Government Intervention and Health: The Impact of WIC Participation on Children

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I. Introduction

To combat high rates of adverse pregnancy outcomes and low levels of nutritional and health status among poor children, U.S. policy makers instituted the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) in 1974. The program has grown steadily, and in fiscal year 1997 the federal government spent 3.7 billion dollars on WIC. The WIC program provides food vouchers, nutritional education, and health care referrals to pregnant, postpartum, and breast-feeding women and their children. In spite of the fact that infants and children constitute about seventy-five percent of all WIC recipients, most research on the effects of the WIC program has focused on the impact of *prenatal* WIC participation on pregnancy outcomes. In this literature, a great deal of attention is paid to the fact that WIC recipients are a non-random sample of eligible persons.[1] The same issue arises when studying the effect of WIC participation on child health; however, the existing studies that examine the effect of WIC participation on child health generally do not control for this potential selection bias. We use a new, nationally representative data set to examine the impact of the WIC program on the health of infants and children, and we pay particular attention to the issue of selection into the program.

One reason that pregnancy outcomes are studied more frequently than child outcomes is that birth weight and gestational age at birth are routinely collected and are important measures of the health of the newborn child. In the same way that birth weight and gestational age measure the health of newborns, height and weight measurements are important indicators of child health, but they are not routinely collected in survey data. The data set we use, the 1991 Longitudinal Follow-Up to the 1988 National Maternal and Infant Health Survey (NMIHS-LF),

[1] See, for example, Gordon and Nelson (1995) or Brien and Swann (1999).

contains information collected during each sample child's medical visits between his or her birth in 1988 and the time of the 1991 follow-up. We examine the effect of participation in the WIC program on anthropometric child health outcomes such as age standardized height, age standardized weight, and height standardized weight. We also investigate whether WIC participation improves either the physician's or the mother's assessment of the child's overall level of health.

This research is in the spirit of a large body of work on the economic analysis of child health.[2] As we noted above, an evaluation of this type is complicated by the selection of children or families into these programs. There could be adverse selection where the parents of children most in need of services choose to participate, or there could be favorable selection where parents who are more health concerned choose to participate. Following Brien and Swann (1999), we explicitly model the child's participation in the program. To successfully implement this approach, one must have variables that influence the participation decision but do not affect the child's health. We make use of data on state-to-state differences in WIC program rules, the availability of WIC clinics, and the generosity of other related transfer programs. The data on state-level WIC program rules come from a 1988 survey of local WIC agencies conducted by the United States Department of Agriculture, the federal agency that operates the program.

Despite considering a number of different child health and development measures and in contrast to earlier work on the relationship between WIC participation and birth outcomes, we find little evidence that the program has a statistically significant impact on infants and children. We find no statistically significant effect of WIC participation on any of our height and weight

[2] See, for example, Rosenzweig and Schultz (1982); Thomas, Strauss, and Henriques (1991); and Currie and Cole (1993).

based outcomes for either whites or blacks. We do find, however, that, after controlling for selection into the program, white WIC recipients are less likely to be characterized by their physicians as being in poor health, but we do not find a similar effect for blacks. At the conclusion of the paper we discuss some possible explanations for our results and directions for future research.

II. Description of WIC Program

WIC is a clinic-based program designed to provide a variety of nutrition and health related goods and services to pregnant, postpartum, and breast-feeding women and their children. It is a federally funded program administered by the Department of Agriculture in conjunction with state and local agencies. The program began as a pilot program in 1972 and received permanent funding in 1974. By the end of fiscal year 1974, the program served 205,511 women, infants, and children from 236 clinics at a cost of approximately $10 million, and by the end of 1993, the program had grown dramatically and was serving almost 6 million participants from 8,989 clinics at a total annual cost of just under $3 billion. Importantly, 77 percent of the six million people served by the program in 1993 were infants or children less than five years old.

Eligibility

An applicant must meet four criteria to be eligible for the WIC program. First, the applicant must be a resident of the state to which she is applying for benefits. Second, the individual must be categorically eligible (e.g., under the age of five).[3] Third, the participant must

[3] In the initial authorization, the program only covered children through age four. The age limit was increased to five in 1975.

reside in a household with an income below 185 percent of the federal poverty guideline. States have some flexibility regarding the income threshold and can set a lower income limit if it is tied to the level used for free or reduced price health services as long as the cutoff is not below one hundred percent of the poverty guideline. In general, if a family is income eligible for a state's AFDC, Medicaid, or Food Stamps program, it is deemed to be income eligible for WIC.

The final eligibility criteria, and one that sets WIC apart from the other welfare programs, is that the individual must be "nutritionally at risk". The level of risk is category dependent and is determined at an initial screening that takes place on the participant's first visit to the WIC clinic. Current risk factors for infants and children include anemia, substantial changes in growth, low birth weight, and inadequate/inappropriate diet.[4] If a child has any risk factors, he or she is categorized as being at nutritional risk. These risk factors are also used to help determine the food packages a child will receive.

Benefits

WIC provides a variety of benefits to the participants. Arguably the most important feature of the program is the food vouchers. The specific items an individual receives depends on both his or her category and level of nutritional risk, but in all cases the foods are selected to be high in protein, calcium, iron and Vitamins A and C. The food packages for infants may include infant formula, milk, juice, and cereal; and food packages for children may include milk, cheese, eggs, peanut butter, and cereal. Participants are allocated specific quantities of each item, and some states require recipients to choose some of these items must be chosen from a specific

[4] This list is based off the risk factors currently in use at the Jefferson WIC Clinic in Charlottesville, VA.

list of brand names. The WIC program is required to spend eighty percent of its budget on the food benefits.

A second benefit that is offered is nutritional and behavioral counseling for the mother. This advice can take the form of literature that is distributed at the time of the visit to the clinic or through an individual consultation with a nutritional expert. Mothers are advised on which foods promote the development of healthy children and which behaviors they should avoid. A major focus of the counseling is on the benefits of breast-feeding.

The third component of the benefit package is referrals to health care providers or other social services. Participants are referred to health services that can address problems detected during the screening process although the WIC program does not pay for the health services. Information regarding other assistance programs for which the families may be eligible (e.g., Food Stamps, Medicaid, AFDC) is also provided.

III. Previous WIC Evaluation Literature

Although relatively few in number, several studies examine the relationship between WIC and child outcomes.[5] These evaluations have considered outcomes such as growth and development (e.g., height and weight), nutritional well-being (e.g., caloric intake), and access to health care (e.g., whether a child receives the appropriate vaccines).

[5] Many studies examine the effect of prenatal WIC participation on pregnancy outcomes. While there are conflicting results across the various studies, the literature in this area suggests that pregnant women who participate in the program can anticipate giving birth to healthier children. The size of the effect appears to be larger for African-American women than for white women, although the reasons for this are not well understood.

The Effect of WIC on Growth and Development

One of the earliest studies of the WIC program (Edozien, et. al. 1979) used data on 41,330 children from 14 states to examine the relationship between WIC participation and several outcomes including child growth. The authors found that WIC participation resulted in an increase in height and weight growth rates.

As part of the National WIC Evaluation, Rush, et. al. (1988) conducted a study of infants and children to examine the effect of WIC on many different child outcomes. The authors were able to attribute no significant differences in growth rates to WIC. In fact, the authors concluded that "the results are most consistent with the conclusion that most of the discrepancies in growth between WIC recipients and Controls arose by selective recruitment (and retention) in the program" (page 504).

The Effect of WIC on Child Nutrition

Since one of the goals of the WIC program is to improve nutrition, outcomes such as caloric intake and the incidence of vitamin and mineral deficiencies are obvious candidates for study. The two studies discussed above each examined this issue. Edozien, et. al. (1979) found no changes in energy intake, an increase in iron intake, and a corresponding reduction in the prevalence of anemia. Rush, et. al. (1988) also found no changes in caloric intake but significant increases in iron intake.

Yip (1989) used data for six states from the Pediatric Nutrition Surveillance System to examine the relationship between WIC participation and anemia. Yip found that the prevalence of anemia fell for both WIC recipients and non-recipients over the time period 1976 to 1985 and WIC recipients were less likely to be anemic than non-recipients. One caveat to this result is that

these trends do not control for demographic characteristics of the children. Yip was only able to control for socio-economic status by restricting his sample to one state (Tennessee). After controlling for age and socio-economic status, WIC recipients were still found to be less likely to be anemic than non-recipients.

Fraker (1990) used data from the 1985 Continuing Survey of Food Intakes by Individuals to examine the dietary intake of children. These data provide dietary information for a sample of 818 children ages one to five. Unlike the other studies in this literature, Fraker controlled for the selection of families into the program. This control is important if the program participants differ from non-participants in ways that are unobserved by the researcher. He used two-stage least squares where he modeled participation in the program in the first stage and nutrient intake of children in the second stage. His results suggested that WIC participants were significantly less likely to suffer from insufficient caloric intake and vitamin E and iron deficiencies.

The Effect of WIC on Access to Health Care

A third way that WIC may improve child health is by making health care more accessible. Paige (1983) compared vaccination records (polio and DPT) of a group of infants who participated in WIC with a group of WIC-eligible infants who lived where WIC was unavailable. The results showed either no significant differences between the two groups or that WIC recipients were worse off than non-recipients.

Two studies use nationally representative data to examine whether WIC participation increases access to health care. Rush et. al. (1988) found WIC recipients were more likely to have a regular source of medical care, receive DPT vaccinations, and receive polio vaccinations. Gordon and Nelson (1990) found that WIC participants were no more or less likely to receive

Polio or DPT vaccinations than are income eligible non-participants. However, neither of these studies accounts for selection into the program.

IV. Model

In this section we outline a simple model of a health production function and discuss the estimation techniques used in the paper.[6] The theoretical basis for this analysis stems from economic models of household decision making in which the mother's utility depends on the health of her children. Choices are limited by income, time, and technology constraints. The health of a child (e.g., age standardized weight) is assumed to be produced via a health production function. This framework generates reduced-form demand functions for child health.

Let h_{ij} denote the health outcome of interest where *i* indexes children and *j* indexes mothers. Let X_{ij} be a vector of exogenous determinants of outcome h_{ij} for child *i* in family *j*, let WIC_{ij} be a policy variable, and assume for simplicity that there are no other potentially endogenous determinants of the outcome of interest. The relationship generating health outcomes is given by

$$h_{ij} = \alpha X_{ij} + \beta WIC_{ij} + \nu_{ij} \quad (1)$$

where α is a conformable vector of parameters, β is a scalar parameter, and ν_{ij} is an idiosyncratic shock to the health outcome.

If we believe that WIC participation is uncorrelated with the error term in equation (1), then OLS will provide unbiased estimates to the parameters of interest. While we will report OLS estimates below, it is likely that the assumption that WIC participation is uncorrelated with

[6] See Corman and Grossman (1985) for a discussion of this methodology. Also see Rosenzweig and Schultz (1982), Rosenzweig (1986), and Rosenzweig and Wolpin (1995) for similar models.

the error is violated. For example, one component of the error term is the mother's attitute toward helath and health care. It is likely that this attitude also influences her decision to enroll herself or her child in the WIC program.

We model the decision to participate in WIC and use Two Stage Least Squares (2SLS) to deal with the endogeneity problem. For this procedure we estimate a first-stage WIC participation equation. Assume that women choose to participate in WIC, $WIC_{ij} = 1$, if $WIC_{ij}^{*} > 0$ where

$$(2) \qquad WIC_{ij}^{*} = \gamma W_{ij} + \omega_{ij} .$$

The regressors in this equation, W_{ij}, include the components of X_{ij} and some instruments Z_{ij} that affect the WIC participation decision but not the health outcome. Predicted values from this equation are then used in the estimation of equation (1). We use state-to-state variation in WIC and other transfer programs to identify the effect of WIC participation. The idea is that specific state rules governing WIC participation and state-level welfare generosity and availability are correlated with WIC participation but not with the unobserved health variables. The program characteristics used to identify this model are described in the data section.

IV. Description of Data

Conducted by the National Center for Health Statistics, the NMIHS and NMIHS–LF were specifically designed to examine the determinants and consequences of adverse pregnancy outcomes and were based on a sample of birth and death certificates in 48 states and the District of Columbia. The base year data include information on a large sample of women who experienced a live birth or a fetal death in 1988, or whose infant born in 1988 subsequently died. The NMIHS contains all information provided on the original birth and death certificates of the

children and data from lengthy questionnaires administered to the mothers following the pregnancy outcome.

The base-year questionnaire data includes detailed demographic and anthropometric information about the mother, information on the mother's behavior and living arrangements during and after the pregnancy, household income, and questions regarding WIC participation during and after the pregnancy. The focus of the current study are the children of 9,953 mothers represented in the Live Birth sample. This sample contains a higher proportion of blacks and babies born with a low birth weight than found in the general population, and we use the provided sample weights in all of our analysis.

To examine issues related to childhood health and morbidity, 8,285 mothers from the original Live Birth sample were re-contacted in 1991 (an 88 percent completion rate).[7] As in the earlier interview, a variety of maternal and child characteristics was obtained, including the mother's assessment of the child's overall health at the time of the interview. The mothers were also asked a series of questions regarding their own participation in the WIC program, their child's participation, including any interruptions in coverage, other services besides food provided by the program (e.g., the types of advice received and any referrals for other services), and, if not participating, reasons for not entering the program. Using the 1988 data and the follow-up we construct a detailed WIC participation history (both pre- and post-natal) for each of the children born in the 1988 sample.

Important sources of data on child outcomes are the child's pediatric care provider and any hospital the child utilized. The NMIHS-LF administrators obtained the names of these

[7] A portion of the mothers in the Fetal and Infant Death samples were also re-interviewed, but these data are not used in this paper.

providers from the mothers and contacted them directly. For each visit the child made to this provider, these data contain height and weight measurements, the purpose of the visit, the presence of any medical conditions, and the outcomes of any medical tests. The providers are also asked for an overall assessment of the child's health if they had recently seen the child. These data provide accurate and repeated measures of the health and development of the children over their earliest years of life.

Using data from the longitudinal follow-up, we analyze child outcomes from two different points in time. The first part of our analysis considers outcomes from one of the many potential doctor visits. To focus this analysis, we consider the last visit prior to the interview date with non-missing height and weight information as long as this visit took place after the child's second birthday.[8] This allows us to analyze the impact of the program as late in the child's life as the data allow.[9] We attach to each of these visits indicators of child WIC participation up to that point, and other child (e.g., birth weight) and family characteristics (e.g., characteristics of the mother and the father).

A substantial portion of this analysis focuses on anthropometric measures such as height for age, weight for age, and weight for height. Since the doctor visits occur at different ages for each child, it is necessary to standardize these measurements. These measures are typically defined as a percentage of the median of standards set by the National Center for Health Statistics

[8] There are reported doctor visits after the date on which the mother was interviewed for the longitudinal follow-up since the pediatric care providers were contacted after the mothers and were asked to report on all visits made by the child regardless of when they occurred. We did not use visits after the interview date since we do not know the level of involvement with the WIC program after the date the mother is interviewed.

[9] There are approximately 100,000 recorded doctor visits for the 8,285 index children in the longitudinal follow-up. Unfortunately, for many of these observations critical data (e.g. child's height or weight, the date of the visit, outcomes of various tests) are missing. This problem severely limits the number of usable observations. Alternative sample restrictions were also considered. The results of this experimentation are described in the conclusion.

(1976). In general, measures of height are seen as an indicator of long-term nutritional status. Weight for height, on the other hand, captures a child's current nutritional status.

Following others (e.g., Waterlow et al. 1977; Thomas, Strauss, and Henriques 1991), we focus on two types of variables. The first is a continuous measure equal to the variable of interest as a percentage of the gender and age specific U.S. median. For example, a child with a standardized height measurement of one has a height that is at the U.S. median for a child of his or her age and sex. The second type of measure is a categorical variable equal to one if the outcome for the child is less than some fraction of the variable of interest. We create three such variables: an indicator for being less than ninety percent of the median age standardized height, an indicator for being less than ninety percent of the median age standardized weight, and an indicator for being less than eighty percent of the median age standardized weight for height.

A second type of outcome that we consider in this part of the analysis is the physician reported health status of the child. The survey asks each medical provider to describe the child's health over the course of the six months prior to the visit as excellent, very good, good, fair, or poor. We recode these into "good health" if the child's health is excellent or very good and "poor health" if the child's health is characterized as fair or poor.

The second part of our analysis includes data obtained from the mother about the child's overall health at the time of the follow-up interview. Similar to the physician's report, we construct a variable for "good health" if the mother reports the child's health to be excellent or very good at the time of the interview and a variable indicating "poor health" if the child's health is characterized as fair or poor.

Descriptive statistics for each sample are provided in Tables 1 and 2. We present descriptive statistics separately for whites and blacks and, for each race, by whether the child is

an income eligible WIC recipient, an income eligible non-recipient, or is non-income eligible. A child is classified as a WIC recipient if he or she received WIC any time in his or her life. A child is categorized as income eligible if the mother reports a family income in the 12 months prior to the birth less than 250% of the poverty guideline for the appropriate family size.[10]

The first section of Table 1 shows that at the time of the doctor visit the average age of the child was 30 months for white WIC recipients and 31.5 months for black recipients. These ages are slightly older than the other groups. This does not necessarily imply, however, that WIC recipients are receiving health care at a different point in time than non-participants. As noted above, the sample drawn for this analysis requires a non-missing value for both the child's height and weight.

The next section of Table 1 considers the child height and weight. There is minimal variation in the unstandardized measures between the various groups. Any differences are probably due to the different ages at which the children visited the doctors. There is also surprisingly little variation in the three continuous variables—particularly across income categories. There are more substantial differences, however, in the likelihood of being below eighty or ninety percent of the median. For example, there is about a 20 percent chance that a poor white child is below ninety percent of the median weight for age, while there is only a 16 percent chance that an income ineligible white child is below the same cutoff. In general these are still relatively small differences and may explain some of the results later in the paper.

[10] For the purpose of this exercise we use the income report available at the time of the base year survey. An alternative is to use the comparable income report provided at the time of the longitudinal follow-up. We use 250 percent of the poverty threshold as a cut-off rather than 185 percent since the NMIHS has a relatively crude measure of income. The crudeness of this measure can in part be seen in Table 1 by the number of respondents who we categorize as income-ineligible but who still report participating in WIC.

The next set of variables in Table 1 relate to the doctor's assessment of the child's health. There are large differences in this outcome both across racial groups and WIC participation categories. Black children are less likely to be in excellent health. Similarly, regardless of race, WIC participants are less likely to be in excellent health. Part of this difference is capturing the potential nutritional risks a person must exhibit to eligible for the program. Overall, there appears to be a strong relationship between income and the health of the child.

To provide some background on which children become WIC participants, the next section of Table 1 shows some selected birth outcomes. We find that WIC recipients have poorer birth outcomes than either eligible non-participants or income ineligible respondents. For whites, average birth weight for recipients is 3,327 grams compared to 3,452 for income eligible non-recipients, and 3,442 for the higher income group. Birth weights for black WIC recipients averaged 3,129 grams compared to 3,141 for eligible non-recipients and 3,250 for the others.

The next set of variables consider the WIC participation of the child and his or her mother. To capture the intensity of participation (and standardize for age) we also calculated the fraction of the child's life on the program at the time of the visit. The children who participated in the program did so for approximately 70-75 percent of their lives. For several reasons, it is also important to consider the level of involvement of the mother with the program. First, prenatal participation may mean a better starting point for the child. In our multivariate analysis we condition on the child's birth weight to account for this relationship. Second, the program contains a large informational content. Any contact that the mother has with the program may have beneficial effects for the child if the mother receives information on how to raise a healthier child. Finally, if the mother participates after the birth she may have more income to spend on the child or she may share some of the WIC provided food with the child. At the time of the

doctor visit, we find that between 86 and 89 percent of the children who participate in WIC had mothers who participated in the program. It is also interesting to note that in the low income non-participating group almost 23 percent of the white children and 43 percent of the black children had mothers who participated in WIC.

Table 2 presents the comparable set of descriptive statistics based on the time of the interview. The key variables in this table are the mother's assessment of her child's health. Overall, the mother's assessments are more optimistic than those reported by the doctors. This might be explained by the fact that the doctors are more likely to have observed the child only when the child was ill. Like the physician's assessment, however, WIC participants appear less healthy than the other groups considered.

Auxiliary Data

To model the program participation decision we use data that characterize the availability and generosity of WIC and other welfare programs. Appendix Table A1 contains a brief description, the source of the data, and descriptive statistics for each instrument. The sample means for each of our samples is listed at the end of Tables 1 and 2. Our primary instruments are state-level characteristics of the WIC program that were reported on a national survey of state and local WIC agencies.[11] The survey provides information on how each state applies the WIC federal guidelines and how local agencies administer the program. A description of the survey methodology and instruments can be found in Research Triangle Institute (1990), and a thorough

[11] The state of residence is the only geographic identifier available on the NMIHS and this is only known at the time of the delivery in 1988 and the 1991 interview. Therefore, it is not possible to take advantage of any within state variation in the WIC program. Consistent with our other assumptions, we used the state of residence at the time of the 1988 delivery as the relevant location.

analysis of these data can be found in Williams et al. (1990). From these data we construct a number of variables that may influence a potential recipient's probability of participation. These variables include an indicator equal to one when women live in states that make it relatively easy to self-declare income, an indicator equal to one when women live in states that have income allowances or exemptions, an indicator equal to one when women live in states that impose brand restrictions on the food that may be purchased, an indicator equal to one when women live in states that explicitly link WIC income eligibility to AFDC, and the first trimester hemoglobin cutoff used to determine whether a woman is nutritionally at risk.

From other sources we construct the number of WIC clinics per 1,000 poor persons and the number of WIC clinics per 1,000 square miles in the state for each state and year.[12] To capture the generosity of other welfare programs we also use the state's maximum AFDC benefit level for a family of four and the average Medicaid expenditure for a family of four.

V. Results

Tables 3 through 5 present estimation results. For each of the outcome variables, we estimate OLS and 2SLS models for several different policy variables. Each model is estimated separately by race and uses only low-income respondents. Due to the large number of regressions, the tables contain only the coefficient on the policy variables of interest. In each table we consider three separate policy variables. The first is an indicator for whether the child ever participated in WIC. The second is the fraction of the child's life spent on WIC. The third is an indicator for whether the either the mother or the child ever participated in the program.

[12] An analysis of the latter variable revealed that, given its physical size, the District of Columbia was an extreme outlier. To minimize the impact of this special case, we top-coded the value of this variable for the District of Columbia to the next highest state.

Each of these variables are defined as of the time of the pediatric-care provider visit or at the time of the longitudinal follow-up interview, which ever is relevant to the outcome under study. In addition to the policy variables, each specification includes a large set of regressors that have been shown to influence a child's health and development.

Height and Weight Outcomes

Table 3 considers each of the height and weight measurements described in the data section that were obtained at the time of the last doctor visit. Panels A and B present the results for white and black respondents, respectively. Consider the child's age standardized weight in the first row of Panel A.[13] Using OLS (column 1) the results for white children show that participating in WIC increases the percentage of the age standardized height by 2.4 percent although the effect is not statistically significant. While this result is encouraging, we might believe that it understates the true effect of WIC participation if WIC participation is proxying for poor health (since one must be nutritionally at risk to be eligible for WIC). To control for the nonrandom selection into the program, we use state level program characteristics to model the participation decisions.[14] Column 2 of Table 3 presents the second-stage results of this exercise. We see that the (statistically insignificant) 2SLS result suggests that WIC participation leads to a ten percent *reduction* in age standardized weight. This result is counterintuitive and may result from relatively weak instruments. The F-statistic for the joint hypothesis that the instruments are equal to zero is only 1.23, and we fail to reject the hypothesis that the coefficients on the

[13] The dependent variable for the three continuous child outcome measures is log of the dependent variable x 100.

[14] The first stage results for one of the policy outcomes are presented in Table A2. The other results are available from the authors.

instruments are jointly equal to zero. We see a similar pattern for the other policy variables for this outcome.

However, we may be more interested in moving a child above a threshold than increasing the ranking of children who are relatively well off. For this reason, we next examine whether WIC participation is able to reduce the incidence of children being below 90 percent of the median age standardized weight. Here we find that, regardless of the policy variable considered, OLS results imply that WIC participation is associated with being more likely to be below this cutoff – although the effect is not statistically significant. Instrumenting for WIC changes the direction of the effect, but the result is never statistically significant.

The next two rows show essentially the same pattern. When focusing on the continuous version of age standardized height, both the OLS and 2SLS coefficients are negative and statistically insignificant. When the dependent variable is the incidence of being below 90 percent of the median height for age, the OLS estimate implies that WIC participation leads to poorer health outcomes, and the 2SLS estimates reverse the sign of the effect regardless of the policy variable. Finally, we fail to find a statistically significant effect of WIC participation for whites when we examine the effect of WIC participation on height standardized weight.

Panel B considers the effects of WIC participation on blacks. While none of the effects are statistically significant, WIC participation seems to have a positive effect on weight-related outcomes for blacks. For example, WIC participation appears to be associated with increases of 4 to 6 percent in weight for height after controlling for the endogeneity of WIC participation depending on the policy variable and decreases in the probability of falling below eighty percent of the median weight for height of around five percent.

Overall Child Health

A second type of health outcome that we examine is the physician's or mother's assessment of the child's health. We look at the effect of several policy variables on the probability that a child is reported as being in good health (either "excellent" or "very good") or poor health (either "fair" or "poor"). The results for the physician's assessment are presented in Table 4, and the results for the mother's assessment are presented in Table 5.

Regardless of the policy variable, the OLS results show that white WIC recipients are less likely to be characterized as being in good health by physician's than are non-participants. Of course this may result from the fact that one must be nutritionally at risk to be a WIC recipient. Controlling for the endogeneity changes the sign of the effect. The result is particularly large for the participation policy variables.

The second row of Panel A examines the effect of WIC participation on the incidence of being characterized as being in poor health. Again, the OLS results show a correlation between WIC participation and the poor health outcome, but after controlling for the endogeneity of WIC participation, we find that WIC participation reduces the likelihood of being characterized by the physician as having poor health. This effect is statistically significant at the 0.10 level for two of the three policy variables.

Panel B presents similar results for blacks. For either outcome variable, the OLS results for blacks are similar to the OLS for whites: WIC participation is associated with worse health outcomes. Unlike the results for whites, however, the 2SLS results for the "good health" outcome are more negative than the OLS results, but the 2SLS results for the poor health outcome are weaker than the OLS results.

The results for the mother's assessment of the child's health are presented in Table 5. For whites, the results for the mother's belief that the child is in good health are similar to the physician's assessment. The OLS results show that WIC participants are less likely to be in good health. Controlling for selection into the program changes the sign, and we see that WIC participation leads to a statistically insignificant increase in the probability of being in good health of between five and thirteen percent depending on the policy variable.

This pattern does not hold when the outcome is poor health. The OLS results do show that WIC participation is associated with a greater likelihood of being characterized as being in poor health, but the 2SLS results show larger positive effects rather than smaller positive or negative effects.

Finally, Panel B presents the results for blacks. For the most part, the OLS results show that black WIC recipients are less likely to be in good health and more likely to be in poor health than eligible non-participants. Controlling for selection into the program changes the sign for the poor health outcome, but not for the good health outcome. Again, however, none of these effects are statistically significant.

VI. CONCLUSIONS

In this paper we examine the effect of WIC participation by infants and young children on the health outcomes of these children. We find little evidence that the program has a statistically significant effect on any of the health measures we consider. It may be the case that the relatively small variation present in the height and weight measures contributed to the lack of any significant finding.

The work presented here suggests many avenues for additional research. In the current analysis we exploit only two of the potentially many observations on child outcomes. We have conducted a exploratory analysis in which we examine the outcome at the last visit conditional on the outcome at the first visit. This is in essence a growth equation. The results indicated the level at the first visit was an important determinant of the level at the last visit, but it did not reveal any new insights regarding WIC participation.

Future work should also take greater advantage of the many alternative child outcome measures reported both by the pediatric care provider and by the mother. Although they are very commonly used, the outcomes in the current paper are only a small fraction of those potentially available in the NMIHS and the NMIHS-LF. A potential drawback of the NMIHS-LF data, however, is missing data. An illustrative example of this problem can be found in the series of questions the mother is asked about the vaccination record of her child. Over 50 percent of the low-income respondents do not provide usable data on whether or not their child had ever received a polio vaccine.

VI. References

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Table 1: Descriptive Statistics, Physician visit

	WIC Participants		Low Income Non-participants		Other Non-participants	
	White	Black	White	Black	White	Black
Child's Age at Visit (months)	30.3	31.5	28.8	29.9	28.4	29.0
Child Height and Weight						
Percent of Median Weight Standard	1.019	1.025	0.992	1.029	1.022	1.015
Percent of Median Height Standard	0.997	1.005	0.997	1.006	1.004	1.015
Percent of Median Weight for Height Sta	1.045	1.044	1.038	1.046	1.042	1.020
Below 90% of Median Weight for Age	0.203	0.184	0.205	0.206	0.161	0.186
Below 90% of Median Height for Age	0.055	0.040	0.037	0.030	0.037	0.024
Below 80% of Median of Weight for Hei	0.018	0.017	0.012	0.016	0.012	0.014
Child Height (cm)	90.1	91.5	89.2	90.6	89.5	90.7
Child Weight (kg)	13.6	13.8	13.0	13.6	13.3	13.3
Physician's Assessment of Overall Child Health						
Child Health Excellent	0.190	0.139	0.326	0.242	0.466	0.414
Child Health Very Good	0.291	0.274	0.367	0.352	0.316	0.189
Child Health Good	0.391	0.477	0.260	0.385	0.185	0.340
Child Health Fair	0.117	0.104	0.047	0.021	0.032	0.038
Child Health Poor	0.011	0.007	0.001	0.000	0.001	0.018
Birth Data						
Birth Weight (grams)	3326.9	3129.1	3451.7	3141.6	3442.7	3249.7
Low Birth Weight (< 2500 g.)	0.077	0.119	0.057	0.150	0.046	0.091
Gestation (weeks)	39.4	38.5	39.6	38.3	39.6	38.8
Pre-term Delivery (< 36 Weeks)	0.101	0.169	0.104	0.200	0.061	0.137
WIC Participation						
Child Participated	1.000	1.000	0.000	0.000	0.057	0.208
Percent of Child's Life Participated	0.681	0.758	0.000	0.000	0.028	0.122
Mother or Child Participated	1.000	1.000	0.225	0.428	0.073	0.235
Family Characteristics						
Mother's Education 0 - 11 years	0.317	0.310	0.184	0.283	0.025	0.044
Mother's Education 12 years	0.489	0.504	0.474	0.401	0.289	0.243
Mother's Education 13-15 years	0.130	0.155	0.232	0.269	0.308	0.349
Mother's Education 16+ years	0.064	0.031	0.110	0.047	0.378	0.365
Household Income $0-5,000	0.215	0.332	0.118	0.203	0.000	0.000
Household Income $5,000-10,000	0.317	0.292	0.081	0.235	0.000	0.000
Household Income $10,000-20,000	0.341	0.270	0.450	0.386	0.006	0.036
Household Income > $20,000	0.128	0.107	0.351	0.176	0.994	0.964
Mother < 19 Years of Age	0.156	0.176	0.060	0.164	0.019	0.052
Number of Past Live Births	0.998	1.044	0.853	1.083	0.605	0.575
Married at Birth of Child	0.630	0.269	0.752	0.476	0.933	0.736
Mother's Wgt. Prior to Preg. (lbs.)	136.2	141.2	129.6	140.0	133.2	138.0
Mother's Height at Survey (ins)	64.3	64.6	64.3	64.6	64.8	64.6
Father's Weight (lbs.)	171.9	172.9	177.7	172.6	179.3	183.0
Father's Height (ins)	69.0	69.6	69.9	69.5	70.6	70.5
Lived in Metro Area	0.688	0.747	0.733	0.878	0.852	0.897
North East	0.250	0.167	0.191	0.128	0.229	0.242
North Central	0.301	0.194	0.286	0.189	0.278	0.203
West	0.132	0.049	0.225	0.142	0.210	0.122

Table 1: Descriptive Statistics, Physician Visit (Continued)

	WIC Participants		Eligible Non-Participants		Ineligible Non-Participants	
	White	Black	White	Black	White	Black
State Data						
Easy Income Determination	0.480	0.485	0.425	0.472	0.446	0.486
Few Income Allowances	0.413	0.483	0.338	0.379	0.324	0.362
Brand Restrictions	0.530	0.545	0.660	0.663	0.627	0.574
Link to AFDC	0.470	0.473	0.452	0.406	0.466	0.566
1st Trimester Hemoglobin	11.8	11.6	11.8	11.7	11.8	11.7
AFDC Guarantee	446.5	365.8	463.4	407.2	466.5	445.3
Medicaid Expenditures	268.2	237.6	264.0	241.7	260.5	265.2
Clinics/1,000 Poor Persons	0.267	0.231	0.296	0.206	0.273	0.235
Clinics/1,000 Square Miles	5.735	5.766	5.007	5.360	5.984	7.627
Number of Observations	280	785	248	267	790	249

Table 2: Descriptive Statistics, Interview

	WIC Participants		Low Income Non-participants		Other Non-participants	
	White	Black	White	Black	White	Black
Child's Age at Visit (months)	35.5	35.9	34.2	35.2	33.5	34.1
Mother's Assessment of Overall Child Health						
Child Health Excellent	0.444	0.430	0.522	0.472	0.605	0.547
Child Health Very Good	0.330	0.312	0.318	0.289	0.266	0.296
Child Health Good	0.167	0.198	0.120	0.196	0.106	0.123
Child Health Fair	0.054	0.055	0.037	0.036	0.020	0.031
Child Health Poor	0.005	0.006	0.003	0.007	0.003	0.002
Birth Data						
Birth Weight (grams)	3376.2	3119.0	3452.4	3164.2	3458.9	3262.3
Low Birth Weight (< 2500 g.)	0.062	0.120	0.048	0.128	0.039	0.089
Gestation (weeks)	39.4	38.6	39.6	38.5	39.6	39.0
Pre-term Delivery (< 36 Weeks)	0.080	0.172	0.072	0.187	0.059	0.119
WIC Participation						
Child Participated	1.000	1.000	0.000	0.000	0.064	0.219
Percent of Child's Life Participated	0.601	0.678	0.000	0.000	0.029	0.117
Mother or Child Participated	1.000	1.000	0.208	0.415	0.078	0.258
Family Characteristics						
Mother's Education 0 - 11 years	0.357	0.327	0.191	0.252	0.038	0.047
Mother's Education 12 years	0.466	0.479	0.473	0.460	0.329	0.290
Mother's Education 13-15 years	0.134	0.166	0.239	0.229	0.305	0.351
Mother's Education 16+ years	0.044	0.028	0.097	0.058	0.328	0.312
Household Income $0-5,000	0.197	0.331	0.111	0.214	0.000	0.000
Household Income $5,000-10,000	0.265	0.298	0.112	0.227	0.000	0.000
Household Income $10,000-20,000	0.395	0.263	0.454	0.363	0.009	0.044
Household Income > $20,000	0.143	0.109	0.323	0.196	0.991	0.956
Mother < 19 Years of Age	0.142	0.180	0.069	0.146	0.020	0.067
Number of Past Live Births	1.010	1.021	1.010	1.033	0.677	0.653
Married at Birth of Child	0.625	0.261	0.794	0.432	0.930	0.699
Mother's Wgt. Prior to Preg. (lbs.)	137.0	140.7	134.1	140.4	134.0	140.5
Mother's Height at Survey (ins)	64.3	64.6	64.4	64.6	64.8	64.8
Father's Height (ins.)	69.3	69.7	70.0	69.9	70.5	70.7
Father's Weight (lbs.)	171.8	172.0	175.2	173.5	179.5	182.8
Lived in Metro Area	0.627	0.719	0.700	0.813	0.817	0.872
North East	0.167	0.128	0.142	0.099	0.198	0.193
North Central	0.283	0.210	0.306	0.181	0.275	0.168
West	0.177	0.050	0.236	0.139	0.219	0.110

Table 2: Descriptive Statistics, Interview (Contin

	WIC Participants		Low Income Non-participants		Other Non-participants	
	White	Black	White	Black	White	Black
State Data						
Easy Income Determination	0.452	0.503	0.443	0.480	0.448	0.503
Few Income Allowances	0.388	0.497	0.344	0.380	0.336	0.373
Brand Restrictions	0.603	0.550	0.659	0.670	0.624	0.597
Link to AFDC	0.428	0.454	0.418	0.381	0.433	0.526
1st Trimester Hemoglobin	11.8	11.6	11.8	11.7	11.8	11.7
AFDC Guarantee	425.6	354.2	448.3	389.7	456.3	418.6
Medicaid Expenditures	257.9	234.2	259.6	233.9	256.5	255.0
Clinics/1,000 Poor Persons	0.260	0.227	0.286	0.207	0.270	0.226
Clinics/1,000 Square Miles	4.743	5.202	4.502	5.025	5.545	7.072
Number of Observations	704	1602	636	636	1582	526

Table 3: Estimated Effect of WIC Participation on Child Weight and Height

Panel A: Low-Income Whites

	Child Participated		% Child's Life Participated		Mother or Child Participated	
Outcome Variables	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
Percent of Median Weight Standard	2.390	-10.130	-0.195	-6.317	1.657	-4.680
	(1.42)	(-1.16)	(-0.10)	(-0.81)	(1.08)	(-0.49)
Below 90% of Median Weight for Age	0.0004	-0.101	0.045	-0.061	0.015	-0.222
	(0.04)	(-0.05)	(0.89)	(-0.26)	(0.36)	(-0.93)
Percent of Median Height Standard	-0.332	-3.989	-0.119	-8.410	-0.405	-2.410
	(-0.34)	(-0.56)	(-0.12)	(-1.01)	(0.43)	(-0.38)
Below 90% of Median Height for Age	0.027	-0.135	0.022	-0.035	0.022	-0.018
	(1.18)	(-0.69)	(0.80)	(-0.20)	(0.80)	(-0.15)
Percent of Median Weight for Height Sta	2.150	-8.040	-0.422	-2.026	1.170	-8.170
	(1.50)	(0.69)	(-0.25)	(-0.18)	(0.88)	(-0.83)
Below 80% of Median of Weight for Hei	0.007	0.032	0.014	0.020	0.001	0.087
	(0.71)	(0.52)	(1.06)	(0.338)	0.07	(0.93)

Panel B: Low-Income Blacks

	Child Participated		% Child's Life Participated		Mother or Child Participated	
Outcome Variables	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
Percent of Median Weight Standard	0.309	2.390	-0.541	0.303	-0.984	3.890
	(0.22)	(0.40)	(-0.36)	(0.05)	(-0.66)	(0.43)
Below 90% of Median Weight for Age	-0.031	0.042	-0.030	0.060	-0.001	0.145
	(-1.05)	(0.27)	(-0.94)	(0.15)	(-0.04)	(0.61)
Percent of Median Height Standard	-0.287	-0.030	-0.811	-1.110	-0.529	1.168
	(0.49)	(-0.01)	(-1.06)	(-0.52)	(-0.80)	(0.31)
Below 90% of Median Height for Age	0.010	-0.063	0.019	-0.002	0.001	-0.079
	(0.79)	(-1.26)	(1.32)	(-0.04)	(0.07)	(-1.12)
Percent of Median Weight for Height Sta	0.563	4.100	0.432	3.894	-0.108	6.200
	(0.41)	(0.79)	(0.30)	(0.75)	(-0.75)	(0.78)
Below 80% of Median of Weight for Hei	-0.001	-0.058	-0.001	-0.054	0.016	-0.057
	(-0.13)	(-1.31)	(-0.08)	(-1.47)	(2.75)	(-0.89)

Note: Continuous outcome variables expressed as log of standardized measure x 100. *t*-statistic in

Table 4: The Effect of WIC Participation on Physican's Assessment of Child Health

Panel A: Low-Income Whites

	Child Participated		% Child's Life Participated		Mother or Child Participated	
Outcome Variables	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
Good Health	-0.230	0.319	-0.163	0.0001	-0.165	0.252
	(-3.44)	(0.67)	(-1.90)	(1.38)	(-2.29)	(0.72)
Poor Health	0.106	-0.507	0.021	-0.522	0.109	-0.406
	(2.16)	(-1.42)	(0.37)	(1.82)	(2.41)	(-1.68)

Panel B: Low-Income Blacks

	Child Participated		% Child's Life Participated		Mother or Child Participated	
Outcome Variables	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
Good Health	-0.213	-0.400	-0.174	-0.340	-0.265	-0.820
	(3.84)	(-1.31)	(-2.97)	(-1.22)	(-3.95)	(-1.77)
Poor Health	0.110	0.007	0.078	-0.115	0.100	0.040
	(3.86)	(0.05)	(2.33)	(-0.87)	(3.45)	(0.18)

Table 5: The Effect of WIC Participation on Mother's Assessment of Child Health

Panel A: Low-Income Whites

	Child Participated		% Child's Life Participated		Mother or Child Participated	
Outcome Variables	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
Good Health	-0.031	0.137	-0.051	0.1080	-0.027	0.054
	(-1.21)	(0.72)	(-1.44)	(0.52)	(-1.00)	(0.24)
Poor Health	0.007	0.066	0.022	0.150	0.000	0.141
	(0.52)	(0.66)	(1.17)	(1.26)	(0.01)	(1.15)

Panel B: Low-Income Blacks

	Child Participated		% Child's Life Participated		Mother or Child Participated	
Outcome Variables	**OLS**	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
Good Health	-0.013	-0.002	-0.049	-0.058	0.002	-0.033
	(-0.60)	(-0.01)	(-2.00)	(-0.46)	(0.09)	(-0.19)
Poor Health	0.011	-0.048	0.013	-0.036	-0.003	-0.034
	(1.02)	(-0.81)	(1.06)	(-0.61)	(-0.21)	(-0.46)

Table A2: First Stage Results for "Child Participated in WIC" Policy Variable

	Whites		Blacks	
	Coef.	t-stat	Coef.	t-stat
Constant	1.69	1.80	0.874	1.42
Birth Weight	0.000	-1.64	0.000	-0.03
Mother's Education 0 - 11 years	0.036	0.41	0.058	0.69
Mother's Education 12 years	0.020	0.25	0.102	1.26
Mother's Education 13-15 years	-0.084	-0.93	-0.012	-0.14
Household Income $0-5,000	0.354	4.47	0.132	2.82
Household Income $5,000-10,000	0.495	8.05	0.079	1.64
Household Income $10,000-20,000	0.137	2.42	0.023	0.47
Mother < 19 Years of Age	0.192	2.42	-0.039	-0.98
Number of Past Live Births	0.058	3.04	0.004	0.35
Married at Birth of Child	-0.073	-1.40	-0.166	-5.01
Mother's Wgt. Prior to Preg. (lbs.)	0.002	2.98	0.000	0.61
Mother's Height at Survey (ins)	-0.004	-0.41	-0.003	-0.52
Father's Weight (lbs.)	-0.018	-2.25	0.004	1.09
Father's Height (ins)	0.000	-0.31	0.000	0.53
North East	-0.014	-0.14	0.181	2.41
North Central	0.034	0.43	0.037	0.71
West	-0.085	-0.85	-0.075	-0.77
Easy Income Determination	0.064	1.19	-0.008	-0.24
Few Income Allowances	0.049	0.83	0.055	1.40
Brand Restrictions	-0.101	-1.75	0.005	0.14
Link to AFDC	0.002	0.03	0.039	1.17
1st Trimester Hemoglobin	0.009	0.16	-0.025	-0.57
AFDC Guarantee	0.000	-0.36	0.000	-1.07
Medicaid Expenditures	0.000	-0.75	0.000	-1.13
Clinics/1,000 Poor Persons	-0.126	-1.25	0.376	3.55
Clinics/1,000 Square Miles	0.009	1.26	-0.003	-0.99
Lived in Metro Area	-0.058	-1.10	-0.110	-3.06
Number of Observations	528		1025	
Instruments F-statistic	1.23		4.04	
R-Squared	0.26		0.12	

Table A1: Descriptive Statistics for the 2SLS Instruments

Variable	Description	*Source*	Mean	Std. Dev.	Min	Max
Easy Income Determination	Indicator for whether it is easy to be certified as income eligible (e.g. allows self-reported income).	Study of WIC Participant and Program Characteristics - 1988	0.43	0.50	0	1
Few Income Allowances	Indicator for whether the state has limited income allowances and special exemptions.	Study of WIC Participant and Program Characteristics - 1988	0.45	0.50	0	1
Brand Restrictions	Indicator for whether the state specifies specific food brands must be purchased with WIC coupons.	Study of WIC Participant and Program Characteristics - 1988	0.63	0.49	0	1
Link to AFDC	Indicator for whether the WIC incomes eligibility in state linked to AFDC.	Study of WIC Participant and Program Characteristics - 1988	0.49	0.50	0	1
1st Trimester Hemoglobin	1st Trimester hemoglobin cutoff to be considered medically needy.	Study of WIC Participant and Program Characteristics - 1988	11.70	0.50	10.9	13.9
Clinics / 1,000 Poor Persons	Number of WIC clinics per 1,000 poor persons in state.	Unpublished USDA Documents	0.41	0.36	0.09	1.87
Clinics / 1,000 Square Miles	Number of WIC clinics per 1,000 square miles in state.	Unpublished USDA Documents	5.33	7.01	0.17	31.54
AFDC Guarantee	AFDC guarantee for a family of four.	Green Book	430.57	152.21	144.0	823.0
Medicaid Expenditure	Medicaid expenditure for a family of four.	U.S. Health and Human Services, "State Medicaid Tables"	273.66	81.78	0	467.77

Notes: 51 observations.