**	**7-8 years**	**8-9 years**	**9-10 years**	**> 10 years**
Aggregate	2.488	5.185	3.423	2.752	3.467	3.881	4.596	2.573	5.627	5.052	3.907
	(2.868)	(3.466)	(4.245)	(5.295)	(6.184)	(7.200)	(8.374)	(9.189)	(9.947)	(10.35)	(10.87)
Female	2.034	3.919	3.793	2.250	3.151	3.054	4.504	2.969	5.065	2.977	3.208
	(3.166)	(3.847)	(5.032)	(6.129)	(6.925)	(8.118)	(9.443)	(10.44)	(11.71)	(12.23)	(13.20)
Male	2.763	6.146	2.659	2.832	3.358	4.224	4.104	1.557	5.525	6.554	3.807
	(3.823)	(4.378)	(5.100)	(6.337)	(7.492)	(8.678)	(9.887)	(10.81)	(11.35)	(12.02)	(12.95)
Black	13.57*	22.56**	19.16*	16.69	25.31	33.15*	34.91*	26.71	40.43*	53.16**	52.50*
	(6.079)	(7.334)	(9.382)	(10.83)	(12.99)	(14.41)	(15.79)	(17.90)	(19.66)	(19.78)	(23.06)
Other race	11.97	19.81	2.861	-17.30	-12.96	-13.83	-9.893	1.939	5.615	-14.93	-1.169
	(15.93)	(17.30)	(14.99)	(17.56)	(19.82)	(23.65)	(26.71)	(28.48)	(31.36)	(34.24)	(40.18)
White	1.379	3.700	1.985	2.371	2.800	2.511	3.831	3.160	5.400	2.633	1.603
	(3.412)	(4.146)	(5.068)	(6.344)	(7.377)	(8.482)	(9.927)	(10.85)	(11.77)	(12.57)	(13.41)
Age 0-19	-2.854*	-4.193*	-5.903**	-4.994*	-5.969*	-6.953*	-5.771	-8.609*	-7.786	-10.17*	-7.576
	(1.386)	(1.728)	(2.213)	(2.404)	(2.698)	(2.975)	(3.403)	(3.684)	(4.318)	(4.509)	(4.960)
Age 20-64	2.595	5.605	5.114	3.976	5.651	6.131	6.881	5.202	6.304	7.291	8.001
	(2.597)	(2.950)	(3.483)	(4.072)	(4.659)	(5.450)	(6.190)	(6.992)	(7.678)	(8.116)	(8.670)
Age 65+	4.935	27.35	20.12	17.50	3.994	12.87	5.524	1.472	7.584	-1.472	-21.63
	(25.08)	(32.49)	(40.39)	(47.01)	(54.97)	(64.11)	(77.06)	(84.25)	(98.27)	(106.8)	(117.2)
Infant**	0.180	-0.342	-0.450	-0.339	-0.537	-0.182	-0.0640	-0.235	-0.00425	-0.112	-0.0251
	(0.509)	(0.277)	(0.349)	(0.390)	(0.426)	(0.470)	(0.541)	(0.596)	(0.702)	(0.746)	(0.819)
Neonatal**	0.279	-0.175	-0.221	-0.0475	-0.301	0.0370	0.117	0.0260	0.247	0.144	0.236
	(0.384)	(0.232)	(0.282)	(0.315)	(0.334)	(0.382)	(0.433)	(0.476)	(0.572)	(0.612)	(0.658)
Cardiovascular	0.868	3.434	1.914	0.103	0.490	1.202	1.355	-0.148	1.553	0.682	-2.707
	(2.489)	(3.062)	(3.978)	(4.752)	(5.533)	(6.435)	(7.541)	(8.398)	(9.445)	(10.35)	(11.25)

≤ 1 year indicates that the FSP has operated in a county for up to and including one year; 1-2 years indicates that the FSP has operated more than one year and up to 2 years; etc.

**Infant and neonatal rates are in deaths per 1,000 live births.

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Table 6. Summary Statistics for High- and Very-High-Poverty* Subsamples

	High-Poverty Counties			Very-High-Poverty Counties		
VARIABLES	**N**	**mean**	**sd**	**N**	**mean**	**sd**
Crude mortality rates						
Aggregate	8,646	1,005	241.3	3,663	959.7	249.8
Female	8,646	826.7	209.7	3,663	789.8	211.5
Male	8,646	1,193	305.8	3,663	1,140	316.2
Black	8,580	1,083	309.7	3,663	1,059	276.5
Other race	8,646	703.4	489.9	3,663	717.1	493.7
White	8,646	989.4	265.4	3,663	934.6	275.8
Age 0-19	8,646	174.7	69.06	3,663	173.3	72.24
Age 20-64	8,646	628.3	171	3,663	615.3	187.8
Age 65+	8,646	5,538	818.9	3,663	5,388	841.1
Infant**	8,646	21.45	10.39	3,663	21.35	10.71
Neonatal**	8,646	14.6	7.929	3,663	14.44	7.772
Major cardiovascular diseases	8,646	516.9	157.6	3,663	483.7	155.8
Diabetes mellitus	8,646	19.34	11.98	3,663	19.06	11.44
Chronic liver disease and cirrhosis	8,492	12.52	9.046	3,630	12.8	9.173
Malignant neoplasms	8,591	10.71	8.279	3,630	12.04	8.456
Pneumonia and influenza	8,646	37.11	20.41	3,663	34.46	20.76
Stroke	8,646	158.9	48.24	3,663	155.8	47.9
Motor vehicle accidents	8,646	36.74	19.07	3,663	35.43	18.83
Other accidents	8,635	33.25	19.27	3,652	31.55	17.84
Homicide and legal intervention	8,646	77.91	41.17	3,663	70.6	41.19
Suicide	8,624	12.02	7.962	3,663	12.69	7.621
Treatment variable						
% of the year the FSP was in operation	8,646	0.811	0.392	3,663	0.825	0.38
Income and transfer controls (1960 dollars, per capita)						
Personal income	7,600	2,223	401.5	3,070	2,033	366.8
Retirement and disability insurance**	7,600	0.151	0.0555	3,070	0.142	0.0541
Medical benefits**	7,584	0.0524	0.0233	3,060	0.0539	0.0235
Unemployment insurance compensation**	6,804	0.015	0.0112	2,709	0.0148	0.0103
Veterans' benefits**	7,582	0.0357	0.0109	3,059	0.0326	0.011
Education and training assistance**	4,968	0.00436	0.00484	1,909	0.00465	0.00519
Income maintenance benefits, excluding food stamps**	7,282	0.0425	0.0188	2,986	0.0502	0.0204
Other transfers**	7,444	0.00174	0.0109	2,991	0.00167	0.0115
1960 county characteristics						
% under poverty line	8,327	56.97	7.531	3,344	64.88	4.985
% rural	8,360	48.66	19.45	3,377	48.62	21.08
% under age 5	8,360	11.73	1.989	3,377	12.66	1.847
% age 65 and older	8,360	9.304	2.814	3,377	8.562	2.316
% non-white	8,360	28.51	22.01	3,377	35.67	25.87

*High-poverty and very-high-poverty counties are those counties with 1960 poverty rates in the highest quartile or decile.
**See notes for tables 1.A. and 1.B.

Table 7.A. Impact of Multi-Year FSP Operation on Different Crude Mortality Rates in High-Poverty* Counties: Changes in Deaths per 100,000

	FSP has been in operation for:					
CRUDE RATE	**0+ years**	**1+ years**	**2+ years**	**3+ years**	**4+ years**	**5+ years**
Aggregate	8.830	4.573	1.831	-5.592	-9.983	-13.56*
	(6.899)	(6.017)	(5.081)	(4.712)	(5.255)	(5.663)
Female	6.449	6.992	4.336	0.0787	-6.724	-14.51*
	(7.367)	(6.409)	(5.574)	(5.768)	(5.812)	(6.111)
Male	11.46	2.068	-1.087	-11.96	-13.77	-12.78
	(9.751)	(8.689)	(7.657)	(7.043)	(7.655)	(8.044)
Black	40.50**	22.72	6.638	-8.438	-17.48	-37.57***
	(14.60)	(11.84)	(9.835)	(9.406)	(9.808)	(10.60)
Other race	62.83	43.36	-10.90	-40.91	-26.53	-30.17
	(38.75)	(50.15)	(28.22)	(29.05)	(44.34)	(40.64)
White	-2.039	-1.541	2.406	-2.583	-5.950	-4.058
	(7.677)	(6.619)	(5.761)	(5.338)	(5.788)	(6.381)
Age 0-19	0.955	-1.547	-0.258	1.822	1.877	-1.107
	(3.835)	(3.446)	(3.142)	(3.267)	(3.182)	(3.188)
Age 20-64	15.43*	13.04*	5.637	-4.083	-7.253	-6.077
	(7.136)	(6.046)	(4.820)	(4.725)	(5.436)	(5.735)
Age 65+	21.47	-17.65	-31.78	-63.87	-85.01*	-110.3**
	(41.01)	(36.46)	(32.30)	(33.56)	(34.33)	(36.53)
Infant**	0.278	-0.334	-0.310	-0.0154	0.362	5.24e-05
	(0.594)	(0.507)	(0.509)	(0.539)	(0.506)	(0.537)
Neonatal**	0.348	-0.428	-0.153	0.0935	0.661	0.547
	(0.520)	(0.443)	(0.411)	(0.432)	(0.417)	(0.432)
Cardiovascular	1.720	-1.178	-5.879	-9.994**	-8.546*	-8.338*
	(4.523)	(4.050)	(3.539)	(3.504)	(3.706)	(3.864)
Diabetes	-0.595	-0.275	0.268	0.710	1.152	0.752
	(0.734)	(0.689)	(0.639)	(0.610)	(0.680)	(0.648)
Liver	0.334	0.232	0.273	-0.393	-0.271	-0.115
	(0.464)	(0.430)	(0.405)	(0.448)	(0.445)	(0.412)
Neoplasms	-0.274	1.105	2.223	2.178	-0.929	-2.321
	(1.992)	(1.880)	(1.597)	(1.591)	(1.616)	(1.815)
Pneumonia and flu	-1.428	-0.689	-0.628	-1.194	-1.172	0.0361
	(1.128)	(0.965)	(0.851)	(0.848)	(0.870)	(0.962)
Stroke	-0.372	0.252	-0.0209	0.375	0.0716	-2.900
	(1.920)	(1.643)	(1.511)	(1.559)	(1.507)	(1.603)
Motor vehicle accidents	0.431	1.121	0.851	0.398	-1.456	-1.680
	(1.162)	(1.023)	(0.941)	(0.906)	(0.952)	(0.951)
Other accidents	0.0166	-0.0668	-0.0144	0.0142	0.520	-0.195
	(0.998)	(0.950)	(0.864)	(0.848)	(0.901)	(0.944)
Homicide and LI	0.894	0.367	-0.0594	-0.529	-0.259	-0.689
	(0.531)	(0.479)	(0.483)	(0.478)	(0.487)	(0.524)
Suicide	0.354	-0.103	-0.320	-0.551	-1.045*	-0.761
	(0.466)	(0.482)	(0.456)	(0.427)	(0.425)	(0.408)

*High-poverty counties are those counties with 1960 poverty rates in the highest quartile.

**Infant and neonatal rates are in deaths per 1,000 live births.

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Table 7.B. Impact of Multi-Year FSP Operation on Different Crude Mortality Rates in High-Poverty* Counties: Changes in Deaths as Percentages of Mean Mortality Rates

	FSP has been in operation for:						
CRUDE RATE	**0+ years**	**1+ years**	**2+ years**	**3+ years**	**4+ years**	**5+ years**	**Mean Mortality Rate*** **
Aggregate	0.88%	0.46%	0.18%	-0.56%	-0.99%	-1.35%*	1,005
Female	0.78%	0.85%	0.52%	0.01%	-0.81%	-1.76%*	826.7
Male	0.96%	0.17%	-0.09%	-1.00%	-1.15%	-1.07%	1,192
Black	3.74%**	2.10%	0.61%	-0.78%	-1.61%	-3.47%***	1,083
Other race	8.93%	6.16%	-1.55%	-5.82%	-3.77%	-4.29%	703.4
White	-0.21%	-0.16%	0.24%	-0.26%	-0.60%	-0.41%	989.4
Age 0-19	0.55%	-0.89%	-0.15%	1.04%	1.07%	-0.63%	174.7
Age 20-64	2.46%*	2.08%*	0.90%	-0.65%	-1.15%	-0.97%	628.3
Age 65+	0.39%	-0.32%	-0.57%	-1.15%	-1.54%*	-1.99%**	5,538
Infant**	1.30%	-1.56%	-1.45%	-0.07%	1.69%	0.00%	21.45
Neonatal**	2.38%	-2.93%	-1.05%	0.64%	4.53%	3.75%	14.60
Cardiovascular	0.33%	-0.23%	-1.14%	-1.93%**	-1.65%*	-1.61%*	516.9
Diabetes	-3.08%	-1.42%	1.39%	3.67%	5.96%	3.89%	19.34
Liver	2.67%	1.85%	2.18%	-3.14%	-2.17%	-0.92%	12.52
Neoplasms	-2.56%	10.31%	20.75%	20.33%	-8.67%	-21.66%	10.71
Pneumonia and flu	-3.85%	-1.86%	-1.69%	-3.22%	-3.16%	0.10%	37.11
Stroke	-0.23%	0.16%	-0.01%	0.24%	0.05%	-1.82%	158.9
Motor vehicle accidents	1.17%	3.05%	2.32%	1.08%	-3.96%	-4.57%	36.74
Other accidents	0.05%	-0.20%	-0.04%	0.04%	1.56%	-0.59%	33.25
Homicide and LI	1.15%	0.47%	-0.08%	-0.68%	-0.33%	-0.88%	77.91
Suicide	2.94%	-0.86%	-2.66%	-4.58%	-8.69%*	-6.33%	12.02

*High-poverty counties are those counties with 1960 poverty rates in the highest quartile.

**Infant and neonatal rates are in deaths per 1,000 live births.

***The mean mortality rate is the average mortality rate for the relevant subpopulation in each county and year in the 1968-1978 sample, weighted by the relevant subpopulation.

Robust standard errors omitted

*** p<0.001, ** p<0.01, * p<0.05

Table 8.A. Impact of Multi-Year FSP Operation on Different Crude Mortality Rates in Very-High-Poverty* Counties: Changes in Deaths per 100,000

	FSP has been in operation for:					
CRUDE RATE	**0+ years**	**1+ years**	**2+ years**	**3+ years**	**4+ years**	**5+ years**
Aggregate	6.547	3.676	-1.922	-9.442	-21.84**	-23.19**
	(12.83)	(11.35)	(9.323)	(7.926)	(8.251)	(8.703)
Female	-0.139	-1.554	-4.400	-3.068	-17.45	-24.64*
	(12.89)	(11.09)	(9.248)	(9.472)	(9.376)	(9.507)
Male	13.09	8.814	0.381	-16.58	-26.71*	-21.56
	(17.34)	(15.67)	(14.10)	(11.72)	(11.40)	(12.37)
Black	32.38	32.10	9.648	-5.848	-34.35*	-45.47**
	(23.04)	(18.91)	(15.77)	(12.55)	(13.57)	(14.78)
Other race	99.63	1.923	-49.20	1.805	29.50	-8.358
	(80.13)	(66.11)	(44.17)	(41.36)	(51.72)	(72.49)
White	-7.406	-10.12	-4.376	-10.68	-14.99	-9.444
	(13.98)	(12.62)	(10.87)	(9.612)	(9.745)	(10.80)
Age 0-19	8.402	9.706	4.285	-0.910	-4.270	-6.842
	(6.078)	(5.645)	(5.080)	(5.870)	(5.863)	(5.874)
Age 20-64	-3.903	2.175	-3.397	-6.912	-9.579	4.143
	(12.79)	(10.55)	(8.737)	(7.994)	(8.338)	(8.928)
Age 65+	76.58	-5.122	-30.97	-59.60	-144.8*	-215.5***
	(72.49)	(70.59)	(57.85)	(55.72)	(60.30)	(60.60)
Infant**	0.663	0.633	-0.0240	-0.0298	0.0390	0.000765
	(0.933)	(0.887)	(0.897)	(1.031)	(0.946)	(0.990)
Neonatal**	0.766	0.302	0.0765	0.372	0.934	0.694
	(0.780)	(0.763)	(0.755)	(0.817)	(0.765)	(0.709)
Cardiovascular	-0.738	-1.351	-6.499	-8.769	-12.88*	-13.56*
	(6.611)	(6.576)	(6.365)	(6.248)	(6.217)	(5.787)
Diabetes	-0.145	0.486	1.604	0.864	-1.024	-0.954
	(1.118)	(1.257)	(1.214)	(1.074)	(1.167)	(0.961)
Liver	0.694	-0.0389	-0.528	-0.747	0.237	-0.257
	(1.003)	(0.923)	(0.977)	(0.941)	(0.782)	(0.768)
Neoplasms	0.292	0.355	0.475	-0.228	-0.366	-0.349
	(0.783)	(0.749)	(0.609)	(0.584)	(0.678)	(0.603)
Pneumonia and flu	0.993	0.234	-0.588	-0.984	-4.771**	-4.327**
	(2.126)	(1.775)	(1.711)	(1.695)	(1.587)	(1.458)
Stroke	-6.672	-5.404	-2.012	0.382	-0.897	0.168
	(3.485)	(3.038)	(2.707)	(2.808)	(2.623)	(2.823)
Motor vehicle accidents	2.092	2.400	0.436	-0.0148	-0.856	-1.970
	(1.775)	(1.599)	(1.435)	(1.405)	(1.438)	(1.800)
Other accidents	-1.733	-0.224	0.278	-1.137	-1.291	0.505
	(2.017)	(1.724)	(1.614)	(1.477)	(1.467)	(1.573)
Homicide and LI	0.819	3.068	3.812	4.844	2.600	-3.701
	(3.012)	(2.637)	(2.510)	(2.497)	(2.322)	(2.354)
Suicide	0.0615	-0.461	-0.476	-0.725	-1.679*	-0.859
	(0.866)	(0.787)	(0.712)	(0.727)	(0.654)	(0.624)

*Very-high-poverty counties are those counties with 1960 poverty rates in the highest decile.

**Infant and neonatal rates are in deaths per 1,000 live births.

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Table 8.B. Impact of Multi-Year FSP Operation on Different Crude Mortality Rates in Very-High-Poverty* Counties: Changes in Deaths as Percentages of Mean Mortality Rates

	FSP has been in operation for:						
CRUDE RATE	**0+ years**	**1+ years**	**2+ years**	**3+ years**	**4+ years**	**5+ years**	**Mean Mortality Rate*** **
Aggregate	0.68%	0.38%	-0.20%	-0.98%	-2.28%**	-2.42%**	959.7
Female	-0.02%	-0.20%	-0.56%	-0.39%	-2.21%	-3.12%*	789.8
Male	1.15%	0.77%	0.03%	-1.45%	-2.34%*	-1.89%	1,140
Black	3.06%	3.03%	0.91%	-0.55%	-3.24%*	-4.3%**	1,059
Other race	13.89%	0.27%	-6.86%	0.25%	4.11%	-1.17%	717.1
White	-0.79%	-1.08%	-0.47%	-1.14%	-1.60%	-1.01%	934.6
Age 0-19	4.85%	5.60%	2.47%	-0.53%	-2.46%	-3.95%	173.3
Age 20-64	-0.63%	0.35%	-0.55%	-1.12%	-1.56%	0.67%	615.3
Age 65+	1.42%	-0.10%	-0.57%	-1.11%	-2.69%*	-4%***	5,388
Infant**	3.11%	2.97%	-0.11%	-0.14%	0.18%	0.00%	21.35
Neonatal**	5.31%	2.09%	0.53%	2.58%	6.47%	4.81%	14.44
Cardiovascular	-0.15%	-0.28%	-1.34%	-1.81%	-2.66%*	-2.8%*	483.7
Diabetes	-0.76%	2.55%	8.42%	4.53%	-5.37%	-5.01%	19.06
Liver	5.42%	-0.30%	-4.13%	-5.84%	1.85%	-2.01%	12.80
Neoplasms	2.42%	2.95%	3.94%	-1.89%	-3.04%	-2.90%	12.04
Pneumonia and flu	2.88%	0.68%	-1.71%	-2.86%	-13.85%**	-12.56%**	34.46
Stroke	-4.28%	-3.47%	-1.29%	0.25%	-0.58%	0.11%	155.8
Motor vehicle accidents	5.90%	6.77%	1.23%	-0.04%	-2.42%	-5.56%	35.43
Other accidents	-5.49%	-0.71%	0.88%	-3.60%	-4.09%	1.60%	31.55
Homicide and LI	1.16%	4.35%	5.40%	6.86%	3.68%	-5.24%	70.60
Suicide	0.48%	-3.63%	-3.75%	-5.71%	-13.23%*	-6.77%	12.69

*Very-high-poverty counties are those counties with 1960 poverty rates in the highest decile.
**Infant and neonatal rates are in deaths per 1,000 live births.
***The mean mortality rate is the average mortality rate for the relevant subpopulation in each county and year in the 1968-1978 sample, weighted by the relevant subpopulation.
Robust standard errors omitted
*** p<0.001, ** p<0.01, * p<0.05

Table 9. Impact of FSP Operation for X Years on Selected Crude Mortality Rates in High-Poverty and Very-High-Poverty Counties*

		FSP has been in operation for:									
CRUDE RATE	**0-1 year**	**1-2 years**	**2-3 years**	**3-4 years**	**4-5 years**	**5-6 years**	**6-7 years**	**7-8 years**	**8-9 years**	**9-10 years**	**> 10 years**
HP: Aggregate	-9.196	-6.087	-12.94	-19.09	-22.22	-31.52*	-38.62*	-51.65*	-44.84*	-44.21	-63.05*
	(8.328)	(9.258)	(10.22)	(11.60)	(13.33)	(15.42)	(17.62)	(20.08)	(21.86)	(24.53)	(26.87)
VHP: Aggregate	-16.91	-11.45	-21.71	-27.42	-31.63	-51.04*	-61.48*	-86.15**	-68.94	-64.31	-86.22*
	(14.06)	(15.84)	(17.66)	(20.07)	(22.91)	(25.14)	(28.12)	(32.81)	(35.04)	(39.17)	(41.80)
HP: Female	-14.50	-8.070	-12.28	-16.34	-16.96	-20.40	-35.59	-47.70*	-38.16	-31.59	-48.81
	(9.180)	(10.22)	(11.16)	(12.88)	(14.97)	(16.75)	(18.88)	(21.46)	(23.19)	(25.98)	(28.65)
VHP: Female	-6.792	-14.41	-18.04	-26.65	-17.51	-33.44	-54.11	-70.08*	-55.10	-35.58	-58.99
	(14.88)	(16.38)	(17.21)	(20.35)	(23.57)	(25.92)	(28.43)	(32.36)	(35.18)	(40.35)	(43.60)
HP: Male	-3.794	-4.065	-13.91	-22.65	-28.55	-44.28	-42.92	-56.86	-53.09	-58.82	-79.73
	(12.58)	(13.43)	(15.37)	(17.92)	(20.39)	(23.74)	(26.93)	(30.29)	(33.41)	(37.36)	(41.51)
VHP: Male	-28.38	-9.092	-26.38	-29.15	-47.77	-71.04	-70.54	-104.5*	-84.93	-96.27	-116.7
	(22.37)	(24.57)	(27.79)	(31.75)	(36.07)	(40.13)	(44.53)	(51.63)	(55.90)	(61.33)	(67.02)
HP: Black	0.175	-1.053	-16.98	-43.01	-49.32	-60.96	-92.52*	-118.6**	-107.7*	-132.9*	-157.6**
	(17.21)	(19.87)	(22.57)	(26.22)	(29.96)	(34.01)	(39.15)	(43.60)	(48.85)	(53.10)	(58.73)
VHP: Black	-46.65	-16.54	-38.80	-57.89	-73.94	-100.8*	-128.4*	-168.7**	-148.5*	-170.7*	-193.0*
	(26.58)	(29.73)	(34.89)	(38.48)	(43.81)	(49.01)	(56.50)	(62.66)	(70.05)	(76.44)	(81.33)
HP: White	-10.24	-11.36	-13.66	-12.26	-14.83	-24.07	-22.71	-31.01	-28.25	-19.16	-36.87
	(9.256)	(10.50)	(11.81)	(13.07)	(14.86)	(17.27)	(20.08)	(22.62)	(24.51)	(27.34)	(30.22)
VHP: White	-7.663	-17.64	-18.11	-18.83	-17.36	-36.60	-36.90	-50.31	-38.59	-22.47	-42.90
	(15.69)	(18.15)	(20.59)	(23.20)	(26.06)	(28.40)	(32.43)	(37.57)	(38.91)	(43.30)	(47.27)
HP: Age 0-19	-0.144	-4.220	-6.654	-7.776	-6.446	-6.177	-9.770	-12.18	-10.17	-19.73	-15.37
	(5.860)	(5.531)	(6.596)	(7.210)	(8.465)	(9.781)	(11.21)	(12.25)	(13.34)	(14.54)	(16.81)
VHP: Age 0-19	-4.106	-5.289	1.057	-4.422	-7.982	-9.793	-15.19	-21.52	-14.10	-26.71	-26.15
	(8.851)	(8.982)	(11.05)	(12.12)	(13.57)	(15.74)	(17.89)	(20.07)	(22.11)	(23.47)	(26.96)
HP: Age 20-64	-1.890	7.630	-0.669	-0.656	-10.23	-15.49	-8.748	-26.54	-20.58	-27.87	-37.40
	(8.892)	(10.07)	(11.21)	(13.05)	(14.75)	(16.64)	(18.87)	(21.76)	(23.84)	(26.23)	(29.01)
VHP: Age 20-64	-19.39	-5.747	-15.49	-15.46	-28.62	-30.91	-21.20	-43.76	-34.31	-40.84	-43.26
	(16.51)	(16.99)	(19.38)	(21.60)	(24.70)	(26.81)	(29.37)	(34.78)	(36.54)	(38.73)	(43.15)
HP: Age 65+	-74.38	-90.41	-135.4	-204.0*	-210.3*	-269.5*	-378.7**	-425.3**	-425.5**	-361.6*	-494.9*
	(58.27)	(62.99)	(73.36)	(84.56)	(96.76)	(109.5)	(126.5)	(142.2)	(155.8)	(174.3)	(197.0)
VHP: Age 65+	-30.50	-34.60	-142.3	-179.4	-145.7	-303.3	-432.7*	-545.4*	-475.4	-352.7	-538.9
	(106.5)	(103.3)	(120.3)	(143.5)	(157.1)	(175.7)	(196.1)	(226.8)	(249.4)	(282.7)	(317.3)
HP: Cardiovascular	-9.119	-6.415	-11.83	-23.07*	-24.91*	-28.92*	-35.91*	-48.52**	-43.71*	-38.97*	-52.40*
	(6.188)	(6.853)	(7.979)	(9.262)	(10.65)	(12.39)	(14.13)	(16.05)	(17.49)	(19.28)	(21.46)
VHP: Cardiovascular	-15.71	-15.56	-22.04	-36.32*	-37.44*	-48.24*	-58.40**	-81.11**	-69.14**	-64.92*	-86.17**
	(9.658)	(10.32)	(12.34)	(14.47)	(17.14)	(19.25)	(21.60)	(24.44)	(26.38)	(29.16)	(31.64)

≤ 1 year indicates operation in a county for up to and including one year; 1-2 years indicates operation for more than one year and up to 2 years; etc.

*High-poverty (HP) and very-high-poverty (VHP) counties are those counties with 1960 poverty rates in the highest quartile or decile, respectively.

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

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