

Supporting Development through Child Nutrition

Diane Whitmore Schanzenbach and Betsy Thorn

Summary

Nutrition is vitally important both during pregnancy and during a child's early years. Inadequate nutrition during this critical period can harm children's health and developmental outcomes throughout childhood and into adulthood. Thus, write Diane Whitmore Schanzenbach and Betsy Thorn, it's particularly important that young children have adequate nutrition and resources.

Yet many young children in the United States lack adequate nutrition. In this article, Schanzenbach and Thorn lay out the extent of the problem and review what the research tells us about inadequate nutrition's detrimental effects on young children's development. They report on the effectiveness of policies and programs that aim to improve nutrition among young children—especially the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)—as well as supplementation of nutrients (both mandatory and voluntary) by the manufacturers of food products, primarily grains. Finally, they suggest how policy makers and others could help more young children, especially the most vulnerable, get the nutrition they need.

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Too many young children in the United States have inadequate nutrition. In 2018, 13.5 percent of children aged zero to three lived in households experiencing food insecurity, meaning that members of their household worried about whether resources to buy food would run out, weren't able to afford balanced meals, skipped meals, or didn't eat enough.¹ Evidence shows that inadequate nutrition in early life, both prenatally and through early childhood, can permanently harm children's health and related outcomes.² In this article, we summarize the research on nutrition among young children and examine policies to improve it.

Some trends and policies affect US children across the income spectrum. Following a sustained public health effort, for example, an increasing share of babies are both being breastfed and being breastfed longer. In addition, manufacturers' food fortification has substantially reduced the share of children who don't get enough of a variety of nutrients, including iron, B vitamins, and iodine. Though many fortification practices were developed almost a century ago, it took a while for such practices to become commonplace: it was only as recently as 1998, for example, that manufacturers of enriched grains were required to add folic acid. Folic acid is particularly important for pregnant women and those who might become pregnant, and indeed, once folic acid fortification was required, the prevalence of neural tube defects at birth dramatically decreased. Risk factors for inadequate folic acid intake remain high among Hispanic women of childbearing age; however, if more corn masa flour and corn tortillas were to be fortified with folic acid, as the Food and Drug Administration

has allowed since 2016, this problem could be rectified.

Nearly all infants and toddlers consume added sugars from sources such as yogurt, fruit drinks, cakes and cookies, sweet snacks, and sugar-sweetened beverages. Although young children's consumption of added sugar has fallen modestly over the past decade and obesity rates for young children have declined, the potential for added sugar intake to be habit forming, along with the high share of young children who consume it, raises concerns.

Several important policies aim to help young children in low-income families. The Supplemental Nutrition Assistance Program (SNAP, formerly the food stamp program) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) are the federal food and nutrition programs that serve the most young children. They reach approximately one in three young children in the United States, including a large number living in families with income levels less than half of the poverty threshold, and both have been shown to improve children's health and developmental outcomes. We review ways to strengthen these programs, such as addressing the sharp drop-off in WIC participation as children age and increasing SNAP benefit levels for families with young children.

How Nutrition Affects Children's Health and Development

Many studies have documented the importance of early-life environments on later-life health and economic outcomes. This body of evidence was recently comprehensively reviewed by Douglas Almond, Janet Currie, and Valentina Duque.³ We summarize it here.

It has long been established that extreme deprivation during the prenatal period, such as can occur during a war, famine, or pandemic, has both immediate and long-term impacts on children.⁴ More recently, though, evidence has been building that more commonplace changes in resources—both deprivation and increases—have important and lasting impacts as well. These have been documented for both the prenatal period and early childhood.

The evidence is particularly strong for the prenatal period. Studies show that even relatively modest changes to the fetal environment can be linked to impacts on children's health and on later outcomes spanning education, economics, and personality.⁵ For example, a recent study comparing siblings in Arkansas showed that greater maternal weight gain during pregnancy predicts a greater likelihood of childhood obesity.⁶ Expectant mothers' fasting during the Muslim observation of Ramadan has been shown to reduce birth weight and to depress their children's later school performance.⁷ High levels of maternal stress can also reduce birth weight, as one recent study showed for pregnant women whose were in the predicted path of a hurricane but did not end up being hit by it.⁸ Relatively mild infectious diseases such as seasonal influenza also have been shown to increase the incidence of both preterm delivery and low birth weight.⁹ These impacts can be long lasting. For example, a recent study that compared siblings in Denmark who were and weren't exposed in utero found that prenatal exposure to seasonal influenza leads to reduced earnings in adulthood.¹⁰

Policy changes that improve maternal health and the environment, on the other hand, can

have positive effects. One recent study found that children born to women in states that raised the sales tax on cigarettes during their pregnancies had better health, measured as days absent from school and whether they visited the doctor more than once per year, than children born to women in states that did not.¹¹ Similarly, birth weight among children born to young mothers is better in states with a higher minimum legal drinking age.¹² Environmental improvements matter as well. Another recent study comparing geographic areas with baseline rates of air pollution that were either just above or just below the threshold for remediation under the Clean Air Act of 1970, and children born in these areas before and after large changes in air pollution, found a positive correlation between improved air quality in a child's birth year and their earnings and labor force participation as adults.¹³

Other policies that give low-income pregnant women access to more resources also improve birth weight outcomes, such as the earned income tax credit (EITC), which is a cash payment made to low-wage workers. A recent study found a higher than average birth weight among infants of women who received EITC payments and a lower incidence of low birth weight.¹⁴ Expectant mothers receive similar benefits from SNAP and WIC.

Timely policy interventions can also offset health damage that children have already experienced. For example, it is well known that lead exposure in early life has detrimental cognitive impacts, even among children exposed to lead levels that have been considered low historically.¹⁵ A recent study found that if children who have been exposed to lead are able to promptly receive lead remediation, the harm can be reversed.¹⁶

Overall, research has established a clear link between early-life circumstances, including modest and commonplace harms, and both short- and long-term effects. On a brighter note, however, there is also evidence that policies designed to provide resources to low-income families or improve the health of pregnant women can have a positive effect on children's health and their economic outcomes as adults. Many of these are policies that promote better nutrition. Together, the evidence suggests that we need to carefully craft policies that champion health and reduce economic hardship for pregnant women and young children.

The voluntary addition of iodine, vitamin D, and B vitamins to widely used products from the 1920s through the 1940s nearly eradicated ailments such as goiter, rickets, beriberi, and pellagra, and folic acid fortification in grains and cereals has dramatically reduced neural tube defects in infants.

Policies Promoting Nutrition

The Dietary Guidelines for Americans (DGA) is a leading source of nutrition advice. Typically updated every five years, the DGA reflects the best scientific evidence on nutrition and is designed to help Americans make healthy consumption

choices.¹⁷ Historically, the DGA hasn't included recommendations for infants (birth to 11 months old) and toddlers (12 to 23 months old) because of their unique nutritional needs, eating patterns, and developmental stages, and so federal nutrition assistance programs have had to rely on recommendations from the American Academy of Pediatrics. But starting with the 2020–25 edition, the DGA will be expanded and begin providing comprehensive guidance for infants and toddlers that covers topics such as the role of beverages (including fruit juices and sugar-sweetened beverages), the development of salt versus sweet taste preferences, and the impact of food marketing on this age group.¹⁸

Supplementation

Food fortified with vitamins and minerals is an important source of nutrients among US children. Though the US Food and Drug Administration doesn't require fortification of any product, it maintains labeling standards under which foods can be labeled "enriched," and many food manufacturers voluntarily fortify their foods.¹⁹ Consumption of fortified foods substantially reduces the share of children who don't get enough of a variety of nutrients.²⁰

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Iodine. The discovery of links between deficiencies in vitamins and nutrients and diseases sparked a movement in the mid-1910s to supplement foods.²¹ In 1924, iodine—a micronutrient needed for healthy thyroid functioning and fetal brain development—was added to table salt. Lack of sufficient iodine leads to goiter, an enlargement of the thyroid gland that can cause coughing and breathing difficulties. Iodine accumulates naturally on the coasts, and people in coastal areas consumed it through fish and dairy products, but it was scarce in diets in other areas of the country where the water and soil contained little iodine. Before the 1920s, between 26 and 70 percent of children had goiter in areas from the Great Lakes to the Appalachians and the Northwest.²² Medical studies published as early as 1917 documented substantially reduced incidence of goiter among children who received iodine supplements. A series of reports, as well as advocacy work by health professionals, led to voluntary iodization of salt by producers, beginning in 1924.²³ Contemporaneous studies documented sharp declines in goiter among those who consumed iodized salt.²⁴ A recent study using geographical variation in baseline iodine consumption levels along with the introduction of iodized salt to pregnant women's diets finds that children exposed to higher levels of iodine in utero showed long-term benefits, including greater participation in the labor force and higher income.²⁵

Today, the majority of US households use only iodized salt.²⁶ Iodine fortification of salt remains voluntary, but manufacturers are required to include a label on the product that says whether the salt does or doesn't supply "iodide, a necessary nutrient," and it is not legal to charge more for iodized table salts.²⁷ While today the US population

at large—if not the world population—gets enough iodine, subsets of the population, including pregnant women, may be at risk for mild to moderate iodine deficiency.²⁸ Guidelines developed by medical experts suggest that iodine be included in all prenatal vitamins, but a recent survey of 223 prenatal multivitamins reported that only half of the brands listed any iodine.²⁹

Vitamin D. In 1900, an estimated 80 percent of children in Boston had rickets, a disease characterized by slow growth and skeletal deformities such as bowed or knocked knees.³⁰ Scientists discovered that rickets could be prevented by exposure to sunlight (a major source of vitamin D) or ultraviolet radiation, or by consuming cod liver oil or foods supplemented with vitamin D. By the 1930s, milk was being widely fortified with vitamin D through irradiation and by the 1940s through the addition of vitamin D concentrate.³¹ Within a few years, rickets was eradicated in the United States.³² As with iodized salt, demand for the fortification of milk was largely driven by medical professionals educating their patients and the public about the importance of vitamin D.³³

There is no federal mandate for vitamin D fortification of milk (though many states do have such a mandate), but in the United States today milk is almost always fortified with it.³⁴ Although rickets is still uncommon, many children don't get enough vitamin D: 61 percent of US children and adolescents have insufficient levels, and 9 percent have deficient levels. Children who spend more than four hours a day in front of a screen and who rarely drink milk are at higher risk for insufficient vitamin D intake.³⁵ Though vitamin D is most commonly thought of as a nutrient that strengthens bones, a recent study showed that increased maternal

exposure to sunlight during pregnancy reduces the fetus's likelihood of developing asthma during childhood.³⁶

B vitamins. Supplementation of bread and flour with B vitamins represents another success story. Illnesses caused by deficiencies of B vitamins were also common in the early 1900s. In particular, beriberi, which harms the cardiovascular system and can cause an enlarged heart in babies, can be prevented by consuming thiamine (also known as vitamin B1).³⁷ Pellagra, a potentially fatal illness characterized by skin and mouth sores and diarrhea, was among the 10 most common causes of nonaccidental deaths in many southern states in the late 1920s; it can be prevented with adequate niacin (also known as vitamin B3) intake.³⁸

In the 1930s, health professionals advocated for requiring manufacturers to add thiamine to flour, based on findings that a substantial population, especially in the South, did not get enough of the vitamin. US bakers and flour producers began to voluntarily enrich their products in the late 1930s. In 1940, the Committee on Food and Nutrition recommended that flour be enriched with thiamin, niacin, riboflavin, and iron.³⁹ By the early 1940s, though, only 40 percent of the nation's flour was enriched, due in part to differences in the cost of enrichment across large and small mills. Thanks to economies of scale, large mills could fortify their flour at a low per-bag cost. Costs were higher for smaller mills, so in the face of weak consumer demand for enriched flour, they delayed enriching their products so that they could remain competitive with larger mills. By 1950, in response to advocacy by health professionals, most states had adopted laws mandating enrichment of flour and bread.

Studies show that deaths from pellagra dropped quickly after states mandated bread enrichment, and such deaths were eradicated nationwide by 1960.⁴⁰ Today, most flour sold is enriched with B vitamins and iron, though properly labeled unenriched flour can still be sold.

More recently, in 1992, the US Public Health Service recommended that women capable of becoming pregnant consume 400 micrograms of folic acid (vitamin B9) daily to prevent neural tube defects such as anencephaly and spina bifida in their babies. Starting in 1998, the federal government required that enriched grains include folic acid. Since then, the number of neural tube defects at birth has declined by approximately 30 percent to 1,300 per year, and the prevalence of folate deficiency in laboratory serum tests has declined from 30 percent to less than 1 percent.⁴¹ Despite these improvements, however, more than 20 percent of women of childbearing age don't have folate concentrations at levels associated with low risk of neural tube defects. Risk factors for and prevalence of neural tube defects among Hispanics are higher than among other groups. One way to address this problem would be to fortify corn masa flour with folic acid, which could prevent an additional 40 cases of neural tube defects each year.⁴²

Nutrient Deficiencies Today

Scientific guidance indicates that discretionary fortification of foods is justified if a substantial share of the population would otherwise not receive an adequate amount of a vitamin or mineral.⁴³ Current fortification levels are clearly improving nutrient intake, and thanks to the fortification of commonly consumed foods many more children consume the estimated average requirement

(EAR) of essential vitamins and minerals. A study of data collected on children aged two through eight between 2003 and 2006 shows that 56 percent didn't reach the EAR for folate through the intrinsic nutrients in the foods they consumed, while 11, 9, and 3 percent didn't meet the EAR for iron, thiamin, and niacin, respectively. Thanks to supplementation, however, the share that failed to consume the EAR was 0.7 percent or lower for each of these nutrients.⁴⁴ The primary foods contributing to these increases included fortified cereals, yeast breads, pasta, and pizza. Some nutrients also have an established upper tolerable level (UL), so it is possible to get too much of them. Supplementation raises approximately 10 percent of children above the UL for folate and niacin (although it's worth noting that there's some scientific controversy over whether the UL is set correctly for children, since it is calculated as a weight-adjusted extrapolation from adults).

A substantial share of children fail to meet the EAR for vitamin D. Without supplementation, 100 percent of children would fall short, but the share drops to 81 percent after supplementation and 63 percent when vitamins are included. Both milk and cereals provide substantial vitamin D in children's diets. Even some foods that add sugar to children's diets have nutritional value. While fruit drinks are a major source of added sugars in children's diets, they are also the major source of vitamin C.⁴⁵

Added Sugars

A particular nutritional concern for infants and toddlers is the extent to which they consume added sugars, which may lead to obesity, dental caries, and preferences for further consumption of sweets.⁴⁶ For

example, a recent study found that overall, 84 percent of infants and toddlers consumed added sugars, and fully 98 percent of toddlers did so.⁴⁷ Added sugars made up about 7 percent of daily calorie intake among toddlers, but fewer than 2 percent of daily calories among infants six to 11 months old. The top sources of added sugars include yogurt, fruit drinks, sweet bakery products such as cakes and cookies, and sweet snacks. Sugar-sweetened beverages (SSBs)—including sodas as well as fruit drinks that aren't 100 percent juice—are also a top-10 source, making up 7.5 percent of toddlers' daily intake of added sugar. In a welcome piece of news, consumption of added sugars among infants and toddlers has decreased over the past decade.⁴⁸

One reason that added sugar consumption among infants and toddlers is concerning is that it may contribute to habit formation, taste preferences, and obesity. In this respect, research has focused particularly on consumption of SSBs. For example, one study that followed children over time found that infants who drank SSBs were substantially more likely to consume SSBs at least once per day at age six.⁴⁹ Cross-sectional studies tend to find that children who consume SSBs are more likely to be overweight, although this correlation isn't uniform across studies, especially among young children. Studies over time tend to find that increased consumption of SSBs at age two or three is associated with an increased likelihood of obesity one to three years later, especially among children who were already overweight when the study began.⁵⁰ Among younger children, non-Hispanic black children are most likely to consume SSBs daily, followed by Hispanics, whites, and Asians, and children in low-income families are substantially more likely

to consume SSBs daily than are children in higher-income families.⁵¹

Raising the price of SSBs by taxing them, with the aim of reducing sales and consumption, is one idea that has received considerable attention as way to discourage overconsumption.⁵² Recent studies have documented that taxes can reduce SSB consumption, although such taxes fall disproportionately on low-income families and aren't designed to reduce children's intakes specifically.⁵³ A more targeted approach was the recent reform in WIC, which reduced the amount of vouchers for juice provided to participants; this change has been associated with reductions in juice consumption.⁵⁴ Others have focused on the potential role of food marketing, finding among older children that even advertising "healthy" fast food options serves to increase children's preferences for fast food but not their likelihood of making healthy food choices among the available options.⁵⁵

Improved guidance from the new DGA on consumption of added sugars and SSBs will help both to educate parents and to highlight areas where further research is needed. Any policies that aim to alter sugar consumption will have to carefully consider a multitude of factors, including supply and demand, access, and prices.

Breastfeeding

There is widespread consensus that breastfeeding is the best source of nutrition for most infants. The American Academy of Pediatrics recommends exclusive breastfeeding for the first six months of life, followed by at least an additional six months of breastfeeding combined with complementary foods.⁵⁶ Similarly, the federal government's Healthy People 2020 initiative

included goals for increased breastfeeding initiation, breastfeeding duration, and exclusive breastfeeding.⁵⁷

However, although breastfeeding has been found to be correlated with a range of desirable outcomes, from fewer ear infections during infancy to a healthy childhood body mass index (BMI) to higher IQ later in life, relatively few studies are able to identify a causal relationship between breastfeeding and those outcomes. Since breastfeeding rates are higher among more affluent families, some of the positive outcomes associated with breastfeeding may be due to other factors. Studies comparing siblings who differ in breastfeeding status tend to find smaller or no impacts on longer-term outcomes.⁵⁸ A landmark study conducted in the 1990s in Belarus randomly assigned pregnant women who intended to breastfeed their infants into groups that received different kinds and amounts of breastfeeding support. The two groups varied substantially in breastfeeding duration and in exclusive breastfeeding. Infants in the group who received breastfeeding support were less likely to experience a gastrointestinal tract infection or a rash such as eczema, but they showed no statistically significant differences in the rates of other problems, such as upper respiratory infections and ear infections.⁵⁹ Follow-up studies on the same group of children found that breastfeeding wasn't related to childhood BMI, blood pressure, or dental health.⁶⁰ These findings suggest that breastfeeding may have less extensive effects on child outcomes than previously believed.

Many of the goals for breastfeeding set out in Healthy People 2020 have been met. The percentage of babies who are breastfed

even if only for a short time increased from 73 percent in 2004 to 84 percent in 2016.⁶¹ The share of babies who are exclusively breastfed through three and six months has generally increased each year. Over half of children were breastfeeding at six months, and over one-third were breastfeeding at 12 months. Today there are also more external supports for breastfeeding. An increasing number of babies are born at hospitals (over one in four for babies born in 2015) that provide recommended care in support of breastfeeding initiation, and nearly half of US employers offer worksite lactation support programs. However, important disparities in breastfeeding remain; in particular, black infants are 16.5 percentage points less likely than non-Hispanic white infants to have ever been breastfed.⁶²

Nutrition Assistance Programs

Through WIC and SNAP, the federal government provides substantial nutritional support to pregnant women and families with young children. Both programs are administered by the US Department of Agriculture's Food and Nutrition Service. Several smaller programs also help young children nutritionally, including the Child and Adult Care Food Program, which makes meals and snacks available to children in day care; the Summer Food Service Program, which provides summer meals through community organizations and schools, some of which may go to young children; and the Special Milk Program, which supplies milk to children in childcare institutions. We couldn't find estimates of how many young children are served by these smaller programs, but their combined budgets add up to less than 4 percent of the total spending on the agriculture department's food and nutrition programs.

Overview of WIC

WIC offers its participants supplemental foods, nutrition education (including breastfeeding promotion and support), and referrals to other services. Only infants in their first year of life, children younger than five, and pregnant or postpartum women (up to 12 months postpartum for women who are breastfeeding, or six months for those who aren't) are eligible. Further, the family's income must be at or below 185 percent of the federal poverty level, and applicants must be at nutritional risk—that is, they must have medical conditions or dietary deficiencies that could be improved through participation in WIC. Total 2017 spending on WIC was \$5.6 billion, which included \$3.6 billion for food.⁶³

A set of supplemental foods, called a food package, is prescribed to participants based on their participant category, and they can obtain these foods at authorized retailers by using electronic benefit transfer cards, paper vouchers, or checks. Benefits and their length vary by participant category, as table 1 shows. The foods included in the monthly packages are intended to provide nutrients generally lacking in the diets of low-income women, infants, and children. For example, regulations require that reduced-fat milk purchased with WIC benefits contain specified minimum quantities of vitamins A and D and that breakfast cereals contain at least a minimum quantity of iron. Participants with qualifying conditions may receive special formulas or foods in addition to the standard foods. Other than for fruits and vegetables, WIC benefits provide a specified quantity of goods regardless of price charged by the authorized grocery outlet. As of 2014, average monthly per-participant food package costs to state agencies was \$42.45.⁶⁴

Table 1. WIC Program Characteristics, by Group

	Infants (up to 12) months)	Children (one to four years old)	Pregnant women	Postpartum women, breastfeeding	Postpartum women, not breastfeeding
Certification length	Through first birthday	12 months (six in AL, AR, KY, LA, NE, NJ, OH, WV)	Duration of pregnancy plus six weeks	One year or until breastfeeding stops	Six months
Value of monthly food package	\$0–\$171, depending on breastfeeding status and age	\$43	\$50	\$50–\$66, depending on intensity of breastfeeding	\$39
Foods included in standard package	Formula Infant food (cereal, fruits and vegetables, and meat	Milk, eggs, breakfast cereal, whole-grain bread, legumes/peanut butter, fruit or vegetable juice, cash-value benefit for fruits and vegetables. Allowable substitutions for milk are cheese, soy-based beverages, tofu, and yogurt			

Source: Data from Special Supplemental Nutrition Program for Women, Infants and Children. 7 C.F.R. § 246 (1985). The market value of the WIC food package is calculated from the 2015 IRI Consumer Network Panel data.

WIC's benefits, unlike SNAP's, aren't phased out as income rises, so the poorest families receive the same benefits as the least-poor families who participate. Under federal rules, immigrants are eligible for WIC, although states have the right to limit that eligibility (currently none does). WIC participants also receive nutrition education as well as referrals to other organizations that provide childcare services, health and dental care, and housing assistance, though little is known about the efficacy of these aspects of the program.

More than half (53.3 percent) of WIC participants are children, and 23.3 percent are infants. The remainder are women who are either pregnant (9.1 percent), breastfeeding (7.8 percent), or postpartum (6.5 percent). Infants and children who participate in WIC are more likely to belong to racial or ethnic minorities than infants and children in the United States as a whole. Participation declines sharply as children grow older.⁶⁵

Overview of SNAP

SNAP provides electronic voucher payments that can be used at most grocery stores to purchase food that is intended to be taken home and prepared. SNAP is a universal program not specifically targeted at children, but its reach among young children is almost as large as WIC's. In 2018, 16.6 percent of SNAP households included a child between zero and three, and 10 percent of all people receiving SNAP benefits were children in that age range. Of the \$60.6 billion spent on SNAP benefits in 2018, \$17.9 billion (29.5 percent of the total) went to families with children three and under. Because SNAP data don't tell us whether a participating woman is pregnant, we can't estimate SNAP's reach among this group.

SNAP is designed to supplement a family's other resources (such as earnings or disability benefits payments) for food purchases, and most participants combine SNAP with other cash resources to meet their food needs.⁶⁶

Table 2. Characteristics of Households on SNAP with Children, by Age of Children

	0–3	Any<18
Share of households on SNAP overall	16.6%	41.3%
Average monthly benefit	\$425	\$384
In deep poverty (<50% FPL)	49.0%	45.3%
No cash income	17.2%	14.9%
With any earnings	57.6%	54.0%
Single parent	57.4%	57.4%
With at least one noncitizen	19.8%	18.9%
Number in SNAP unit	3.54	3.24
Total people in household	3.89	3.58

Source: Authors' calculations from 2018 USDA FNS Supplemental Nutrition Assistance Program (SNAP) Quality Control Data, available at <https://www.fns.usda.gov/resource/snap-quality-control-data>.

Eligibility depends on a family's income and asset levels, and benefits are calculated as the difference between the minimum monthly amount necessary to feed a family of a given size and the resources that the family has available to purchase food. The family's resource availability is calculated according to a formula that takes into account cash income from all sources, minus certain deductions such as childcare expenses, a portion of housing expenses, and a portion of earnings. SNAP benefits drop as income rises.

Legal immigrants were barred from the program as part of the 1996 welfare reform legislation, but the 2002 Farm Bill restored eligibility for all legal immigrants who are children or disabled, as well as for some categories of adult immigrants, such as refugees or those who have been in the country for at least five years.

SNAP households with young children have lower incomes and are generally more disadvantaged than participants with older children. Table 2 records the presence of children in various age ranges in households, documenting one aspect of SNAP recipient demographics. Information for families with children in multiple age ranges appears in

more than one column. In 2018, average benefits for households with young children were \$425 per month, or about \$14 per day. This is about 10 percent higher than average benefits for all SNAP households with children, reflecting the fact that SNAP families with young children have both larger households and lower incomes than SNAP families with older children. A majority of these households receive earnings in the same month they receive SNAP, but 17 percent of SNAP households with young children report no cash income from any source. More than half live in households headed by a single parent, and nearly 20 percent of SNAP households with young children include at least one noncitizen.

Table 3 breaks down the caseload with young children by their income-to-poverty levels, revealing substantial variation in the population and large numbers of extremely disadvantaged children. Nearly half of SNAP households with young children live in deep poverty. By design, these families receive higher SNAP benefits, averaging \$531 per month—an amount that comprises three-quarters of their total cash resources. Twenty-six percent of those in deep poverty also earn money in the month they receive

Table 3. Characteristics of Households on SNAP with Children from Birth to Three, by Household Income Relative to the Federal Poverty Threshold

	Less than or equal to 50% FPL	Greater than 50% to 100% FPL	Greater than 100% FPL
Distribution of SNAP households w/young children	47.3%	36.3%	16.1%
Average monthly benefit	\$531	\$390	\$193
Share of total resources made up by SNAP	75%	16%	6%
With any earnings	26%	84%	95%
With no cash income	35%	0%	0%
Single parent	69%	44%	50%
Total in household	3.76	4.16	3.78
Share w/children ages 0-3 among total SNAP households at this income level	21.4%	12.9%	15.6%

Source: Authors' calculations from 2018 USDA FNS Supplemental Nutrition Assistance Program (SNAP) Quality Control Data, available at <https://www.fns.usda.gov/resource/snap-quality-control-data>.

SNAP benefits, while 35 percent have no cash income from any source in the month. More than one in five SNAP households in deep poverty have a child three or younger.

Another 36 percent of SNAP households with young children have income levels between 51 and 100 percent of the poverty threshold; they receive an average of \$390 per month in SNAP benefits, and 84 percent of these households have earnings. The remaining 16.4 percent of households have incomes above the poverty threshold. Nearly all of these families have earnings, and their average monthly benefits are less than \$220.

Impacts of Federal Nutrition Programs

Research on SNAP and WIC shows how important these programs are for young children and their families, both in the short and the long run. A primary challenge for researchers is to disentangle the effects of these programs from the needs they were designed to address. Because the programs are designed to serve people who have low

incomes, are experiencing food insecurity, or have other characteristics reflecting need, studies have to be carefully designed to separate the impact of the programs from the underlying reasons that people are eligible for or opt to participate in them. Drawing from other recent reviews, we briefly summarize the research, limiting our focus to studies that employ a research design that can isolate the programs' causal impacts.⁶⁷

In order to assess whether SNAP improves nutritional intake and reduce food insecurity among children, we must draw on estimates for the program overall because there are no separate studies of impacts among families with young children. Studies have shown that SNAP benefits increase access to food, measured by higher food spending and more nutrient availability. Results on the relationship between SNAP and food insecurity are mixed—some studies have found that food insecurity actually rises under SNAP, while others have found that, as expected, it falls—due in large part to the challenges in establishing

the program's causal impact.⁶⁸ The best studies are those that use variation in policies, such as differences in immigrants' eligibility for SNAP or in expected benefit levels compared to populations with fewer eligibility requirements or access to more benefits; these studies have found that SNAP indeed reduces food insecurity.⁶⁹ Another line of research uses so-called partial identification approaches that transparently allow for different assumptions about who decides to participate in each program; using this approach, both SNAP and WIC have been shown to reduce food insecurity.⁷⁰

Most studies of WIC and nutritional intake have focused on changes in participants' diets associated with the change in food packages implemented in 2009. One study that compared child WIC participants to income-eligible nonparticipants found correlations between participation and intake along a variety of measures (for example, WIC children consume more potassium and fewer empty calories and are more likely to consume the foods in the WIC food package). But these studies don't address how families who decide to participate in WIC may differ from those who don't, so they can't disentangle correlation from causality.⁷¹ The 2009 revisions to the food packages were also intended to promote breastfeeding. Studies of WIC participants have found increases in breastfeeding, but breastfeeding rates have also increased in the general population.⁷²

Another question is how the programs affect children's health and wellbeing. Studies show that expectant mothers' access to SNAP and WIC leads to improved birth weight.⁷³ This is important because improvements in birth weight result in improved learning outcomes in children and even to improvements

across a wide range of outcomes measured in adulthood, including wages, disability, health conditions, and human capital accumulation.⁷⁴ In particular, several studies that use credible research designs—for example, that compare similar families who do and don't receive WIC because of variation in access—find that participation in WIC improves birth weight and/or reduces the incidence of low birth weight.⁷⁵ Some important recent studies also find that loss of ready access to WIC due to closures of local clinics or stores that took part in the program reduces expectant mothers' participation and in turn has a harmful impact on birth outcomes.⁷⁶ For SNAP, studies that use policy variation in program access—due to cross-county variation in the original introduction of the program or to changes in immigrants' eligibility status in the wake of welfare reform—also find that in utero exposure to SNAP improves health at birth.⁷⁷

More recently, direct evidence has emerged that access to SNAP and WIC in early life improves later-life outcomes. A recent study used the fact that originally the program was introduced on a county-by-county basis over a span of more than a decade to compare outcomes of children who lived in different counties in the same states and therefore had different access to SNAP from conception through age five.⁷⁸ Children who received SNAP longer had better health in adulthood, measured by large and statistically significant reductions in an index of characteristics associated with metabolic syndrome, including obesity, high blood pressure, heart disease, and diabetes. The study also found that for women, but not men, access to SNAP in early childhood improved later economic self-sufficiency, a measure that includes earnings and family income, and had a positive effect on indicator

variables including whether the individual graduated from high school, is currently employed, is currently not living in poverty, and is not participating in Temporary Aid for Needy Families or SNAP. For both health and economic outcomes, the effects were largest among children who had access at the youngest ages and who spent their childhoods in the most disadvantaged counties. Another recent study estimates what happened when immigrants lost and eventually regained eligibility for SNAP in the years after the 1996 welfare reform law.⁷⁹ Among children of immigrants, access to SNAP between conception and age five led to improvements in health between ages six and 16 (as reported by parents), with suggestive evidence that children missed fewer school days and visited the doctor and were hospitalized less often. Similarly, a recent study comparing siblings found that prenatal WIC participation led to fewer diagnoses for ADHD and other childhood mental health conditions and reduced grade repetition.⁸⁰

There are many important questions we don't have adequate research to answer, and more research would vastly improve

our understanding of the impacts of SNAP and WIC and how to improve the designs of these programs. It would be particularly important to better understand the causes and consequences of the dramatic decline in WIC participation as children age. In addition, although it may be likely that WIC and SNAP have similar impacts on children's short- and long-term outcomes, it would nonetheless be useful to have more direct evidence on WIC's impacts. Certainly, we need much more research into how nutrition education, including breastfeeding promotion and support, and other aspects of WIC can best promote healthy diets and development.

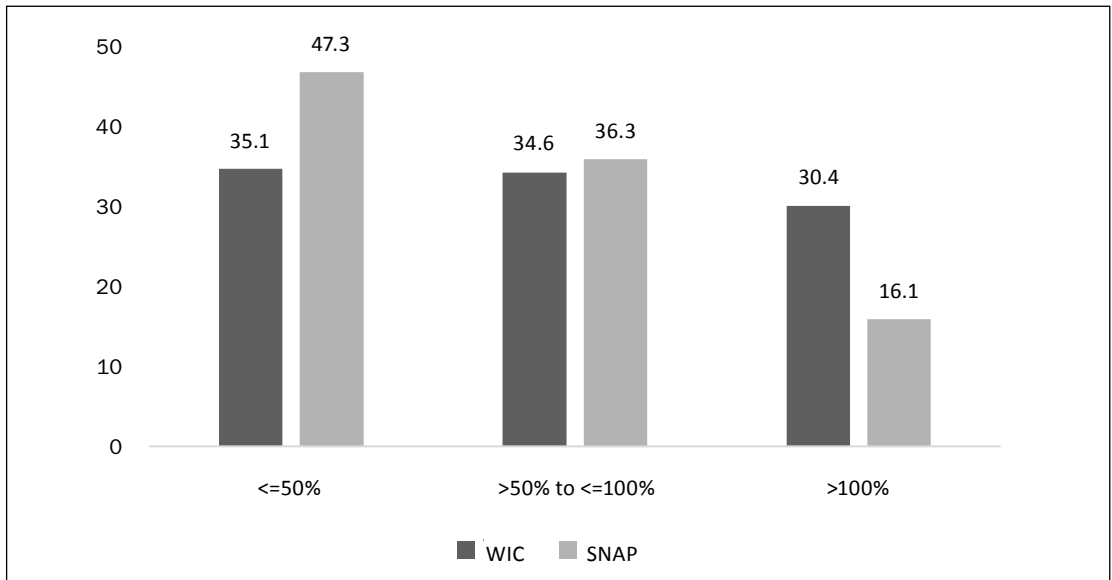
The Reach of WIC and SNAP, and Policy Challenges

SNAP and WIC are extremely important in boosting food access among US children, and each program reaches a substantial share of US children. As table 4 shows, according to calculations from the Current Population Survey (CPS), 24.7 percent of all children from birth to three participate in WIC, and 21.8 percent participate in SNAP. About half of these children (12.8 percent) participate in both programs simultaneously.

Table 4. Participation in WIC and SNAP, by Child's Age

	Age 0	Age 1	Age 2	Age 3	Age 0–3 Pooled
<i>Panel A: Survey estimates from CPS (2015–19)</i>					
WIC	30.9%	27.8%	20.9%	19.2%	24.7%
SNAP	21.2%	21.9%	21.6%	22.4%	21.8%
Both	15.4%	14.4%	11.3%	10.4%	12.8%
<i>Panel B: Estimates from administrative records (2015–16)</i>					
WIC	47.6%	35.1%	27.0%	24.0%	33.4%
SNAP	28.6%	31.4%	30.1%	30.0%	30.0%
Ratio WIC:SNAP	1.67	1.12	0.90	0.80	1.11

Source: Authors' calculations from US Census Bureau Annual Social and Economic Supplement of the Current Population Survey, USDA FNS "WIC 2016 Eligibility and Coverage Rates," USDA FNS SNAP Quality Control data 2015-1026, US Census Bureau American Factfinder.

Figure 1. Distribution of WIC and SNAP Caseloads for Children Three and Under, by Income-to-Poverty Level Ratios

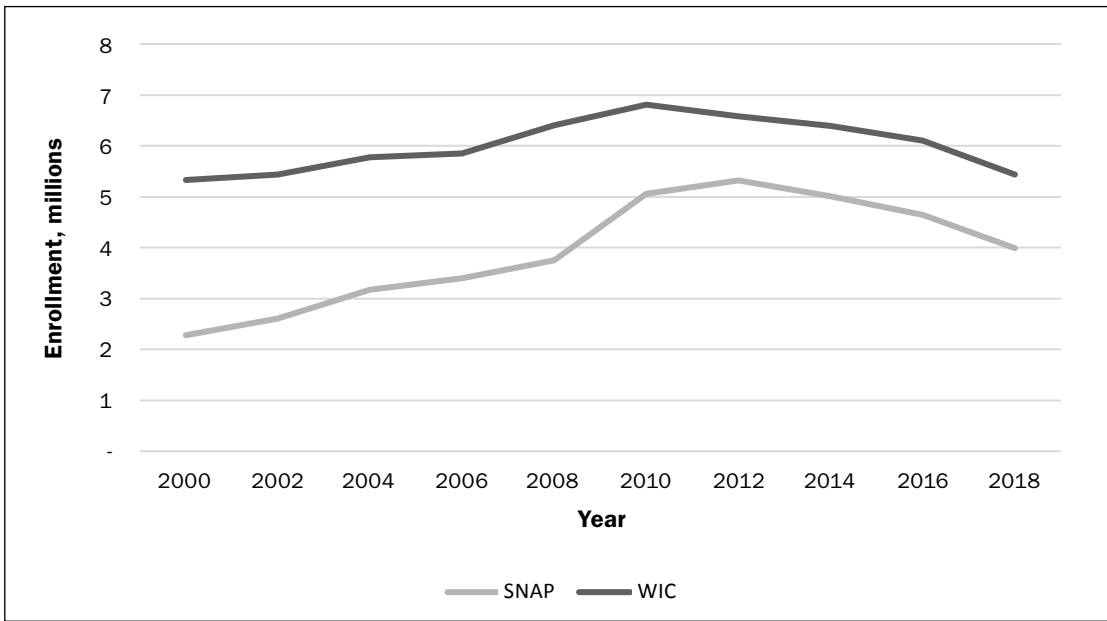
Sources: Authors' calculations from USDA FNS "WIC 2016 Eligibility and Coverage Rates," USDA FNS SNAP Quality Control data 2015–2016.

A known problem with the CPS is that respondents underreport their participation in programs like SNAP and WIC, so actual participation rates are likely higher. We can calculate a more accurate measure by using administrative records for SNAP and WIC participation and calculating the ratio of those to population counts. As panel B shows, this method increases the estimated participation of children three and under to 30 percent for SNAP and 33 percent for WIC. Participation in WIC declines sharply with age—only half as many three-year-old children participate as do infants. By contrast, SNAP participation among three-year-olds is 5 percent greater than among infants. The bottom row shows the ratio in program participation by children's age. WIC serves 67 percent more infants than SNAP does, but by ages two and three, SNAP serves more children than WIC, which raises the question of the causes and consequences of the drop-off in participation in WIC.

Most WIC and SNAP participants have incomes below the poverty line, but WIC participants are somewhat less disadvantaged than SNAP's because WIC's income eligibility threshold is higher (see figure 1). Nearly half of SNAP households with children three and under have incomes less than 50 percent of the federal poverty level—equal to an annual income level of less than \$8,455 for a family of two in 2019. Among WIC participants, the share living in deep poverty is 36.5 percent. Both programs have a substantial minority with income above the poverty line—27 percent of WIC households and 16 percent of SNAP households.

In 2016, 4.9 million infants and children and 3.9 million women were enrolled in WIC, and 4.6 million children from birth to age three were enrolled in SNAP.⁵¹ Participation in each program by children three and under increased substantially in the 2000s: WIC enrollment increased 29 percent,

Figure 2. Enrollment of Children Three and Under in WIC and SNAP, by Year



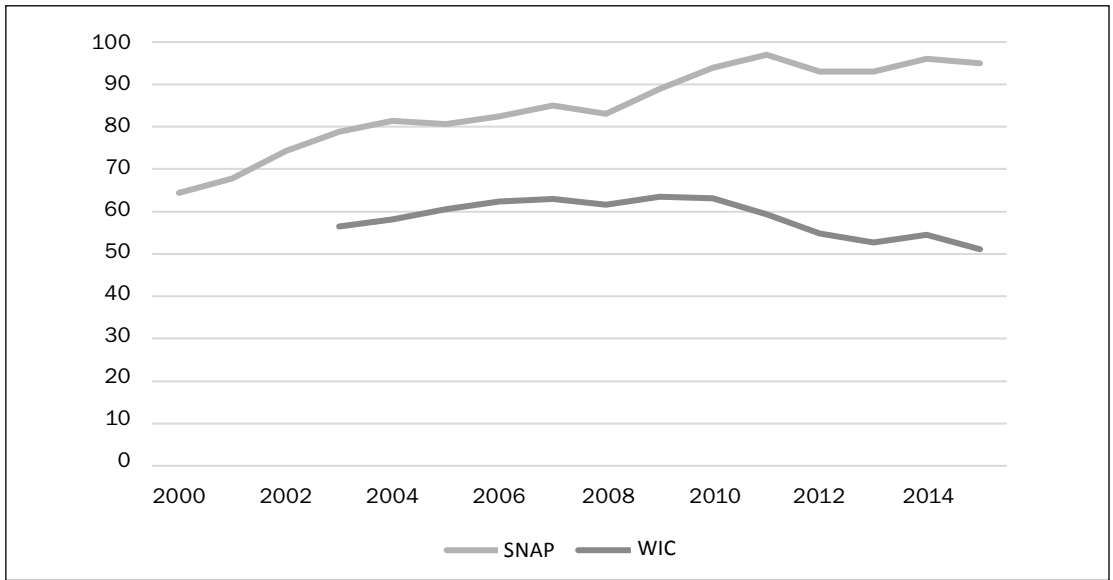
Sources: SNAP data from authors’ calculations from USDA FNS SNAP Quality Control data 2000-2018. WIC data from Nicole Kline et al., *WIC Participant and Program Characteristics 2018*, US Department of Agriculture, Food and Nutrition Service, 2020.

and SNAP enrollment more than doubled. WIC and SNAP enrollments peaked in 2010 and 2011, respectively, at the height of the recession. Before COVID-19, both had decreased to levels similar to those of the mid-2000s (see figure 2). A portion of benefits go unused. Only 87 percent of those enrolled in WIC claimed their benefits in a given month in 2016, and most households didn’t redeem those benefits for the full food package prescribed to them; 97 percent of SNAP benefits are spent within the month.⁸²

Variation in the number of participants is driven both by the number of people who have incomes low enough to qualify for the programs and the participation rate among those who are eligible. The participation rate can be increased by factors such as outreach and policies designed to reduce the burden associated with applying for and

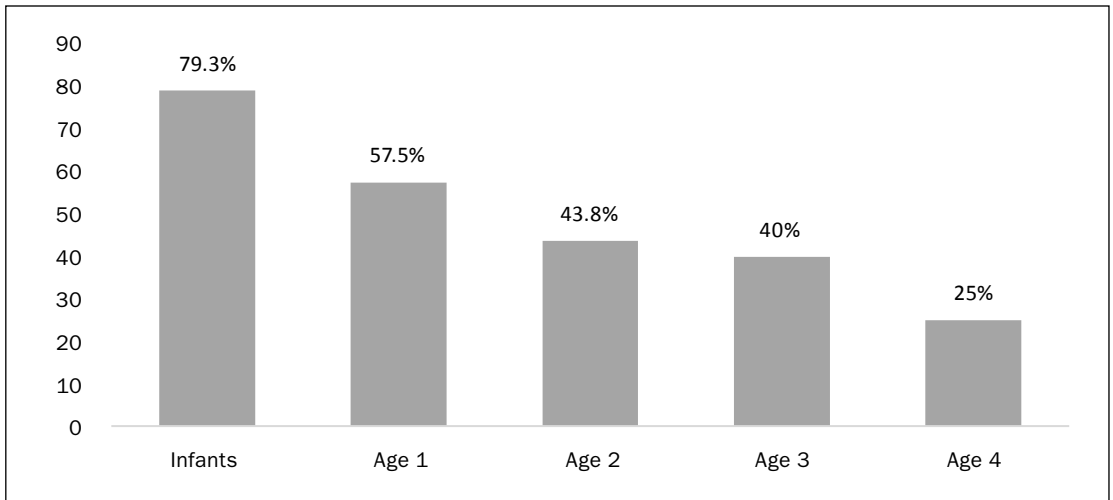
participating in the program. Figure 3 shows time trends in program participation rates among those eligible for WIC and SNAP. Participation in SNAP among the eligible population has been increasing in recent years, from 68 percent in 2002 to 95 percent in 2017 (due to data limitations, SNAP participation is calculated for all households with children, not just households with young children). Participation in WIC, by contrast, has dropped off over the last eight years, falling from a peak of 63.5 percent in 2011 to a low of 51 percent in 2017. As figure 4 shows, participation rates in WIC among the eligible population decline sharply by children’s age, ranging from 86 percent of infants to 40 percent of three-year-olds and 25 percent of four-year-olds.⁸³ Rates of participation in WIC also vary by race and ethnicity, from a low of 42.6 percent of eligible non-Hispanic whites to a high of 66.7 percent of eligible Hispanics.⁸⁴

Figure 3. Participation Rate in WIC and SNAP among Those Eligible



Sources: Data from the following reports. For SNAP: Joshua Leftin, *Trends in Supplemental Nutrition Assistance Program Participation Rates: 2001 to 2008*, Mathematica Policy Research, 2010; Alma Vigil, *Trends in Supplemental Nutrition Assistance Program participation Rates: Fiscal Year 2010 to Fiscal Year 2017*, Mathematica Policy Research, 2019. For WIC: Kelsey Gray et al., *National- and State-Level Estimates of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Eligibility and Program Reach in 2017*, US Department of Agriculture, Food and Nutrition Service, 2019.

Figure 4. Participation in WIC among Eligible Children, by Age (2017)



Sources: Data from Kelsey Gray et al., *National- and State-Level Estimates of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Eligibility and Program Reach in 2017*, US Department of Agriculture, Food and Nutrition Service, 2019.

Given the documented importance of having adequate food and the high levels of food insecurity among young children, an important question is how to improve

WIC’s and SNAP’s impacts on vulnerable children. One straightforward way would be to increase maximum SNAP benefits for families with young children. This

would yield a double dividend by reducing poverty for families with young children and improving those children's life trajectories.⁸⁵

For WIC, a primary concern is how to stem the decline in participation as children age. One hypothesis for the decline is that the costs of signing up for benefits, in terms of time and hassle, may discourage some families from remaining in the program. For example, in a sample of 10 states, 40 percent of families with multiple participating children must separately recertify each child, sometimes in different months. An estimated 28 percent of low-income families with young children have more than one child four and under, and the added transaction costs of multiple certification dates could be a meaningful barrier to them. Moreover, the WIC certification process is intensive: it requires height and weight measurements, a blood test, and a nutrition risk assessment for each participant. Another hypothesis is that families don't value the benefits sufficiently. The monthly value of the child's food package is \$43, but since recipients are restricted in the foods they can buy with the benefits, many families likely value the benefits at substantially lower than their face value. Many recipients report that it's hard and stigmatizing to use WIC benefits in grocery stores, which also diminishes their value.⁸⁶ Of course, the combination of these factors—the costs of signing up and the nature of the benefits package—likely has more of an impact than either one alone as families decide whether to continue to participate in WIC. It's worth noting that the decline in participation as children age is nearly uniform across income levels, even though the relative value of the food package is likely higher among the poorest families. This suggests that hassle factors, either at the point of signing up or at the point of use,

may be an important reason for the decline in participation.⁸⁷

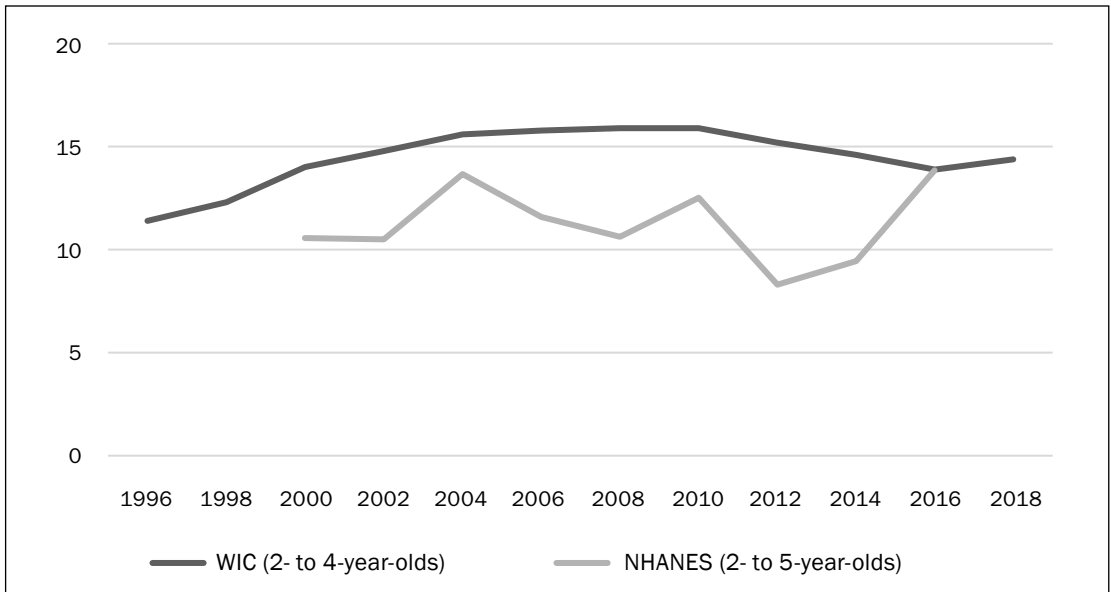
Another factor could be the nature of the current political and policy environment for immigrants. In particular, news reports have documented recent declines in participation in SNAP and WIC among households containing noncitizens, potentially due to the chilling effects of proposed changes to immigration policy.⁸⁸ Barriers to access to WIC, SNAP, or other programs that invest in early health are likely to harm health in the short run and both health and human capital in the longer run, and more vulnerable populations may be more at risk.⁸⁹

Obesity among Young Children

While much of our discussion to this point has been focused on a deficiency of food and nutrients, obesity is also a pressing public health concern. Children (and adults) can experience both simultaneously. For example, a recent study found that 10 percent of children in poverty are both obese and food insecure.⁹⁰

The overall prevalence of childhood obesity has more than tripled since the late 1970s; by 2016, 18.5 percent of US children were obese. According to Centers for Disease Control and Prevention statistics calculated from the National Health and Nutrition Examination Survey (NHANES), obesity among young children (defined as two- to five-year-olds) has increased more slowly than it has among older children. In 2016, 13.9 percent of two- to five-year-old children were obese, compared with 18.4 percent of six- to 11-year-olds and 20.6 percent of 12- to 19-year-olds.⁹¹ Some evidence suggests that obesity rates among the youngest children are declining, in contrast to older children, whose obesity rates have continued to rise in

Figure 5. Obesity among WIC Participants (Ages 2–4) and Nationally Representative Sample (Ages 2–5)



Sources: Nationally representative sample drawn from the National Health and Nutrition Examination Survey (NHANES). Source for NHANES data: Patricia M. Anderson et al., “Understanding Recent Trends in Childhood Obesity in the United States,” *Economics & Human Biology* 34 (2019): 16-25, <https://doi.org/10.1016/j.ehb.2019.02.002>.

the past decade.⁹² Although the NHANES data are nationally representative, they are calculated from a relatively small sample, which means that it’s hard to know whether changes in obesity from year to year are statistically meaningful.

We have more detailed information on obesity among WIC participants, because the height and weight of children must be reported as part of the application and recertification process. This yields a large dataset, with approximately six million observations in each biennial wave of WIC program data. These data allow researchers to examine obesity among racial and ethnic groups, such as Native Americans and Pacific Islanders, that cannot be reliably measured in smaller nationally representative datasets. A limitation, however, is that information is available only for WIC participants, and participation rates vary by children’s age, by

their race/ethnicity, and over time. Despite these limitations, this is the best source of data on obesity among young children.

As figure 5 shows, among the WIC sample, measured obesity among two- to four-year-old children increased substantially between 1996 and 2000. Between 2000 and 2010, the rate edged up slightly, but then we see a statistically significant decline for the period from 2014 to 2018 (compared to 2010). The decline has been significant for all children, but sharper among boys.⁹³ Figure 5 also includes obesity rates for a nationally representative but small sample of two- to five-year-old children from NHANES data. These data show lower estimated obesity rates, which is to be expected since WIC participants come from lower-income families among whom obesity rates are higher.⁹⁴ In addition, the nationally representative data show a large spike in

2016, while the WIC data continue to show a decline. Though the NHANES spike may be concerning, we need more data; due to its small sample size and considerable sampling variability, the change from 2016 to 2018 is not statistically significant. Blacks, whites and Asians have had similar rates of obesity since 2004, and for all three groups those rates were somewhat lower in 2016 than in 2004. Hispanics have also seen a decline in obesity rates between 2010 and 2016, though the level of obesity among Hispanics is substantially higher than among blacks and whites in the WIC data.

We can't be certain whether the drop in obesity in the WIC data stems from sample changes or from a true underlying improvement because at the same that obesity among WIC participants has fallen, the rate of participation in WIC has also declined. However, a recent study compared state-level changes in participation rates to state-level changes in obesity among WIC participants and found that changing caseload participation wasn't closely correlated with the observed drop in obesity rates. This suggests that the decline we see likely reflects a true shift in obesity's prevalence, at least among the low-income population.⁹⁵

In 2009, the WIC food package was revised, reducing the amounts of some items—notably fruit juices and also milk and cheese—and introducing fruits and vegetables, whole-grain foods, and low-fat milk. The revised food packages were also intended to promote breastfeeding by providing more supplemental foods to breastfeeding mothers. Comparing purchases before and after the food package revisions, recent studies have found that after the revisions, WIC households purchased more whole grains and that WIC participant

children had a higher Healthy Eating Index-2010 score and consumed fruits and vegetables more frequently.⁹⁶ Notably, WIC households also purchased less fruit juice. Before the change, WIC vouchers accounted for two-thirds of the total juice purchases in these households. Afterwards, juice purchases declined but by less than the decline in WIC vouchers, implying that families increased their purchases of juice (and other sweetened fruit drinks) using other resources.⁹⁷ Though the timing of the food package change lines up with the decrease in obesity in this population, we can't yet determine whether the relationship is causal due to challenges in isolating the effects of WIC participation from other factors.

Conclusions

Research has clearly documented the vital importance of nutrition in early life. Resources available to children during this critical period influence health and developmental outcomes throughout later childhood and into adulthood. As a result, it's particularly important that young children have adequate nutrition and resources, and, to the extent possible, be insulated from negative shocks such as economic recessions that could cause permanent harm to their health and other measures of wellbeing.

Dietary fortification of certain foods helps improve nutrient intake among young children overall and reduces the number of children who don't get enough of a number of vitamins and minerals needed for healthy development. The addition of folic acid to enriched grains beginning in 1998 means that more women of childbearing age are getting an adequate amount of this vitamin, which in turn has dramatically reduced neural tube

defects among newborns. Still, a sizeable share of Hispanic women don't get enough folic acid in their diets, and adding folic acid to more corn masa flour products would help address this shortfall and further reduce neural tube defects among Hispanics.

Given the importance of adequate nutrition in early life for later outcomes, it's particularly important to ensure that children from low-income families have access to the foods they need to grow and thrive. SNAP and WIC provide essential additional resources that allow families to purchase food for almost a third of young children. Research demonstrates that each of these programs has important positive impacts on children's nutrition, health, and wellbeing.

Many issues require urgent attention from researchers and policy makers. One set of issues surrounds participation in and adequacy of food support programs. We know little about what an optimal level of food support would be, but the fact that studies show sizeable returns to such support suggests that benefit levels are too low. In addition, participation in WIC dramatically declines as children age, but we don't know

much about the causes and consequences of this decline and what types of reforms would improve participation and children's outcomes. Given high rates of food insecurity and the documented importance of early life nutrition, we should explore reforms to enhance SNAP's and WIC's impact on young children. Furthermore, fully two-thirds of food insecure families (overall, not limited to those with children aged zero to three) have annual incomes greater than the federal poverty threshold. These families are generally ineligible for SNAP and WIC. Because it's important to shield young children from nutrition deprivation, it's worth investigating whether we're adequately protecting young children in families with incomes above the poverty line.

The scientific evidence is strong enough to conclude that resources available from conception through age three are an important investment in the future health and wellbeing of America's children. We need to protect all children, especially the most vulnerable, from food insecurity, inadequate nutritional intake, and negative shocks such as recessions.

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