Soc Work Soc Welf, 2020, 2(1): 53-62
DOI: 10.25082/SWSW.2020.01.002

RESEARCH ARTICLE

An evaluation of social assistance programs on infant health

Jeffrey Swanson[1*] Johany Chavez[2]

Abstract: Policymakers have been debating the value of social assistance programs, specifically whether they create a dependence resulting in unnecessary waste. We examine the impact of targeted social assistance programs on infant health, while also accounting for variations in sociodemographic and economic factors across the nation. Using information from the Centers for Disease Control (CDC), we combine information on infant health with data on state social assistance programs taken mostly from the University of Kentucky's Center for Poverty Research between the years 1998 and 2015 for all US states. We find that an increase in TANF and SNAP generosity within a state is associated with an improvement in infant health. Our findings demonstrate the need for a social safety net to help the less fortunate and keep a productive society healthy.

Keywords: policy evaluation, welfare, social assistance, public policy, health policy

1 Introduction

Infant mortality rates are an important indicator of population health. The primary goal of this paper is to serve as an evaluation of government redistributive programs and population health. Evaluation refers to a retrospective assessment of the outcome of government interventions[1]. Do the outputs of social assistance programs reach their intended beneficiaries? One example of this kind of research in political science is Kim and Jennings[2] who study the impact of state welfare systems on population health. The authors find that more progressive policies, such as generous education spending, progressive tax systems, and lenient welfare rules reduces age-adjusted mortality rates. In this research, we extend the scope of previous work by studying the association between infant health and the level of generosity of several social assistance programs. Furthermore, we highlight the importance and need for targeted social programs that can help improve a child's outcomes and potentially have long-term benefits for the nation's development. Infant mortality is an important indicator of a society's development, especially when poverty can have a negative influence on child health and development along several dimensions, like cognitive development[3]. This research takes advantage of the variation in policies to study the impact of social assistance programs on infant mortality, while also accounting for variations in sociodemographic and economic factors across the nation. The Centers for Disease Control (CDC) publishes a data collection of infant births and deaths that occur within the US to residents between the years 1995 to 2015. Their data contains information on the mother's race, education, age, birth order, child's weight, and other important factors. Using this data, we combine information on infant health with data on state social assistance programs taken mostly from the University of Kentucky's Center for Poverty Research. The policies that we will cover in this research are Temporary Assistance for Needy Families (TANF), Supplemental Nutrition Assistance Program (SNAP), Women, Infants, and Children (WIC), and Medicaid.

We find that a state's economic development can have profound effects on infant health. As is expected states that have stronger economies and more urban centers have lower infant mortality rates. The same is true when you look at the development within states where a growing economy and urban development reduce infant mortality rates. As for social assistance programs TANF and SNAP generosity help reduce infant mortality rates both within and between states. Furthermore, as SNAP generosity has increased over time states have seen profound reductions in infant mortality rates. An important contribution of this research is that we avoid the issue of committing an exception fallacy by using macro-level data rather than aggregated individual-level data. The concern with an exception fallacy is that any observed relationship

Received: June 6, 2020 **Accepted:** August 4, 2020 **Published:** August 12, 2020

* **Correspondence to**: Jeffrey Swanson, Florida Agency for Health Administration, Tallahassee, FL 32308, USA; Email: jvswanson@fsu.edu
1 Florida Agency for Health Administration, Tallahassee, FL 32308, USA
2 Keiser University, Tallahassee, FL 32309, USA

Citation: Swanson J and Chavez J. An evaluation of social assistance programs on infant health. *Social Work and Social Welfare*, 2020, **2**(1): 53-62.

between the outcome and any one of the predictors in the model could be a statistical artifact of individual-level dynamics to infer group-level associations.

2 Infant health factors

Poverty can have negative impacts on the health and development of a child through several factors. The focus of this research is the direct impact that occurs during pregnancy in the form of poor nutrition or prenatal care received by the mother. Low birth weight is an important predictor of infant mortality because this can be a result of poverty or poor prenatal care and increases the risk of death by 25 times compared to other infants[4]. Furthermore, reducing low birth weight has a greater incidence of decline in IMR rates of non-white and non-metropolitan infants[5]. Even if a low birth weight child were to survive past the first year of life, he or she is at a severe disadvantage relative to his or her peers especially when the child is a premature birth[6]. These disadvantages can result in neurological deficits (*e.g.* language comprehension and visual recognition acuity) that lead to lower educational attainment and earnings[3,7,8].

Social determinants have a tremendous impact on health outcomes. Although "downstream" determinants (*e.g.* health care quality, environmental factors, or health behaviors) have been known to have significant effects on health outcomes, government agencies can help address what is known as "upstream" factors. Social assistance programs can target "upstream" social determinants by providing low-income individuals with access to nutrition assistance, supplemental income, or access to health care[9].

Conley and Springer[10] explain that low birth weight helps mediate individual social demographic factors (*e.g.* prenatal care, nutrition, and bad habits) because these factors are usually not available at the macro-level and are likely not captured by state and/or federal predictors. If government programs can reduce IMR net of low birth weight, then this would imply that investments in social assistance programs have net social benefits well beyond their intended goals. Since neither the presence of medical facilities nor health care workers is associated with a reduction in IMR rates within US counties, the importance of social assistance programs' impact on infant survival is elevated[11].

3 Government programs and their relation to infant health

The choice of state programs is taken from a survey of the literature and a focus on the types of programs that can help families through either increasing the amount of disposable income available or by providing in-kind assistance. Four programs will be reviewed in this study: Supplemental Nutrition Assistance Program (SNAP), The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), Temporary Assistance for Needy Families (TANF), and Medicaid.

The first set of programs is cash or near-cash transfer programs. First, there is SNAP (formerly known as food stamps) a federally funded nutrition assistance program for low-income individuals and families that have helped lift millions of children out of poverty. SNAP is a cash or food assistance program that provides beneficiaries with an electronic card that can be used for the purchase of groceries (using approved vendors) or a direct cash for the beneficiary. Furthermore, SNAP has helped supplement the income of poor families who lose access to TANF due to time limits[12]. Almond *et al.*[13] find food stamps help to increase a child's birth weight, which improves the likelihood of survival past the first year of life. Although SNAP is an in-kind benefit, Hoynes and Schanzenbach[14] find that recipients behave as if the benefits were equivalent to a cash transfer.

The second program is TANF, a conditional cash transfer block grant program designed to eliminate welfare dependency through employment. TANF came about from the reform to Aid to Families with Dependent Children (AFDC) program, which provided cash assistance to eligible beneficiaries. Overall, the transition has made TANF less effective than AFDC was at lifting individuals out of poverty[15]. Furthermore, Leonard and Mas[16] find that more stringent TANF programs, in the form of shorter time limits for receiving benefits compared to the 60-month federal limit, contributed to a deterioration in infant health and significant increases in infant mortality. Although eligibility standards vary, most states provide TANF benefits to needy families, if that family includes a minor child or a pregnant woman[17].

The final set of programs is related to the health and wellness of the mother. The first is WIC, a federally funded program that aims to improve the nutrition of low-income pregnant and postpartum women, infants, and children under five. The nutritional improvements from WIC have led to healthier infants, more nutritious diets, and better health care for children. To participate in WIC a family must be no more than up to 185 percent of the federal poverty level. WIC has helped reduce infant mortality by connecting expecting mothers to prenatal care, nutritional assessments, and providing access to healthy foods[18]. The positive benefits from WIC are demonstrated in Hoynes *et al.*[19] who find that WIC implementation increased birth weights. This program is administered and funded by the federal government through the US Department of Agriculture. Unlike most of the programs discussed WIC and TANF are not entitlement programs because Congress reauthorizes funds each year. As a result of these resource limitations, WIC has a priority system to determine who will receive benefits. For example, the top priority goes to pregnant women, breastfeeding women, or infants with nutrition-related medical conditions (*e.g.* anemia).

Finally, Medicaid is a state-run health insurance program that traditionally covers low-income elderly, disabled persons, and non-disabled parents and children receiving cash assistance. State governments have a considerable degree of leeway over their Medicaid programs because even though the federal government sets minimum eligibility and benefits standards, state governments make the final decision over covered services, the amount paid to providers, and the extent of the eligible population[20]. However, the ability of state governments to innovate their Medicaid programs can create massive variations in the types of services provided, as well as the health outcomes of the patients. For example, states can expand access using 1115 Medicaid research and demonstration waivers or at their own expense[21].

4 Data and methods

Infant health is measured using the infant mortality rate. However, neonatal infant mortality (death less than 1 month after birth) is affected by birth weight, genetics, and health care delivery factors, which can inflate the overall infant mortality rate[22]. Therefore, we include post-neonatal (*i.e.* at least a month old) and normal birth weight (*i.e.* at least 2.5 kg) infant mortality rates to assure that the associations persist when considering infants more likely to survive. The data are drawn from the CDC's Wonder database and includes the years 1998 to 2015 for all 50 US states (shown in Table 1). Although infant health data are available from 1995, we start in 1998 because TANF did not take effect until July of 1997. The state with the highest infant mortality rate is Mississippi with about an average of 10 deaths for every 1,000 live births. The state with the lowest IMR is New Hampshire with 4.8 deaths for every 1,000 live births. (see Figure 1)

In this paper, we use the within-between estimator (WB), which is a decomposition model that provides separate estimates for the within and between-effects. To clarify the interpretation of the results for the reader, the between-effect expresses the cross-sectional information reflected in the changes between states, while the within effect expresses the annual effect of a predictor on the outcome within a state[23]. We use clustered standard

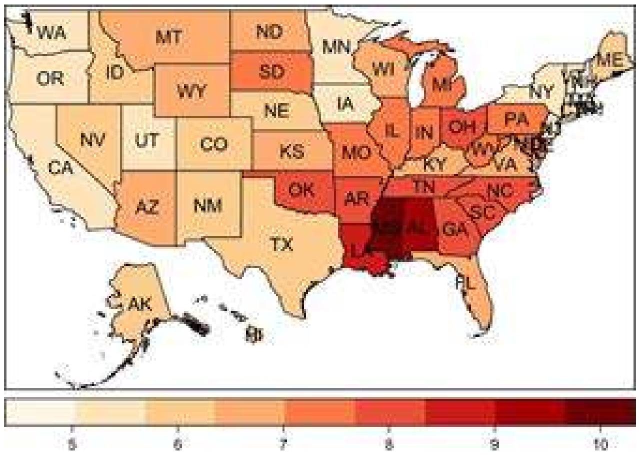

Figure 1. Yearly average infant mortality rates

errors to adjust the standard errors for autocorrelation and group-wise heteroscedasticity.

4.1 Social assistance programs

All social assistance programs are lagged by one period because the programs have a delayed effect through maternal health. By design, our model will estimate the independent effect of each government program on infant mortality, but programs are likely to operate independently of one another in reality. This is because different levels of government handle those programs and state legislatures are likely to treat the funding to each state agency that administers the program differently. Furthermore, the public holds different views for social assistance programs depending on the target population. However, not all programs are truly independent because eligibility for some can oftentimes be linked together (*e.g.* Medicaid and TANF). We do estimate a model where we perform factor analysis to estimate a state's social assistance benefit generosity and find no significant differences between our reported results. Welfare reform created a variation in eligibility requirements and program stringency rules[24], which makes it more difficult to assess the generosity of TANF using an access generosity measure. However, state legislators can set the maximum benefit levels for families, which serves as a reflection of the expected level of support from the state government. Using the maximum benefit is better than the actual cash benefit received because the maximum benefit is not directly affected by the characteristics of the recipient population. According to Plotnick and Winters[25], the best available generosity measure would be the maximum benefit provided to a four-person family with no other income. This value is expressed in hundreds of 2009 dollars adjusted using an implicit price deflator. SNAP generosity is measured as the average benefit received for a SNAP beneficiary in

Table 1. Summary statistics

	N	Min	Max	Mean	SD	Source
Overall IMR	900	3.57	11.46	6.67	1.38	CDC Wonder
Post neonatal IMR (> 1 month)	890	0.97	5.00	2.30	0.68	CDC Wonder
Normal Birth Weight IMR (> 2.5 kg)	869	0.60	4.03	1.63	0.52	CDC Wonder
TANF Generosity$_{t-1}$	900	1.78	13.14	5.30	2.00	University of Kentucky Center for Poverty Research[1]
SNAP Benefits$_{t-1}$	900	0.68	2.13	1.04	0.20	University of Kentucky Center for Poverty Research[1]
WIC Generosity$_{t-1}$	900	3.60	19.88	10.00	2.36	University of Kentucky Center for Poverty Research[1]
%Coincident Index	900	-1.05	0.78	0.18	0.25	Federal Reserve Bank of Philadelphia
Medicaid Generosity$_{t-1}$	900	10.01	123.75	63.54	17.73	Census of Government Finance
Health Spending Share$_{t-1}$	900	1.61	15.39	7.24	2.69	Census of Government Finance
%Low Birth Infants (< 2.5 kg)	900	5.36	12.37	7.90	1.27	CDC Wonder
Racial Diversity	900	3.18	55.33	28.06	12.65	US Census Population Estimates
Cigarette Price	900	2.27	9.54	4.72	1.24	Orzechowski and Walker[2]
lnPopulation Density	900	-6.83	0.19	-2.45	1.40	US Census Population Estimates

Notes: [1] University of Kentucky Center for Poverty Research. UKCPR national welfare data, 1980-2016, 2017. data retrieved from Gatton College of Business and Economics, University of Kentucky, Lexington, KY, http://www.ukcpr.org/data; [2] William Orzechowski and Robert Walker. The tax burden on tobacco: Historical compilation, Tobacco Tax Council, 2016.

hundreds of 2009 dollars adjusted by an implicit price deflator. WIC generosity is measured using access data because data on benefits for WIC participants are not available at the state level. Access to WIC is expressed as the percentage of recipients to the total female population in a state.

The variation in Medicaid services and eligibility by state renders an access generosity measure unreliable. This is because physician fees can vary anywhere from 37 to 140 percent of Medicare fees for comparable services[26]. The US Census publishes vendor payments made for medical assistance or general health care needs. However, the measure also includes medical payments made by general relief, public assistance, and any other state welfare program. Although these additional spending programs might increase overall spending, this measure is a more direct indicator of the package of medical services covered than total Medicaid spending. Vendor payments can reflect a state's benefit generosity and are adjusted by the number of Medicaid beneficiaries to reflect differences in state Medicaid populations. Missing data was either recovered using the state's Medicaid website or by calculating the average of the years in between the missing year. The vendor payment per beneficiary is expressed in hundreds of 2009 dollars adjusted using an implicit price deflator.

4.2 Control variables

We include several control variables that are related to both the quality of a state's health care and associated with overall health outcomes. First, we include the per capita budget share of hospital and health state-only spending to capture investments made in public health, as they can reflect the quality of a state's health care system[27]. This variable is composed of the summation of two spending categories. Public health spending includes state spending on outpatient health services, research and education, immunization clinics, environmental health activities, nursing, and other general public health activities. Hospital spending includes financing to support private or public hospitals and the provision of hospital care. Also, this includes spending on hospitals administered by the government except for nursing homes that do not have a direct affiliation with a government hospital. This variable is lagged by one year to account for the delayed impact of state investments on infant health care.

Second, previous research has found a negative association between economic development and infant health because higher income levels are associated with higher education levels, better functioning health systems, and better institutions[28]. The first is a measure of economic strength using a yearly average of the Federal Reserve Bank of Philadelphia's monthly coincident index. This is a measure of state economic health and is composed of non-farm payroll employment, average hours worked in manufacturing, unemployment rate, and wage and salary disbursements. We calculated the percentage growth in the state coincident index to estimate the health of a state's economy. Finally, we include population density measured as the population per square mile in thousands of people and is logged to reduce skew. The US Census defines urbanization as a place with a population density of at least 1,000 people or more per square mile. Therefore, population density is meant to account for a state's urbanization and development over time, which are the areas more likely to attract physicians[29].

Cigarette use during pregnancy can have a whole host of negative effects on infant health, such as low birth weight, death, premature birth, and birth defects. Taxation can help reduce smoking because evidence has found pregnant smokers change their behavior in response to cigarette prices[30]. Therefore, we include the average cost per pack of cigarettes in each state drawn from Orzechowski and Walker[31].

Race has played a prominent role in the development and implementation of social assistance programs[32,33].

Table 2. Effect of social assistance on infant mortality (1998-2015)

	Total	Post-Neonatal (> 1 month)	Normal Birth Weight (> 2.5 kg)
Within Effect:			
SNAP Generosity	-1.364*** (0.324)	-0.279 (0.166)	-0.210 (0.122)
Medicaid Generosity	-0.003 (0.002)	-0.001 (0.001)	0.0004 (0.001)
TANF Generosity	-0.045 (0.045)	-0.053* (0.026)	-0.059* (0.023)
WIC Generosity	-0.038 (0.035)	0.003 (0.013)	0.012 (0.010)
%Coincident Index	-0.076 (0.091)	-0.133** (0.043)	-0.090* (0.043)
ln Population Density	-3.075*** (0.829)	-1.624*** (0.400)	-1.353*** (0.324)
%Health Spending	0.001 (0.021)	-0.017 (0.010)	-0.011 (0.006)
Racial Diversity	0.028* (0.013)	0.006 (0.007)	-0.002 (0.004)
Cigarette Prices	-0.158*** (0.035)	-0.074*** (0.020)	-0.043* (0.019)
%Low Birth Weight	0.275** (0.093)	0.132* (0.052)	0.059 (0.046)
Between-Effect:			
SNAP Generosity	0.028 (0.564)	-0.184 (0.231)	-0.034 (0.184)
Medicaid Generosity	-0.010 (0.007)	-0.002 (0.003)	-0.001 (0.003)
TANF Generosity	-0.190 (0.102)	-0.100* (0.045)	-0.068* (0.032)
WIC Generosity	-0.023 (0.054)	0.055* (0.023)	0.045* (0.018)
%Coincident Index	-7.784*** (1.319)	-3.938***(0.628)	-3.328*** (0.486)
ln Population Density	-0.126 (0.087)	-0.198*** (0.037)	-0.182*** (0.029)
%Health Spending	-0.070* (0.032)	-0.032* (0.013)	-0.033** (0.011)
Racial Diversity	0.036*** (0.008)	0.016*** (0.003)	0.008***(0.002)
Cigarette Prices	-0.338 (0.201)	-0.075 (0.067)	-0.087 (0.053)
%Low Birth Weight	0.214 (0.115)	0.081 (0.062)	0.007 (0.040)
Intercept	9.018*** (1.320)	2.355*** (0.693)	2.190*** (0.528)
σ_μ	0.50	0.23	0.19
σ_s	0.55	0.31	0.26
ICC	0.47	0.36	0.35
Observations	900	890	869
Adjusted R^2	0.466	0.346	0.307
F Statistic	40.241*** (df = 20; 879)	24.485*** (df = 20; 869)	20.238*** (df = 20; 848)

Notes: State clustered SEs in parentheses; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Furthermore, research on infant health has found a clear gap between the

mortality rates of white and black infants[22]. We use a racial heterogeneity measure derived from Census population estimates derived from research by Hero and Tolbert[34]. Higher values would indicate a more racially heterogeneous state. Finally, to mediate for individual-level effects we include the percentage of low birth weights.

5 Results

The results are displayed in Table 2, each column represents the dependent variable of interest measured at different periods of life for the infant. The first column represents overall IMR, the second is post-neonatal IMR (> 1 month), and the third column is normal birth weight IMR (> 2.5 kg). We will first discuss the overall trends across the different measures of IMR to then describe the findings for overall IMR in more detail. We have included post-neonatal and normal birth weight IMR as robustness checks. These additional variables are included because Chen *et al.*[24] note that infant mortality rates are inflated in the US compared to other nations because the available medical technology allows doctors to undertake riskier deliveries that can increase the infant mortality rate. Therefore, we include the additional measures of infant mortality to filter out infants who were at a higher risk of death.

We include the intraclass-correlation coefficient (ICC) in Table 3, which is calculated by dividing the between-group-variance (random intercept variance) by the total variance (*i.e.* the sum of between-group-variance and within-group (residual) variance). The value indicates the proportion of the variance explained by grouping the observations into states. Thus, higher values indicate a larger share of the variance being explained by the between-effect of the clusters.

A glance of the results highlights that within and between states, economic development has improved the survival rates of infants. This result is expected given the fact that economic growth has helped increase life expectancy in developed nations[35]. These findings indicate that as a state's economy expands, or its population becomes more urbanized there is a reduction in expected IMR. Also, we find that wealthier and urban states are more likely to have a lower IMR. In other words, a 1 percentage point increase in economic health is associated with a reduction of infant deaths by about 778 for every 100,000 live births. The effect diminishes to a reduction in infant deaths of about 333 for every 100,000 live births when considering post-neonatal and normal birth weight IMR. Wealth growth within a state influences post-neonatal and LBW IMR. A 1 percentage point increase in economic health is associated with a reduction in 13 deaths for every 100,000 live births and drops to a reduction in 9 deaths for LBW IMR.

As for urban density, a 1 percent increase in population density decreases post-neonatal and normal birth weight IMR by about 2 deaths for every million live births. States that become more densely populated are associated with a drop in IMR across all measures. For example, a 1 percent increase in population density is associated with a reduction in 3 deaths for every 100,000 live births. Racial diversity increases infant mortality where a 1 percentage point increase in racial diversity increases IMR by about 4 deaths for every 100,000 live births. Finally, states that allocated more resources to health spending reduced infant mortality. A 1 percentage point increase in health spending decreases infant deaths by 70 for every 100,000 live births and reduces to about 30 when considering infants more likely to survive.

Overall, across each measure of IMR a state that increases its TANF generosity every year by

$100 is expected to see a decline in post-neonatal and normal birth weight IMR. A two-standard deviation increase of TANF generosity within a state over time can reduce overall infant deaths by an average of 6 deaths for every 100,000 live births, holding all other variables constant. Therefore, TANF generosity does not appear to have a substantive impact on infant deaths, at least not in comparison to an increase in SNAP generosity on overall infant deaths. Although TANF has shifted away from providing cash benefits to employment assistance programs[17], cash benefits have a negative association with infant mortality.

The results highlight a limited net impact of social assistance programs on infant mortality. However, we do find programs that provide cash assistance are more likely to reduce overall IMR. On average, a $100 increase in SNAP benefits over time is associated with 100 fewer deaths per 100,000 live births. The negative association with SNAP benefits is likely a product of increased access to nutrition. SNAP recipients are more likely to suffer from food insecurity preceding their entry, but food insecurity declines months after entering the program. The improvement in access to nutrition does not persist in the other measures of IMR because SNAP is likely affecting the mortality rates of less healthy infants.

Policies that target individual habits have their expected association with infant mortality. A dollar increase in cigarette prices is associated with a drop in infant deaths, but the effect is attenuated by different measures of IMR. Also, the percentage of low birth weights has a positive impact on IMR. This result confirms my expectations because low birth weight is more likely to be associated with infant death. Including the percentage of low birth weights in the model does create a stronger test for the effect of social assistance programs on infant deaths because low birth weight does mediate for things like the mother's health and prenatal care, as these two factors can improve an infant's health while in utero. Another overall trend is that infant deaths are more likely to occur in racially diverse states, even within a state an increase in racial diversity is associated with an increase in overall IMR. The finding complements research on the racial gap in infant mortality in the United States[4].

The data depicts a positive relationship in WIC access generosity on post-neonatal and normal birth weight IMR between states. States with relatively higher participation of women in the WIC program (two-standard deviation increase) have an expected increase of 26 deaths for every 100,000 live births compared to low participation states. Also, a two standard deviation increase in a state's WIC coverage in the female population results in an expected increase of 21 deaths for every 100,000 live births, when holding all other variables constant.

Although the state of the economy or population dynamics are out of the control of state governments, the results do show that there are different policy avenues through which state policymakers can improve infant health. For example, an increase in cigarette prices can have positive influences on infant health. Over time within a state a dollar increase in cigarette prices can reduce overall infant health by an average of 16 deaths for every 100,000 live births, holding all other variables constant. Furthermore, addressing the issues related to low birth weight can help improve a child's chance of survival. Examples of this can include improving access to prenatal care for women or guaranteeing access to nutritional food.

5.1 Low birth weight

The results demonstrate that low birth weight has a substantive effect on a newborn's chance of survival. Therefore, we decided to include an additional section to model the relationship between social assistance program generosity and the proportion of newborns that are born weighing less than 2,500 grams (5 pounds, 8 ounces). As was mentioned previously, low birth weight newborns are at a significant disadvantage relative to their peers. Although low birth weight babies can live healthy lives, the common causes include genetic factors and the mother's health (*e.g.* drug use). Thus, low birth weight can mediate the effects of social assistance generosity on infant mortality. Furthermore, given the causes of low birth weight, more generous social assistance programs are likely to affect the mother's health which then affects the health of the newborn. Figure 2 demonstrates the average

Table 3. LBW beta regression

Variable	Value
μ **Mean:**	
TANF Generosity	-0.0080** (0.0025)
WIC Generosity	0.0029** (0.0011)
Medicaid Generosity	0.0001 (0.0001)
SNAP Generosity	-0.0628*** (0.0123)
%Coincident Index	-0.0025 (0.0040)
ln Population Density	0.0903*** (0.0253)
%Health Spending	-0.00004 (0.0008)
Racial Diversity	0.0055*** (0.0008)
Cigarette Prices	0.0011 (0.0019)
Intercept	-2.1560*** (0.0809)
φ **Precision:**	
Medicaid Generosity	-0.0108* (0.005)
%Coincident Index	-1.058*** (0.20)
ln Population Density	4.35*** (1.23)
%Health Spending	-0.155*** (0.040)
Racial Diversity	-0.0971*** (0.0320)
Cigarette Prices	0.438*** (0.0774)
Intercept	24.487*** (3.95)
State Fixed Effect	Yes
Observations	900
Pseudo R^2	0.9481
AIC	-8129.63

Note: Standard Errors Adjusted by State; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

low birth rate for each state. Much like infant mortality, Mississippi has the highest yearly average percentage of low birth weights at about 11.5 percent and the lowest is Alaska with 5.8 percent.

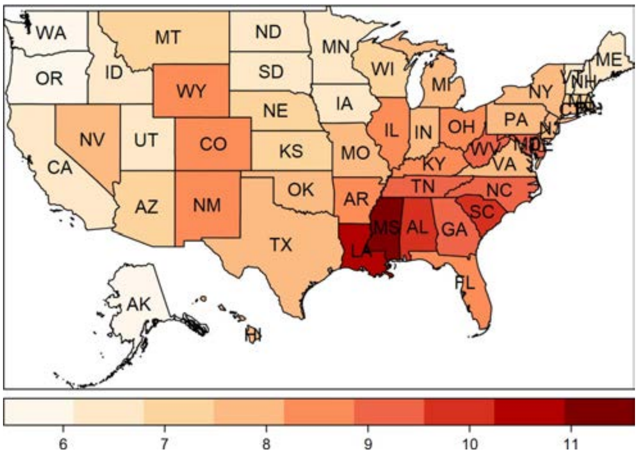

Figure 2. Yearly average percentage of low birth weight births

To construct a model that has the percentage of low birth weight children as the outcome variable is problematic for linear regression because the results would be biased and inefficient. OLS standard errors will be biased and coefficient estimates are likely to not be efficient because proportions tend to be heteroskedastic and are bounded between 0 and 1. Therefore, we will use a beta regression model that can model the means and the variance each with its own distinct set of predictors. The model uses the logit as the link function, which makes the results somewhat analogous to logistic regression. We include plots estimating the expected proportion since the estimated coefficients cannot be directly interpreted. We constructed the expected proportion by simulation where we held all other observations at their observed values while varying the value of the key independent variable across its range of observed values[36].

The key independent variables were chosen because of statistical significance and the plots include a 95% confidence interval. The independent variables of the model are like the previous tables, but the regression was conducted with state fixed effects. Finally, the variables chosen to estimate the precision parameter (variance) were decided based on the Akaike Information Criterion (AIC) to get the best fitting model. The precision parameter helps tune the variance by accounting for heteroscedasticity. The variables are chosen because of model fit because they are not directly interpreted. We have also adjusted the variance by state fixed effects to help account for the clustering within panel data.

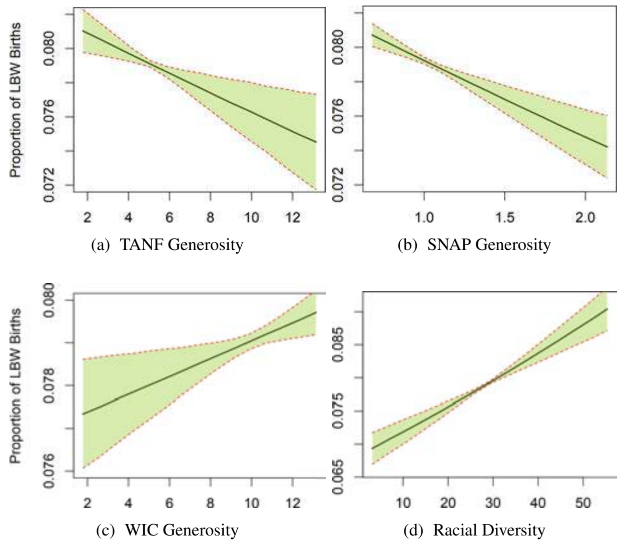

Figure 3. Change in expected proportions of LBW

The results of the beta regression largely echo the results from the analysis of infant mortality finding programs that target nutrition, such as SNAP or TANF, which can improve infant health outcomes. Figure 3 demonstrates the expected proportions for statistically significant and relevant variables for the first column of variables. The results demonstrate that TANF's impact on a newborn's weight is not a substantive amount compared to SNAP. Although SNAP benefits are low compared to TANF, they have a far more profound impact on infant health. The SNAP findings demonstrate that small investments in a program that supplies access to nutrition have substantial effects on a child's health when all other variables are held at their observed values.

We calculated the first difference in expected proportions using simulations to highlight the effects of the different programs. We calculated the expected differences in proportions by looking at a change from the 75th percentile to the 25th percentile in each of the statistically significant variables. We chose the first quarter and third quarter values to avoid issues with outliers that would occur had we chose the minimum and maximum values. For a shift in TANF generosity, there is a statistically significant reduction of 0.17 percent of low birth weight births. This effect would imply an average drop of about 1,100 low birth weight births. For SNAP generosity there is a statistically significant expected reduction of 0.13 percent of low birth weight births or about 856 low birth weight births.

Again, we find a positive relationship between WIC participation generosity and poor infant health. Figure 3c shows a very weak positive effect. The expected difference in proportions due to WIC generosity is a statistically significant increase of 0.06 percent or an increase of 410 low birth weight births.

Finally, Figure 3d demonstrates the often-mentioned racial gaps that exist in newborn health. The simulated findings demonstrate that an increase in racial heterogeneity within a state increases the expected proportion of low birth weight births. Although racial heterogeneity is not the main theme of this paper, the inclusion of the figure is meant to complement the previous finding on infant mortality.

6 Discussion

This paper sought to evaluate the effect of social assistance programs across and within the United States on infant health. We control for several sociodemographic, economic, and the mediating effect of low birth weight. The results demonstrate the expected associations between economic development and infant mortality. We do find a negative association between cash assistance program generosity and infant mortality. The results demonstrate the positive effects of targeted programs on infant health, as SNAP and TANF are more likely to accept low-income families with pregnant women in the household. Furthermore, we complement the results on infant mortality using a beta regression to predict the program relationships to low birth weight births. We still find that programs that provide nutritional support and cash assistance have tremendous impacts on preventing the number of low birth weight births.

However, we find the opposite relationship to WIC participation. The findings are likely an indication not of the failure of WIC to improve infant health, but a reflection of the impact of poverty on infant health. An important factor to remember about WIC is that it is not an entitlement program and that it prioritizes the enrollment of the unhealthiest applicants. Although WIC is a federal program designed to provide nutrition to pregnant women and infants, the potential selection mechanisms of WIC and the low funding are likely not making it as effective as programs like SNAP or TANF. WIC can only accept a limited number of beneficiaries and therefore tend to prioritize women and children who are the unhealthiest.

The results of this analysis find a positive association between the percentage of low birth weight births in a state and infant mortality, which highlights the strong connection between individual habits and socioeconomic status on infant survival. Also, the data demonstrate a negative association between cigarette prices and infant mortality within states demonstrating that the increase in cigarette prices over time has not only reduced the incidence of cancer rates in adults but also benefited the survival of newborns.

7 Conclusion

Currently, with Congress debating the need to maintain programs like SNAP and state policymakers seeking ways to limit access to TANF, the results depict a bleak outcome if they were to ever be successful. By reducing support for targeted programs, policymakers are likely to contribute to the persistence of a cycle of poverty. Even when infants, who are at a higher risk of death, survive past the first year of life they are likely to be worse off relative to their peers. Furthermore, these individuals are less likely to achieve their full potential regarding earnings power or education because of cognitive deficits. Policymakers should be made aware of the potential long-term impacts of cuts to social assistance programs.

Conflict of interest and funding

There is no conflict of interest to declare or funding.

References

[1] Vedung E. Public Policy and Program Evaluation. Routledge, 2017. https://doi.org/10.4324/9781315127767

[2] Kim AS and Jennings ET. Effects of us states' social welfare systems on population health. Policy Studies Journal, 2009, **37**(4): 745-767. https://doi.org/10.1111/j.1541-0072.2009.00333.x

[3] Aber JL, Bennett NG, Conley DC, *et al*. The effects of poverty on child health and development. Annual Review of Public Health, 1997, **18**(1): 463-483. https://doi.org/10.1146/annurev.publhealth.18.1.463

[4] Mathews TJ AND Macdorman MF. Infant Mortality Statistics From the 2013 Period Linked Birth/Infant Death Data Set. National vital stats reports: from the Centers for Disease Control and Prevention, National Center for Health Stats, National Vital Stats System, 2006, **54**(14): 1-29. https://doi.org/10.1037/e558952006-001

[5] Johnson NE and Zaki KP. Racial and residential differences in U.S. infant death rates: A temporal analysis. Rural Sociology, 1988, **53**(2): 207-219.

[6] Racine AD. Child poverty and the health care system. Academic Pediatrics, 2016, **16**(3): S83-S89. https://doi.org/10.1016/j.acap.2015.12.002

[7] Strully KW, Rehkopf DH and Xuan Z. Effects of prenatal poverty on infant health: State earned income tax credits and birth weight. American Sociological Review, 2010, **75**(4): 534-562. https://doi.org/10.1177/0003122410374086

[8] Komro KA, Livingston MD, Markowitz S, *et al*. The effect of an increased minimum wage on infant mortality and birth weight. American Journal of Public Health, 2016, **106**(8): 1514-1516. https://doi.org/10.2105/AJPH.2016.303268

[9] Woolf SH and Braveman P. Where health disparities begin: The role of social and economic determinants-and why current policies may make matters worse. Health Affairs, 2011, **30**(10): 1852-1859. https://doi.org/10.1377/hlthaff.2011.0685

[10] Conley D and Springer KW. Welfare state and infant mortality. American Journal of Sociology, 2001, **107**(3): 768-807. https://doi.org/10.1086/338781

[11] Miller MK, Voth DE and Danforth DM. The medical care system and community malady: Rural, urban, and suburban variations in impact. Rural Sociology, 1982, **47**(4): 634-654.

[12] Sherman A and Trisi D. Safety net more effective against poverty than previously thought. Center on Budget and Policy Priorities, 2015.

[13] Almond D, Hoynes HW and Schanzenbach DW. Inside the war on poverty: The impact of food stamps on birth outcomes. The Review of Economics and Statistics, 2011, **93**(2): 387-403. https://doi.org/10.1162/REST_a_00089

[14] Hoynes HW and Schanzenbach DW. Consumption responses to in-kind transfers: Evidence from the introduction of the food stamp program. American Economic Journal: Applied Economics, 2009, **1**(4): 109-139. https://doi.org/10.1257/app.1.4.109

[15] Floyd I, Pavetti L and Schott L. Policy brief: TANF reaching few poor families, 2017. http://www.cbpp.org/research/family-income-support/tanf-continues-to-weaken-as-a-safety-net

[16] Leonard J and Mas A. Welfare reform, time limits, and infant health. Journal of Health Economics, 2008, **27**(6): 1551-1566. https://doi.org/10.1016/j.jhealeco.2008.05.013

[17] Hanson K and Andrews M. State variations in the food stamp benefit reduction rate for earnings. Economic Information Bulletin Number 46, United States Department of Agriculture, 2009.

[18] Steven Carlson and Zoë Neuberger. WIC works: Addressing the nutrition and health needs of low-income families for 40 years. Center on Budget and Policy Priorities, 2015.

[19] Hoynes H, Page M and Stevens AH. Can targeted transfers improve birth outcomes?: Evidence from the introduction of the WIC program. Journal of Public Economics, 2011, **95**(7-8): 813-827. https://doi.org/10.1016/j.jpubeco.2010.12.006

[20] Kubik JD. Fiscal federalism and welfare policy: The role of states in the growth of child SSI. National Tax Journal, 2003, **56**(1): 61-79. https://doi.org/10.17310/ntj.2003.1.04

[21] Holahan J, Coughlin T, Ku L, *et al*. Insuring the poor through section 1115 Medicaid waivers. Health Affairs, 1995, **14**(1): 199-216. https://doi.org/10.1377/hlthaff.14.1.199

[22] Chen A, Oster E and Williams H. Why is infant mortality higher in the united states than in Europe? American Economic Journal: Economic Policy, 2016, **8**(2): 89-124. https://doi.org/10.1257/pol.20140224

[23] Bell A and Jones K. Explaining fixed effects: Random effects modeling of time- series cross-sectional and panel data. Political Science Research and Methods, 2015, **3**(1): 133-153, 2015. https://doi.org/10.1017/psrm.2014.7

[24] Klarner C, Mao X and Buchanan S. Business interest group power and temporary assistance to needy families. Social Science Quarterly, 2007, **88**(1): 104-119. https://doi.org/10.1111/j.1540-6237.2007.00449.x

[25] Plotnick RD and Winters RF. A politico-economic theory of income redistribution. American Political Science Review, 1985, **79**(2): 458-473. https://doi.org/10.2307/1956660

[26] Lukens G. State variation in health care spending and the politics of state Medicaid policy. Journal of Health Politics, Policy, and Law, 2014, **39**(6): 1213-1251. https://doi.org/10.1215/03616878-2822634

[27] Ewalt JAG and Jennings ET. The great recession and social welfare spending in the American states. International Review of Public Administration, 2014, **19**(3): 308-323. https://doi.org/10.1080/12294659.2014.966887

[28] Baird S, Friedman J and Schady N. Aggregate income shocks and infant mortality in the developing world. Review of Economics and Statistics, 2011 **93**(3): 847-856. https://doi.org/10.1162/REST_a_00084

[29] Goetz SJ and Debertin DL. Rural-urban locational choices of medical doctors: A county-level analysis. Review of Agricultural Economics, 1996, **18**(4): 547-563. https://doi.org/10.2307/1349589

[30] Patrick SW, Warner KE, Pordes E, *et al*. Cigarette tax increase and infant mortality. Pediatrics, 2016, **137**(1): 1-8. https://doi.org/10.1542/peds.2015-2901

[31] Orzechowski W and Walker R. The tax burden on tobacco: Historical compilation, Tobacco Tax Council, 2016.

[32] Hero R. Multiple theoretical traditions in American politics and racial policy inequality. Political Research Quarterly, 2003, **56**(4): 401-408. https://doi.org/10.1177/106591290305600402

[33] Soss J, Fording RC and Schram SF. The color of devolution: Race, federalism, and the politics of social control. American Journal of Political Science, 2008, **52**(3): 536-553. https://doi.org/10.1111/j.1540-5907.2008.00328.x

[34] Hero RE and Tolbert CJ. A racial/ethnic diversity interpretation of politics and policy in the states of the U.S. American Journal of Political Science, 1996, **40**(3): 851-871. https://doi.org/10.2307/2111798

[35] Farag M, Nandakumar AK, Wallack S, *et al*. Health expenditures, health outcomes and the role of good governance. International Journal of Health Care Finance and Economics, 2013, **13**(1): 33-52. https://doi.org/10.1007/s10754-012-9120-3

[36] Smithson M and Verkuilen J. A better lemon squeezer? Maximum-likelihood regression with beta-distributed dependent variables. Psychological methods, 2006, **11**(1): 54. https://doi.org/10.1037/1082-989X.11.1.54