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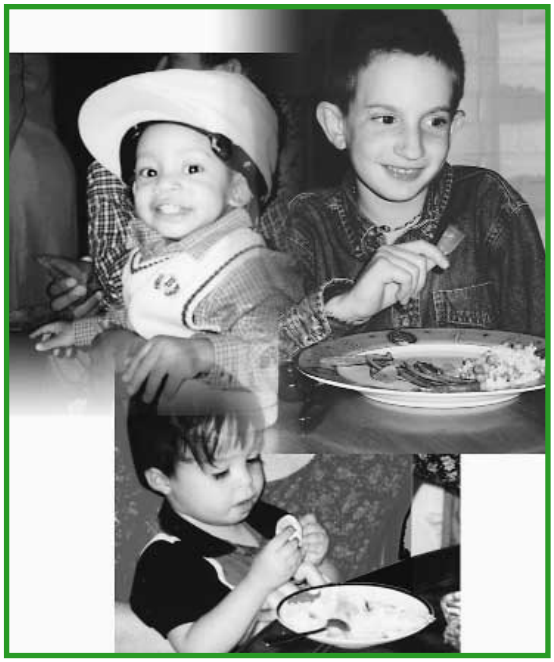

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A Look at America's Children and Their Families

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The number of children in the United States continued to grow in the last decade of the 20th century, though children now represent a smaller proportion of the Nation's total population than they did in the mid-1960s. Racial and ethnic diversity in the child population has increased dramatically in the last three decades. The structure of American families has also changed significantly, and more children today can expect to live in a single-parent family at some point in their lives due to both high rates of divorce and increased out-of-wedlock childbearing. Mother-only families are more apt to be poor. Trends in children's well-being over the past two to three decades have been mixed, with social changes such as later, more stable marriages and smaller families having positive implications for children.

The well-being of children is a multifaceted issue that is important for community planning because families are the building blocks of the community. An understanding of the social and economic well-being of children is important for shaping successful public policies to improve the condition of children and to help them attain their potential. For example, statistics on child poverty may assist in evaluating the effects of welfare reform. This article examines recent trends for children and their families, including the size and composition of the child population, family circumstances and living arrangements of children, and measures of the economic and physical well-being of children. Findings are based on data from the March 2000 Current Population Survey (CPS) data file and published data sources for previous years.

Number of Hispanic Children Increased Dramatically

The overall size of the child population in the United States has fluctuated markedly since the 1960s, reflecting the high fertility of the postwar baby boom (1946-64), the subsequent low fertility of the 1970s, and the increased fertility of the late 1980s. In 1980, the child population was 63.7 million, increasing to 64.2 million in 1990. Beginning in 1990, the rate of growth in the number of children increased, although not as rapidly as during the baby boom. Children under age 18 totaled 70.4 million in America in the year 2000; the U.S. Census Bureau projects the number of children will reach 77.2 million by 2020. The size of the child population determines the demand for schools, health care, and other services and facilities that serve children and their families.

Although the number of children continues to increase, children under age 18 now constitute a smaller, but still substantial, proportion of the U.S. population than in the 1960s. In the mid-1960s, the proportion of children peaked at 36 percent of the total population, but by 1980, children represented 28 percent of the total population, declining to 26 percent in 2000. As the Nation's population ages, the child population is projected to be a smaller share of the total, reaching 24 percent by 2020.

Racial and ethnic diversity has increased dramatically in the United States in the last three decades, and such diversity is projected to increase even more in the coming decades. The child population in the year 2000 contains a larger share of minority youth due to high Black and Hispanic fertility rates and substantial immigration of Hispanics and Caribbean Blacks to the United States. The proportion of children who are White, non-Hispanic decreased from 74 percent in 1980 to 64 percent in 2000, while the proportion of children who are minorities increased (table 1).

As a proportion of the U.S. child population, the shares of Black, non-Hispanic children and American Indian children have been fairly stable between 1980 and 2000. However, the percentage of Hispanic children has increased faster than any other racial and ethnic group,

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growing from 9 percent of the child population in 1980 to 16 percent in 2000. Much of the growth in the percentage of Hispanic children is due to the relatively high fertility of Hispanic women, particularly Mexicans, who have the highest fertility of all Hispanic groups. The percentage of Asian/Pacific Islander children doubled from 2 to 4 percent of all children between 1980 and 2000 and is projected to increase to 6 percent by 2020. Based on these racial/ethnic trends, the child population in 2020 is projected to decline for Whites, remain essentially the same for Blacks, and increase substantially for Hispanics and moderately for Asians.

Most U.S. children reside in urban areas, although racial/ethnic groups differ in residential concentration. White children are more likely to live in rural areas than Black children or Hispanic children (fig. 1). Among all children in 2000, the highest proportion (34 percent) resided in the South. Minority children tend to concentrate in certain regions, with over half of all Black children residing in the South and nearly half of all Hispanic children residing in the West.

Family Size Has Declined

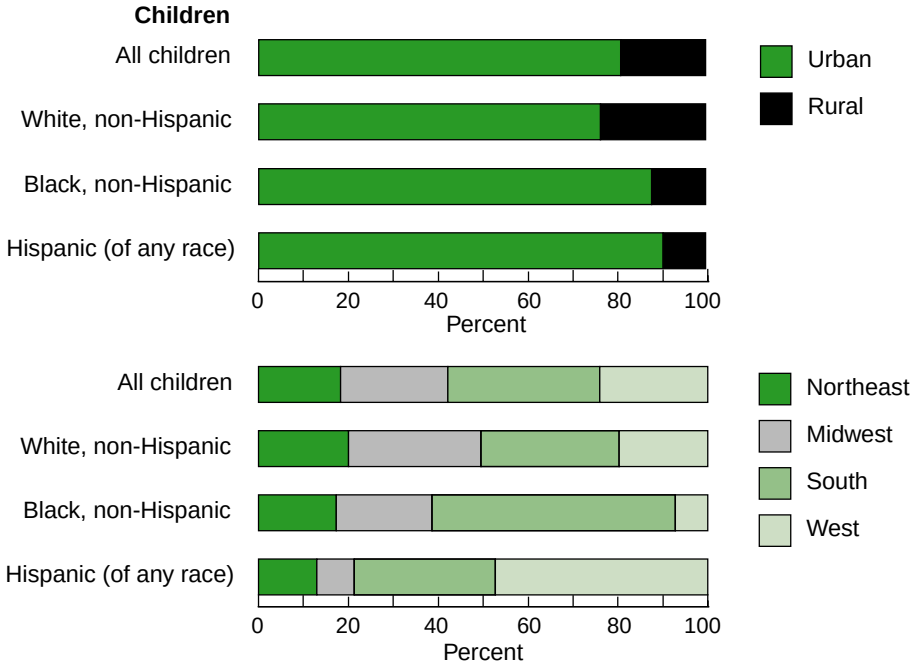
Changes in family composition and childbearing patterns have resulted in families that, on average, include fewer persons than in the past. Much of the decline in family size is due to lower fertility, fewer children per family, and more single-parent families. Average family size has declined steadily since 1960, and by 1998, families averaged 3.0 persons for Whites, 3.4 persons for Blacks, and 3.9 persons for Hispanics. A family is defined as a group of two or more persons who live in the same household and who are related by birth, marriage, or adoption. All racial/ethnic groups experienced declines in family size over

Table 1
Minority Children Represent an Increasing Share of the U.S. Child Population

Children	1980	1990	2000	2020 (Projection)
		Millions		
Total, under age 18	63.7	64.2	70.4	77.2
Ages:				
0-5	19.6	22.5	22.7	26.3
6-11	20.8	21.6	24.1	25.6
12-17	23.3	20.1	23.6	25.2
		Percent		
Race-ethnicity				
Under age 18:				
White, non-Hispanic	74	69	64	55
Black, non-Hispanic	15	15	15	14
Hispanic	9	12	16	23
Asian/Pacific Islander	2	3	4	6
American Indian/Alaska Native	1	1	1	1
Children as share of total U.S. population	28	26	26	24

Sources: U.S. Census Bureau, *Current Population Reports*, "Preliminary Estimates of the Population of the United States by Age, Sex, and Race: 1970 to 1981" (Series P-25, No. 917); "Estimates of the Population of the United States by Age, Sex, and Race: 1980 to 1985" (Series P-25, No. 985); unpublished estimates and projections from the Census Bureau Web site (www.census.gov/population/estimates/nation); and Federal Interagency Forum on Child and Family Statistics, *America's Children: Key National Indicators of Well-Being, 2000*, Web site (www.childstats.gov).

Figure 1
Most Children Under Age 18 Reside in Urban Areas



Source: Calculated by ERS from the March 2000 Current Population Survey.

time, although minority families remain larger than White families.

Minorities tend to have larger families than Whites, with Hispanics having the largest families. About 17 percent of both Black children and Hispanic children lived in families with three or more siblings, compared with 11 percent of White children. Larger families tend to reduce the amount of time and resources parents can devote to each child, although older siblings may help care for their younger brothers or sisters. By contrast, smaller families imply improved opportunities for educational, occupational, and economic advancement. Two-child families now constitute the most common family size. Within 25 years, Whites, Blacks, and Hispanics are expected to have nearly identical and comparatively smaller family sizes, with an average of less than two children per family.

More Children Today Live in Single-Parent Families

In 2000, 72 percent of U.S. children under age 18 lived in two-parent families, compared with 77 percent in 1980 (table 2). Minorities experienced living-arrangement changes similar to those among Whites, with declines in married-couple families and increases in mother-only families. The decline in the proportion of children in married-couple families reflects higher rates of marital disruption and divorce and increased childbearing and rearing by unmarried women.

Two-parent families represented a lower proportion of households in 2000 than in 1980 for all racial/ethnic groups. Blacks had the lowest proportion of married-couple families and the greatest decline in this proportion over time. Hispanics have generally followed the same trends of increasing family instability as Whites since 1960.

The increase in the number of mother-only families was one of the major changes in family composition during the 1970s, continuing in the 1980s but at a much slower pace. The proportion of children living with mothers only rose among all racial/ethnic groups from 16 percent in 1980 to 23 percent in 2000. Black children are more likely than White or Hispanic children to live in mother-only families; in 2000, 54 percent of Black children lived with their mother only, more than three times the percentage of White children. While only a small proportion of children live with their fathers only, this share, too, increased between 1980 and 2000. Based on late-1980s trends, 50 percent to perhaps 60 percent of children born in the late 1980s are projected to spend some part of their childhood living in single parent families.

Racial differences in the family living arrangements of children have grown since the 1960s. The proportion of White children living with two parents declined by 4 percentage points between 1980 and 2000, but it declined more for Blacks—6 percentage points. Mothers heading families alone often face multiple burdens, such as lower average incomes and higher unemployment. Never-married mothers are likely to have the additional disadvantages of younger age and less education. Furthermore, many children in mother-only families lack contact with or support from their fathers and must rely on government assistance for support.

Family structure has an enormous impact on the well-being of children. The number of parents living with a child is generally linked to the amount of human and economic resources available to that child. The households of children living with one parent are substantially more likely to have family incomes below the poverty line than are households of children living with two parents. One-parent families have an economic disadvantage because only one parent generates income and that effort is often limited by child care responsibilities. Children in single-parent families tend to face more disadvantages than children in intact two-parent families—they may receive less care and attention from parents; they tend to have

Table 2
Nearly 3 Out of 10 U.S. Children Live in Single-Parent Families

Children	1980	1990	2000
		Percent	
Living with both parents:			
All children	76.6	71.9	72.2
White, non-Hispanic	83.2	80.4	79.5
Black, non-Hispanic	46.9	37.0	41.1
Hispanic (of any race)	71.1	64.0	68.8
Living with mother only:			
All children	16.3	20.0	23.4
White, non-Hispanic	11.4	13.4	16.1
Black, non-Hispanic	39.2	49.3	54.2
Hispanic (of any race)	19.8	24.0	26.6
Living with father only:			
All children	2.0	3.9	4.4
White, non-Hispanic	2.0	3.3	4.4
Black, non-Hispanic	2.8	5.4	4.7
Hispanic (of any race)	1.6	5.9	4.6

Sources: U.S. Census Bureau, *Current Population Reports*, "Marital Status and Living Arrangements," annual reports for 1980 and 1990 (Series P-20); and unpublished estimates calculated by ERS from the March 2000 Current Population Survey.

High divorce rates and increased out-of-wedlock childbearing have made single-parent households, both mother-only and father-only, a fact of life for many U.S. children.

more school-related, health, and behavioral problems; they live in families with lower incomes; and they complete fewer years of schooling and earn less in future years.

The trend to marry at later ages may have a positive effect on the well-being of children as later marriages are more likely to endure than marriages that occur in the teenage years or the early twenties. Another change affecting the well-being of children is the increased probability of having mothers working for pay outside the home. Working mothers add to family income, which is particularly important for low-income families. Employed mothers also tend to have fewer children than unemployed mothers, and smaller families imply that more economic resources are available per child. As maternal employment has risen, the need for substitute care for the children of working mothers has increased and the location of this care has shifted outside of the child's home.

Child Poverty Declined Slightly in the 1990s

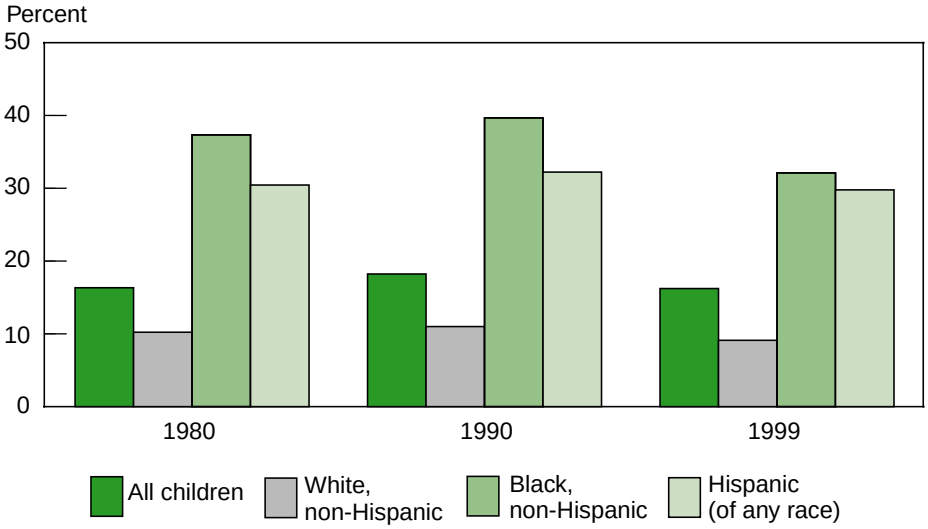
Assessing the economic well-being of children helps identify those in need of assistance and serves as a benchmark to evaluate the potential effects of welfare reform and other policies on the condition of children. In 1999, 11.5 million children under age 18 were poor, representing 37 percent of the poverty population. That year, the poverty threshold for a family of four (including two children) was $16,895. Many factors contribute to high child-poverty rates, including the reduced earnings of mothers as they work fewer hours to accommodate the presence of children, the assumption of greater household needs when children are present, and the explicit raising of the poverty threshold as family size increases, with fewer per child resources available in larger families.

Children have a higher probability of being poor than adults. In 1999, 16.2 percent of U.S. children were poor, compared with 11.8 percent of the general population. Still, despite fluctuations over time, poverty among children under age 18 has declined substantially since the early 1960s (when the rate was 27.3 percent).

The poverty rate among all racial/ethnic groups increased between 1980 and 1990 but declined by 1999 (fig. 2). Black children and Hispanic children are more likely to be poor than are White children and are over-represented in the count of poor children relative to their share in the general population. While most poor children are non-Hispanic Whites, the 1999 poverty rate for Black children (32 percent) or Hispanic children (30 percent) is much higher than the poverty rate for White children (9 percent).

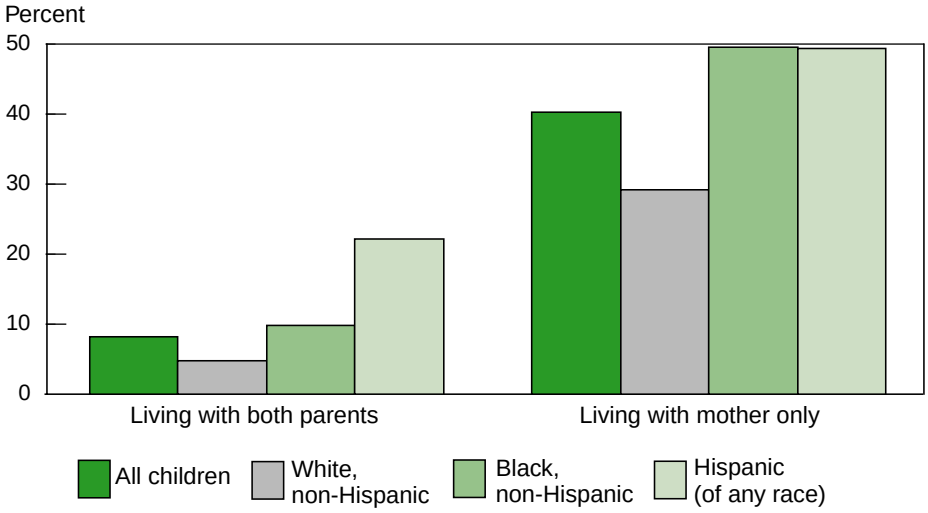
The gap in childhood poverty among races has decreased since the 1960s, but differences persist because a growing proportion of Black children lives in mother-only families. Children living with only their mothers have a greater chance of being poor than children living with two parents. In 1999, 40 percent of children in mother-only families were in poverty, compared with 8 percent of children in two-parent families (fig. 3). Among children in mother-only families, about half of Black children and Hispanic children are poor, compared with 29 percent of White children. The contrast by family structure is especially pronounced by racial/ethnic group. For example, in 1999, 10 percent of Black children in two-parent families were poor, compared with 50 percent of Black children in mother-only families. Children in

Figure 2
Child Poverty Rates Declined Slightly in the 1990s



Source: Calculated by ERS from the March 2000 Current Population Survey.

Figure 3
Children in Mother-Only Families Are Five Times More Likely To Be Poor



Source: Calculated by ERS from the March 2000 Current Population Survey.

mother-only families often suffer economically because their mothers usually have low earnings, their fathers often do not contribute to child support, and their financial assistance benefits may not cover their needs.

Childhood poverty has both immediate and long-term negative effects. Children in low-income families fare less well than children in more affluent families on many indicators of economic security, health, and education. Compared with children living in families above the poverty line, children living below the poverty line are more likely to have difficulty in school, to become teenage parents, and, as adults, to earn less and be unemployed more frequently. The cost of child poverty to the Nation is high because child poverty may affect the future productivity and competitiveness of the labor force.

Some Measures Show Children in Good Health

Several measures indicate that the overall physical health of children in the United States is better today than in 1960, although recent evidence shows an alarming increase in obesity and related diseases (see "Overweight Children: Is Parental Nutrition Knowledge a Factor?" elsewhere in this issue). Most children (81 percent) reported themselves in very good or excellent health in 1997 (self-reports of health have been found to track very closely with results of physical exams). Self-reported health status differs along the poverty line, however, with 68 percent of poor children rating their health as very good or excellent, compared with 86 percent of children at or above the poverty line. Furthermore, the infant mortality rate—the proportion of babies who die within the first year of life—declined from 26.0 in 1960 to 6.9 in 1999, according to the U.S. Department of Health and Human Services. Although infant mortality rates have improved for both Blacks and Whites, a gap among races persists. In general, Black and Hispanic children, especially those in central cities or rural areas, are less healthy than White children. Poor children and children with less-educated parents tend to be less healthy than children of better educated, affluent parents.

Most children age 19-35 months have been vaccinated for selected diseases. As of 1998, 79 percent of these young children had been vaccinated in the combined series consisting of diphtheria and tetanus toxoids and pertussis vaccine, polio vaccine, a measles-containing vaccine, and *Haemophilus influenzae* type b vaccine. White children (82 percent) were more likely to have been vaccinated than were Black children (73 percent) and Hispanic children (75 percent). Seventy-four percent of children below the poverty level were vaccinated, compared with 82 percent at or above the poverty level.

Children's good health and development depend on a diet sufficient in nutrients and calories. Food security has been defined as access at all times to enough nourishment for an active, healthy life. A family's ability to provide for children's nutritional needs is linked to income or other resources and secure access to adequate, nutritious food without relying on emergency feeding programs or resorting to scavenging or stealing. According to USDA's Economic Research Service, 3.8 percent of children in 1999 lived in households experiencing food insecurity with hunger, a level of food deprivation so severe that one or more household members were hungry at times because they could not afford enough food. The number of children in food-insecure households with hunger who actually experience hunger themselves is significantly smaller than the total number of children living in such households because in most of these households the adults go without food, if necessary, so that the children will have food.

Most food-insecure households do not report actual hunger; in 1999, 13.1 percent of all children and 32.2 percent of poor children lived in households experiencing food

insecurity without hunger. Food-insecure households without hunger have difficulty obtaining food, lower quality diets, and anxiety about their food supply, and increasingly rely on emergency food sources.

Children with access to health care have reasonable assurance of obtaining the medical and dental attention needed to maintain their physical well-being. Health care access involves both the availability of a regular source of care and the ability of the child's family to pay for it. The Census Bureau shows that in 1999, 23 percent of children from families below the poverty line were not covered by some form of health insurance; of the Nation's total child population, 14 percent had no health insurance. Health insurance coverage also varies by racial/ethnic group, with 9 percent of White, non-Hispanic children uninsured, 18 percent of Black, non-Hispanic children uninsured, and 27 percent of Hispanic children uninsured. The percentage of children who have health insurance coverage at least part of the year is one measure of the extent to which families can obtain preventive care or health care for a sick or injured child.

Indicators of Children's Well-Being Are Mixed

The family remains the central institution in children's lives. The family environment and the financial resources available to children as they grow up will affect both their educational attainment and future productivity in the workforce. Trends in children's well-being have been mixed, with improvement and stability in some areas but deterioration in others.

Increases in maternal employment have resulted in greater family incomes for at least two-parent families, as well as a greater demand for child care outside the home. Family disruptions, such as divorce, and out-of-wedlock childbearing and rearing have also increased over time, resulting in a greater number of children being raised in single-parent, most often mother-only, families. Other trends, such as higher levels of parental education, later marriages, and smaller families, are generally positive for children. Fewer children imply less competition for resources in the home as well as social services for children, such as public schooling.

Recent demographic changes in American society, such as increases in both maternal employment and mother-only families, imply changing demands for services such as child care and a need for more convenience services for working parents. The future of America's children will depend on how families adapt to meet their needs. An understanding of the impact of the increase in mother-only families on child poverty is important in planning welfare and program assistance such as food stamps, free school meal programs, and health insurance coverage. Because of the increased racial/ethnic diversity of the child population and the large proportion of minority children who are poor, policymakers will need to pay greater attention to the needs of America's minority children to ensure their health and access to education, training, and other resources.

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American Children's Diets Not Making the Grade

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Many health professionals are concerned about the quality of children's diets in the United States. A varied diet is one of the keys to good nutrition, but many children are choosing foods high in fat or added sugars at the expense of nutrient-dense fruits, vegetables, whole grains, and other foods. These diet choices may be exacerbating the trend toward increasing obesity and other health problems among the Nation's young people.

Where children obtain foods can affect their food choices. Between 1977 and 1996, eating out became a much larger part of American children's lives, posing a growing challenge to the nutritional quality of their diets. An American child's diet typically contains too much fat, saturated fat, and sodium, and not enough fiber and calcium—characteristics more likely associated with away-from-home foods than home foods. School meals, which provide high amounts of fiber and calcium, are the only away-from-home exception. Excessive intakes of fat and saturated fat are common problems facing children of all ages and both genders, but some dietary deficiencies vary by age and gender. Excessive intake of cholesterol and sodium is a problem facing many male teens, while insufficient intake of iron and calcium is a major dietary problem for female teens.

Away-from-home foods and home foods are defined by where the foods are obtained, not where they are eaten. Home foods are purchased at retail stores, such as grocery stores or supermarkets. Away-from-home foods consist of foods obtained from foodservice and entertainment establishments. Away-from-home foods are classified into four groups: "restaurants," or places with waiter service; "fast food," such as self-service and carry-out eating places and cafeterias; "schools," including day care centers and summer camps; and "others," which include vending machines, community feeding programs, and someone else's home.

The information for this article is obtained from food consumption surveys conducted by USDA since 1977, including Nationwide Food Consumption Surveys 1977-78 and 1987-88 (NFCS 1977-78 and NFCS 1987-88) and Continuing Survey of Food Intakes by Individuals 1989-91 and 1994-96 (CSFII 1989-91 and CSFII 1994-96). These surveys collect information on what, when, where, and how much Americans eat. Data are collected from a nationwide sample, which yields results representing the American population. USDA's Agricultural Research Service (ARS) maintains a nutrient database, which is used to calculate the amount of nutrients in each food eaten. This article analyzed 1-day individual intakes for children age 2-17, with particular emphasis on meal and snack patterns and sources of foods. Children were grouped into four categories according to their gender and age: children age 2-5, children age 6-11, males age 12-17, and females age 12-17.

Fast Foods Contributing More Calories to Children's Diets

The number of meals eaten by children age 2-17 has been stable at 2.8 meals per day over the past two decades. However, children are snacking more frequently and these snacks are increasingly being obtained away from home. In 1977-78, children ate 1.1 snacks per day, compared with 1.8 snacks in 1994-96. Older children ate fewer meals and snacked less frequently than younger children. For example, teenagers ate 2.6 meals and 1.6 snacks per day during 1994-96 and pre-school children age 2-5 ate 2.9 meals and 2.1 snacks per day. Twenty percent of children's snacks were obtained away from home in 1994-96, up from 13 percent in 1977-

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78. During 1994-96, schools and fast food places evenly split a 35-percent share of away-from-home snacks. Snacking at someone else's home is also popular with children.

Over the past two decades, the proportion of meals eaten away from home by children rose from 17 percent in 1977-78 to 30 percent in 1994-96. In the same period, preschool children more than doubled their meals eaten away from home, from 10 percent to 22 percent. During 1994-96, school-age children ate about 33 percent of their meals away from home. As children start schooling, they can participate in the School Breakfast Program and the National School Lunch Program. These programs provided meals to about 26 million school children each day in 1996. Younger children who attend licensed day care centers and family day care homes and children in summer camps and after-school programs also can obtain meals and snacks through USDA food assistance programs. As with school meals, these meals and snacks must meet nutritional standards set by USDA's Food and Nutrition Service (FNS). However, children at school also can obtain a la carte items from school cafeterias or vending machines, which do not have to meet USDA standards. In this article, all foods obtained at school, regardless of requirement for meeting USDA standards, are included in school meals and snacks.

During 1977-78, school meals accounted for 63 percent of all meals children ate away from home. This proportion declined to 36 percent in 1994-96 due to the increasing popularity of eating at fast food places and restaurants. In 1977-78, only 1 in every 10 meals eaten away from home by children was purchased at a fast food place; this proportion rose to 1 in every 3 away-from-home meals in 1994-96. Restaurants increased their representation of the away-from-home meals consumed by children from 4 percent in 1977-78 to 11 percent in 1994-96.

As children eat out more frequently, the nutritional quality of away-from-home food plays an increasingly important role in determining the overall quality of their diets. In 1977-78, home foods accounted for 80 percent of total calories consumed by children. This percentage declined steadily to 68 in 1994-96 (table 1). Fast food places, which boosted the popularity of eating out, accounted for only 2 percent of children's total caloric consumption in 1977-78 but 10 percent in 1994-96. During the same period, restaurants increased their share of children's caloric intake from 1 percent to 4 percent. School meals, however, reduced their contribution to children's caloric consumption from 11 percent in 1977-78 to 9 percent in 1994-96.

Comparing Nutritional Quality of Foods

We compared the nutritional quality of foods from various sources using the nutrient-to-calorie (or nutrient) density, which measures the amount of a nutrient or food component for each 1,000 calories of that food. Because dietary recommendations for fat and saturated fat

Table 1
Fast Food Has Become Children's Preference for Eating Out

Food source by age group	1977-78	1987-88	1989-91	1994-96
	Percent of total caloric intake			
Age 2-17:				
Home foods	80	73	71	68
Away-from-home foods[1]	20	27	29	32
Fast food	2	7	8	10
Schools[2]	11	10	10	9
Restaurants	1	1	3	4
Others	6	8	9	8
Age 2-5:				
Home foods	88	84	78	76
Away-from-home foods	12	16	22	24
Fast food	2	4	6	7
Schools	3	3	6	7
Age 6-11:				
Home foods	79	71	70	68
Away-from-home foods	21	29	30	32
Fast food	2	6	7	9
Schools	14	14	12	11
Males age 12-17:				
Home foods	80	69	72	65
Away-from-home foods	20	31	28	35
Fast food	3	11	8	14
Schools	12	11	10	9
Females age 12-17:				
Home foods	78	71	67	65
Away-from-home foods	22	29	33	35
Fast food	3	9	10	11
Schools	11	10	11	8

[1]The categories "restaurant" and "others" are dropped for children by age and gender due to limited number of observations.
[2]Schools include day care centers and camps.
Sources: Compiled by USDA's Economic Research Service from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, CSFII 1994-96, 1-day data.

are expressed as a percentage of total calories consumed, we used the proportion of total calories that come from fat and from saturated fat as measures of the fat and saturated fat densities.

For each nutrient or food component, we also derived a "benchmark" density by dividing the recommendation for a given nutrient or food component by an individual's reported caloric intake in 1,000 calories. The benchmark density represents the nutrient density necessary for an individual's diet to meet the dietary recommendation at the reported caloric-intake level.

We used dietary recommendations from the 2000 edition of the *Dietary Guidelines for Americans* and other health authorities to derive the benchmark densities for seven nutrients and dietary components: fat, saturated fat, cholesterol, sodium, fiber, calcium, and iron (only fat, calcium, and iron were reported in NFCS 1977-78). The *Dietary Guidelines for Americans* defines benchmark densities for fat and saturated fat—fat intake should not exceed 30 percent of total calories and saturated fat should be less than 10 percent of total calories. The benchmark densities for cholesterol, sodium, fiber, calcium, and iron vary according to the reported caloric intakes (table 2). For example, to meet the dietary recommendations in 1994-96, children age 2-17 should consume at least 7.3 grams of dietary fiber, 530 milligrams of calcium, and 5.8 milligrams of iron for each 1,000-caloric intake. Children age 2-17 should limit their cholesterol and sodium consumption to no more than 153 and 1,222 milligrams, respectively, for each 1,000-caloric intake.

We calculated benchmark densities for specific groups of children by dividing the sum of the recom-

Table 2
Benchmark Nutrient Densities for Children Vary by Age and Gender

Age group	Benchmark nutrient density[1]				
	Cholesterol	Sodium	Fiber	Calcium	Iron
	Milligrams per 1,000 calories		*Grams per 1,000 calories*	*Milligrams per 1,000 calories*	
1977-78:					
Age 2-17	-	-	-	564	6.2
Age 2-5	-	-	-	467	7.1
Age 6-11	-	-	-	563	5.7
Males age 12-17	-	-	-	516	4.8
Females age 12-17	-	-	-	707	8.2
1987-88:					
Age 2-17	170	1,363	8.2	589	6.5
Age 2-5	224	1,795	6.3	490	7.5
Age 6-11	169	1,349	7.6	586	6.0
Males age 12-17	127	1,016	8.3	550	5.1
Females age 12-17	175	1,399	11.4	758	8.7
1989-91:					
Age 2-17	164	1,313	7.7	560	6.2
Age 2-5	212	1,697	6.0	458	7.1
Age 6-11	161	1,288	7.2	565	5.7
Males age 12-17	124	990	8.1	536	4.9
Females age 12-17	165	1,324	10.8	717	8.3
1994-96:					
Age 2-17	153	1,222	7.3	530	5.8
Age 2-5	197	1,572	5.6	427	6.6
Age 6-11	156	1,251	7.1	553	5.5
Males age 12-17	110	877	7.1	475	4.4
Females age 12-17	159	1,270	10.3	688	7.9

- = Intakes of cholesterol, sodium, and fiber were not reported in the NFCS 1977-78.

[1]Benchmark densities are obtained by dividing the recommended intake for each nutrient by the individual's reported food energy intake. The benchmark densities for specific groups of individuals are the ratios of the sum of recommended intakes for all individuals to the sum of their food energy intakes.

Sources: Compiled by USDA's Economic Research Service from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, CSFII 1994-95, 1-day data.

mended intakes for all children in the group by the sum of their reported caloric intakes. Due to limited numbers of surveyed children who reported eating at restaurants, nutrient content of restaurant foods is reported only for all children age 2-17, not for age and gender. Also, due to lack of interpretive value, nutrient content of the others category is not reported.

Children Need To Trim Fat Intakes, Especially When Eating Out

Although children have reduced their fat intake since 1977, they still consume too much fat and saturated fat. In 1994-96, fat accounted for 33 percent of children's total caloric consumption, down from 39 percent in 1977-78. Children obtained 12 percent of calories from saturated fat in 1994-96, compared with 13 percent in 1987-88. During 1994-96, 37 percent of children met the recommendation for fat intake and 31 percent of children met the recommendation for saturated fat intake (table 3).

Over the past two decades, foods eaten by children at home have become less dense in fat than foods eaten away from home. In 1994-96, away-from-home foods had 36 percent of calories from fat, higher than the 32 percent for home foods. Foods obtained by children at fast food places, schools, and restaurants were much more dense in fat than foods children ate at home (table 4).

Similarly, away-from-home foods were higher in saturated fat than home foods. Foods that children obtained at schools in 1994-96 were lower in total fat, but higher in saturated fat, than foods from fast food places and restaurants. In 1994-96, total fat contributed 36 percent of total calories from school foods, compared with 38 percent for foods from fast food places or restaurants. Saturated fat contributed 14.4 percent of calories from school foods in 1994-96, compared with 13.6 percent for foods from fast food places and 12.5 percent for restaurant foods.

USDA's School Meals Initiative for Healthy Children of 1994 aims to lower the fat and saturated fat content of school meals to levels consistent with recommendations of the *Dietary Guidelines for Americans*. The initiative was not put in place until the fall of 1996, and many schools received permission to delay its implementation; therefore, these data do not represent the effects of its implementation. A recent study commissioned by USDA's FNS shows significant reductions in fat and saturated fat in school meals offered between 1991-92 and 1998-99, but fat content in school meals still exceeds the recommended level. For example, lunches served to ele-

Table 3
Children Reduced Their Fat Intake But Are Still Over the Recommended Allowance

Years	Food energy	Total fat	Saturated fat	Chole-sterol	Sodium	Fiber	Calcium	Iron
	Calories	*Grams*		*Milligrams*		*Grams*	*Milligrams*	
Average daily intake:								
1977-78	1,900	83.2	-	-	-	-	921	11.1
1987-88	1,761	70.3	26.2	253	2,846	11.4	897	13.0
1989-91	1,827	70.1	26.8	238	3,006	12.4	925	13.3
1994-96	1,964	72.0	26.2	225	3,094	13.1	908	14.9
				Percent				
Intake as share of recommendation:								
1977-78	90	129	-	-	-	-	92	96
1987-88	86	118	132	84	119	84	94	115
1989-91	90	113	130	79	125	93	99	119
1994-96	95	108	119	75	129	97	95	132
				Percent				
Share of children meeting the recommendation:								
1977-78	33	14	-	-	-	-	37	39
1987-88	28	20	14	73	45	30	38	47
1989-91	35	30	20	76	40	35	40	51
1994-96	38	37	31	77	39	39	37	59

- = Intakes of saturated fat, cholesterol, sodium, and fiber were not reported in NFCS 1977-78.
Sources: Compiled by USDA's Economic Research Service from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, CSFII 2994-96, 1-day data for children age 2-17.

mentary school children in 1998-99 contained 33 percent of calories from total fat and 12 percent of calories from saturated fat.

Restaurant Foods High in Cholesterol, Sodium

Many health authorities recommend that daily cholesterol intake should not exceed 300 milligrams (mg). The U.S. Food and Drug Administration (FDA) uses this recommendation to set the daily value for cholesterol on nutrition labeling. Cholesterol intake was first reported in the 1987-88 NFCS. From 1987 to 1996, children's cholesterol intake declined and the proportion of children meeting the recommendation rose.

Cholesterol density (the amount of cholesterol per 1,000 calories) in home and away-from-home foods has declined since 1987 (table 5). In 1994-96, foods eaten by children had a cholesterol density of 115 mg, lower than the 153-mg benchmark. In 1994-96, foods prepared at restaurants contained more cholesterol than foods prepared at home or other away-from-home sources.

Foods eaten by boys age 12-17 contained 114 mg of cholesterol per 1,000 calories, higher than the 110-mg benchmark. Excessive cholesterol consumption is more of a problem for teenage boys, who tend to consume more food than other children. The recommended cholesterol intake is set at 300 mg per day for all individuals, regardless of age and gender. During 1994-96, 63 percent of male teens met the cholesterol recommendation, compared with 84 percent of pre-school children.

The National Academy of Sciences' *Diet and Health* recommends an upper limit of 2,400 mg of sodium per day, regardless of age or gender. Sodium intakes in the NFCS and CSFII include sodium occurring naturally in foods, as well as that added via food processing and preparation. Intakes reported do not include sodium added at the table.

Table 4
Children's Food Choices at Home Lower in Fat and Saturated Fat Than Away From Home

Food source by age group	Share of calories from fat				Share of calories from saturated fat			
	1977-78	1987-88	1989-91	1994-96	1977-78	1987-88	1989-91	1994-96
	Percent							
Age 2-17	39.4	36.0	34.5	33.0	-	13.4	13.2	12.0
Home foods	39.4	35.2	33.7	31.6	-	13.0	12.7	11.5
Away-from-home foods	39.5	38.0	36.6	36.1	-	14.5	14.4	13.2
Fast food	38.9	38.8	38.4	38.2	-	15.5	14.4	13.6
Schools	40.1	38.0	37.1	36.3	-	13.9	15.5	14.4
Restaurants	42.2	40.5	37.4	38.1	-	15.2	14.1	12.5
Age 2-5	38.1	34.6	33.6	32.7	-	12.8	13.2	12.4
Home foods	38.1	34.3	32.8	31.6	-	12.6	13.0	12.1
Away-from-home foods	37.9	36.4	36.1	36.0	-	14.0	14.0	13.3
Fast food	39.1	37.9	37.2	38.4	-	15.6	14.2	13.7
Schools	38.8	37.4	35.7	33.2	-	13.9	14.3	13.2
Age 6-11	38.9	35.9	34.4	33.0	-	13.3	13.3	12.1
Home foods	38.8	35.1	33.6	31.5	-	12.8	12.7	11.5
Away-from-home foods	39.4	37.8	36.5	35.9	-	14.4	14.5	13.4
Fast food	38.7	39.8	39.3	37.9	-	16.0	14.7	13.4
Schools	39.8	37.5	36.7	35.9	-	13.8	15.4	14.7
Males age 12-17	40.3	36.6	35.3	33.7	-	13.7	13.2	12.0
Home foods	40.4	35.7	34.6	32.1	-	13.2	12.6	11.3
Away-from-home foods	40.1	38.6	37.2	36.6	-	14.7	14.7	13.4
Fast food	38.8	38.7	38.7	38.2	-	15.4	15.1	13.7
Schools	40.6	38.8	39.6	38.3	-	14.0	16.9	15.2
Females age 12-17	40.1	36.6	34.9	32.5	-	13.8	12.9	11.5
Home foods	40.1	35.9	34.0	30.7	-	13.4	12.4	11.0
Away-from-home foods	39.8	38.4	36.6	35.8	-	14.6	14.0	12.4
Fast food	39.0	37.8	37.4	38.2	-	15.0	13.4	13.6
Schools	40.4	38.3	36.3	37.4	-	13.8	14.8	13.6

- = Saturated fat intake was not reported in NFCS 1977-78.
Notes: The category "others" in away from home is dropped due to limited interpretive value. The category "restaurants" for children by age and gender has also been dropped due to the small number of observations.
Sources: Compiled by USDA's Economic Research Service from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, CSFII 1994-96, 1-day data.

The USDA surveys first measured sodium content in 1987-88.

Children's sodium intake has increased since 1987 as their food consumption has increased (table 3). The proportion of children meeting the sodium recommendation declined from 45 percent in 1987-88 to 40 percent in 1989-91 and to 39 percent in 1994-96.

As with cholesterol, excessive consumption of sodium is more common among teenage boys than other children. Teen boys consumed an average of 2,726 calories and 4,371 mg of sodium per day during 1994-96, resulting in a sodium density of 1,598 mg per 1,000 calories. The 1994-96 sodium-density benchmark is 877 mg for teenage boys. Only 18 percent of male teens consumed less than 2,400 mg of sodium per day during 1994-96, compared with 58 percent of pre-school children and 37 percent of children age 6-11.

Foods eaten by children during 1994-96 contained 1,575 mg of sodium per 1,000 calories (table 5), almost 30 percent higher than the 1,222-mg benchmark. Home foods eaten by children contained 1,570 mg of sodium per 1,000 calories, less than the 1,588 mg in away-from-home foods. School meals contained less sodium than foods prepared at fast food places or restaurants but still exceeded the 1994-96 1,222-mg benchmark. Restaurant foods had a sodium density of 1,721 mg per 1,000 calories during 1994-96, which is more than 40 percent higher than the benchmark.

Overconsumption of sodium is a problem for most consumers, except young children and elderly women. Children, as well as other consumers, have to make a greater effort to reduce the amount of sodium in foods they eat at home and away from home.

School Foods Lead in Fiber, Calcium

The American Health Foundation recommends a dietary fiber intake of "age plus five" for children age 2 and older. For example, 15 grams of dietary fiber each day is recom-

Table 5
Male Teens Consume Too Much Cholesterol and Sodium

Food source by age group	Cholesterol 1987-88	Cholesterol 1989-91	Cholesterol 1994-96	Sodium 1987-88	Sodium 1989-91	Sodium 1994-96
	Milligrams per 1,000 calories					
Age 2-17	143	130	115	1,616	1,645	1,575
Home foods	149	134	118	1,637	1,676	1,570
Away-from-home foods	129	121	106	1,561	1,567	1,588
Fast food	125	115	101	1,484	1,582	1,621
Schools	121	117	104	1,604	1,510	1,607
Restaurants	176	174	142	1,674	1,852	1,721
Age 2-5	142	135	121	1,558	1,612	1,555
Home foods	145	139	124	1,572	1,631	1,541
Away-from-home foods	126	121	111	1,483	1,542	1,601
Fast food	97	103	104	1,380	1,488	1,602
Schools	118	105	106	1,561	1,473	1,562
Age 6-11	143	130	112	1,594	1,626	1,563
Home foods	148	137	115	1,613	1,654	1,550
Away-from-home foods	132	116	105	1,547	1,563	1,591
Fast food	143	121	96	1,451	1,545	1,621
Schools	122	120	108	1,612	1,542	1,629
Males age 12-17	144	131	114	1,645	1,697	1,598
Home foods	151	130	117	1,690	1,727	1,609
Away-from-home foods	128	134	107	1,546	1,621	1,578
Fast food	126	119	104	1,485	1,767	1,602
Schools	119	123	100	1,591	1,494	1,634
Females age 12-17	145	123	114	1,687	1,662	1,592
Home foods	153	127	120	1,697	1,727	1,595
Away-from-home foods	126	114	103	1,662	1,534	1,587
Fast food	113	109	102	1,578	1,524	1,672
Schools	120	111	93	1,618	1,460	1,541

Sources: Compiled by USDA's Economic Research Service from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, CSFII 1994-96, 1-day data.

mended for a 10-year-old child. Since 1987, children have increased their consumption of dietary fiber from 11.4 grams per day in 1987-88 to 12.4 grams in 1989-91 and to 13.1 grams during 1994-96. In 1994-96, the average consumption amounted to 97 percent of the recommended level but only 39 percent of children met the recommendation.

Based on a daily intake of 1,964 calories in 1994-96, the fiber-density benchmark is 7.3 grams per 1,000 calories for all children. Foods eaten by children during 1994-96 contained 6.7 grams of fiber per 1,000 calories, with 6.9 grams from home foods and 6.2 grams from away-from-home foods (table 6). While school meals had the highest fiber density of away-from-home foods (7.1 grams per 1,000 calories in 1994-96), the fiber density of school meals was higher in 1989-91 with 7.7 grams per 1,000 calories. In light of the increased popularity of eating out, the relatively low fiber density in fast food (5.6 grams) and restaurant foods (6.2 grams) indicates that it may become more difficult to close the gap between actual and recommended fiber consumption.

Recommended levels of fiber intake rise with age for children, regardless of gender. A larger proportion of older children failed to meet the fiber recommendation than younger children. During 1994-96, 57 percent of pre-school children met the fiber recommendation, whereas only 33 percent of male teens and 18 percent of female teens met the recommendation. With a daily intake of 1,890 calories in 1994-96, female teens needed 10.3 grams of fiber per 1,000 calories in order to meet their recommendation, compared with 7.1 grams of fiber for male teens. Teenage girls consumed only 6.9 grams of fiber per 1,000 calories, about two-thirds of the benchmark level. Teenage boys consumed slightly less, 6.3 grams of fiber per 1,000 calories, equivalent to 88 percent of their benchmark level.

School meals consumed by children under 12 were rich in fiber. For example, children age 6-11 obtained 7.6 grams of fiber per 1,000 calories

Table 6
Older Children Made Poorer Food Choices at School Than Younger Children

Food source by age group	Fiber			Calcium				Iron			
	1987-88	1989-91	1994-96	1977-78	1987-88	1989-91	1994-96	1977-78	1987-88	1989-91	1994-96
	Grams per 1,000 calories			*Milligrams per 1,000 calories*							
Age 2-17	6.4	6.8	6.7	485	509	506	462	5.8	7.4	7.3	7.6
Home foods	6.6	6.9	6.9	479	520	518	474	6.0	8.0	7.9	8.3
Away-from-home foods	6.2	6.5	6.2	507	480	476	437	5.1	5.7	5.6	6.0
Fast food	4.9	5.5	5.6	310	338	343	357	5.1	5.4	5.5	5.9
Schools	7.6	7.7	7.1	643	648	640	662	5.0	5.4	5.6	6.2
Restaurants	5.2	5.4	6.2	327	341	416	336	5.4	5.7	5.7	6.1
Age 2-5	6.4	6.7	6.8	534	569	575	528	5.9	7.6	7.6	7.9
Home foods	6.4	6.8	6.9	543	593	601	552	6.0	7.9	8.1	8.3
Away-from-home foods	6.2	6.5	6.6	472	442	483	451	5.2	5.9	6.0	6.4
Fast food	5.7	5.7	5.5	317	261	351	366	5.1	5.0	5.1	6.0
Schools	7.4	7.9	8.0	645	675	622	657	5.0	5.8	6.7	7.1
Age 6-11	6.7	6.9	6.7	499	517	509	476	5.9	7.4	7.2	7.9
Home foods	6.8	6.9	6.9	485	522	516	472	6.1	8.0	7.9	8.7
Away-from-home foods	6.5	6.7	6.4	551	505	494	486	5.1	5.9	5.5	6.2
Fast food	4.5	5.5	5.7	292	323	334	353	5.2	5.4	5.5	5.9
Schools	7.9	8.0	7.6	673	646	651	743	5.0	5.6	5.5	6.4
Males age 12-17	6.2	6.6	6.3	467	483	477	427	5.8	7.6	7.3	7.2
Home foods	6.5	6.9	6.6	458	493	475	437	5.9	8.6	8.0	8.0
Away-from-home foods	5.8	6.1	5.7	499	461	482	407	5.0	5.4	5.6	5.8
Fast food	4.8	5.2	5.2	334	329	401	353	5.0	5.6	5.7	6.0
Schools	7.7	7.2	6.3	625	618	684	619	4.9	5.3	5.2	5.6
Females age 12-17	6.2	6.8	6.9	447	466	449	408	5.7	6.7	6.8	7.1
Home foods	6.3	7.0	7.2	443	460	461	426	5.9	7.2	7.5	7.9
Away-from-home foods	5.9	6.4	6.2	462	479	426	375	5.0	5.4	5.6	5.7
Fast food	5.0	5.5	6.1	297	414	291	367	5.0	5.3	5.4	5.9
Schools	6.6	7.5	6.2	605	693	568	496	4.9	5.0	5.7	5.3

Sources: Compiled by USDA's Economic Research Service from NFCS 1977-78, NFCS 1987-88, CSFII 1989-91, CSFII 1994-96, 1-day data.

from school meals, higher than the 7.1-gram benchmark. The fiber density in school meals dropped to 6.3 grams for male teens and 6.2 grams for female teens. The nutrient standards for school meals served to teens are the same as those for younger children, but it appears that older children make poorer food choices at school than younger children. The same finding is also reported for calcium intake.

In 1997, the Institute of Medicine of the National Academy of Sciences revised dietary recommendations for calcium and several other nutrients. The 1997 calcium recommendations are 500 mg for children age 2-3, 800 mg for children age 4-8, and 1,300 mg for children age 9-18. The proportion of children meeting the calcium recommendation has fluctuated between 37 and 40 percent over the past two decades. As with fiber intake, older children's diets were lower in calcium than younger children's; however, the deficit was worse among girls than boys. For example, 60 percent of pre-school children met their calcium recommendations, whereas only 32 percent of teenage boys and 13 percent of teenage girls met their recommendations in 1994-96.

Calcium density in foods consumed by children rose between 1977-78 and 1989-91 but then declined. During 1977-78, home foods provided less calcium than away-from-home foods because of high calcium density in school meals, which accounted for more than half of calories from outside the home. Today, however, a larger share of children's away-from-home meals are eaten at fast food places and restaurants, where foods are lower in calcium.

In 1994-96, the calcium density was 357 mg per 1,000 calories for fast food and 336 mg for restaurants, compared with 662 mg for school meals. Clearly, the increased popularity of eating out at fast food places and restaurants poses a challenge to improving children's calcium intakes.

Low calcium intakes have been identified as a serious public health concern, especially among teenage girls. Teenage girls have higher recommended calcium intakes and consume foods lower in calcium density than other children. Even the calcium density of meals that teenage girls eat at school has declined. During 1994-96, school foods provided 764 mg of calcium per 1,000 calories for girls age 6-11 but dropped to 496 mg for girls age 12-17. In comparison, teenage girls obtained 605 mg of calcium per 1,000 calories from school meals in 1977-78. The data suggest that although calcium-rich foods are available in school cafeterias, teenage girls are increasingly less likely to choose them.

Even though teenage boys maintained the amount of calcium they obtained from school foods from 1977-78 to 1994-96, they consumed far less calcium-rich food at school than younger children. During 1994-96, school foods provided 724 mg of calcium per 1,000 calories for boys age 6-11 and 619 mg of calcium for boys age 12-17.

Teenage Girls' Diets Too Low in Iron

The 1989 recommended daily allowances (RDA) for iron are 12 mg per day for boys 11 and older, 15 mg for girls 11 and older, and 10 mg for children 2-10. Children increased their iron intake 34 percent over 20 years, from 11.1 mg per day in 1977-78 to 14.9 mg per day in 1994-96. Consequently, the proportion of children meeting the iron RDA increased from 39 percent in 1977-78 to 59 percent in 1994-96. After rising substantially between 1977-78 and 1987-88, children's iron intake levels have been stable.

Home foods eaten by children are much higher in iron than away-from-home foods. In 1977-78, the iron density for home foods was 18 percent above the level for away-from-home foods; the differential increased to 38 percent in 1994-96. An earlier study indicated that morning meals provided the largest share of iron intake among children

The popularity of eating out poses a challenge to the nutritional quality of children's diets, which are typically high in fat and sodium.

in 1989-91. Iron-fortified breakfast cereals, which are mostly eaten at home, help explain the high iron density of morning meals.

Female teens have the highest recommended iron intake of all children, yet their foods contained the least amount of iron. During 1977-78, only 15 percent of female teens met their iron recommendation. For 1994-96, female teens needed 7.9 mg of iron per 1,000 calories to meet their iron recommendation. Home foods eaten by female teens in 1994-96 provided 7.9 mg of iron per 1,000 calories, but away-from-home foods provided only 5.7 mg of iron per 1,000 calories. With an average of 7.1 mg of iron per 1,000 calories in their diets, only 33 percent of female teens met their iron recommendation in 1994-96.

Wiser Food Choices Needed, Especially When Eating Out

To improve children's diets, two basic challenges must be met: increase intakes of some nutrients and food components, such as fiber, calcium, and iron; and limit others, such as fat, saturated fat, cholesterol, and sodium.

Overall dietary quality tends to decline as children get older. Preschool children had diets that compared favorably with benchmark densities for cholesterol, sodium, fiber, calcium, and iron. Among teenagers, however, boys met the benchmark density only for iron, whereas girls met the benchmark only for cholesterol. Excessive intakes of fat and saturated fat occur among all children, but teenagers face additional dietary problems. Teenage girls, despite having the greatest needs for calcium and iron, obtain the least amount of these nutrients in their diets. Teenage boys are the most likely group to have excessive intakes of cholesterol and sodium.

An increase in eating out appears to be a factor in the age-related decline in diet quality. Away-from-home foods contributed 20 percent of total calories consumed by children in 1977, rising to 32 percent during 1994-96. During 1994-96, teenagers obtained 35 percent of their caloric intake away from home, compared with 32 percent for children age 6-11 and 24 percent for children age 2-5. Away-from-home foods generally contain more of the overconsumed nutrients and food components and less of the underconsumed nutrients and food components than home foods. Away-from-home foods are no longer the occasional treats they were two decades ago. Children and their parents need to recognize away-from-home foods for their effect on the overall diet. Furthermore, since eating out is expected to continue trending upward, nutrition policy, education, and promotion strategies need to stress the importance of making wise food choices when eating out.

The findings in this study suggest that broad messages appropriate for all audiences need to be supplemented with targeted messages designed to reach high-need groups. For example, the National Institute of Child Health and Human Development launched a "Crash Course on Calcium" in partnership with a coalition of government, private sector, and medical groups. This program features videos, advertisements, and other media featuring teen celebrities promoting the benefits of calcium. A similar program targeting cholesterol and sodium intake might be useful for teen boys.

USDA has taken action to improve the nutritional quality of school meals and to encourage more nutrition education in schools. USDA's School Meals Initiative for Healthy Children has devoted considerable resources to developing and disseminating educational materials for use with foodservice staff, students, teachers, parents, and the community. A recent study has demonstrated that the devoted resources have led to improvement in the nutritional quality of meals served through the school meals programs. Some restaurants and fast food places have also taken steps to serve more nutritious foods by adding more healthful options, such as salads and low-fat dairy products, to their menus.

Unfortunately, serving more nutritious foods does not guarantee the foods will be eaten. Our results indicate that even when school meals are good sources of nutrients, such as fiber and calcium, children may not choose to eat them. This finding is particularly true for teenagers. Schools serving meals to older children and teenagers tend to offer more choices than elementary schools. They are more likely to follow the "offer versus serve" provision for school meal service, which typically allows students to choose only three of the five USDA meal-pattern items offered (milk, meat or meat alternative, two servings of vegetables and/or fruits, bread or bread alternative). Schools serving older children are also more likely to serve a la carte foods and beverages that are not part of the USDA-subsidized school meal. Other competing foods and beverages may be available through noncafeteria sources, such as school stores and vending machines. These factors may influence teenagers' school meal choices. Research on how we can encourage teenagers to take advantage of the nutritional benefits of school meals may be useful.

In 1994-96, fast food places contributed an average of 10 percent of children's total calories. The caloric contribution from fast food rises with children's age, increasing from 7 percent among preschoolers to 15 percent among teen boys. Fast foods consumed by children are relatively high in fat, saturated fat, and sodium, and low in fiber and cal-

cium, compared with home foods. Improvements in the nutritional composition of fast foods are most likely to be influenced by consumers. Strategies that promote nutrition need to encourage both parents and children to make the most healthful choices available from among the various menu items and to demand a wider range of nutritious options.

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Overweight Children: Is Parental Nutrition Knowledge a Factor?

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A greater proportion of U.S. children and adolescents are overweight than ever before. This has sounded a public health alarm. Overweight children are much more likely to end up obese when they are adults. Obesity in adulthood is a known risk factor for chronic diseases, including heart disease, diabetes, high blood pressure, stroke, and some forms of cancer. According to articles in a 1999 issue of the *Journal of the American Medical Association*, 280,000 annual deaths in the United States are attributable to obesity, and obesity-related diseases may account for 6.8 percent of U.S. health care costs.

What can be done to prevent the growing prevalence of obesity among U.S. children? Establishing a set of standards regarding whom to treat and how to treat them is a key step. In a recent issue of *Pediatrics*, a committee of childhood obesity experts provided a detailed set of guidelines for obesity evaluation and treatment. Prominent among the guidelines is the important role of parents and family. The committee called parenting skills "the foundation for successful intervention that puts in place … targeted reductions in high-fat, high-calorie foods." Yet, little is known about the association between nutrition knowledge and attitudes of the parents and the prevalence of overweight conditions among children. The committee noted that during the evaluation phase of treatment, it is essential to address a family's readiness to make changes in diets and activity. This evaluation phase will be more effective if it can be ascertained whether the prevalence of overweight children is associated with such factors as parents' perception of their own weight status, parents' awareness of nutrition labels, and parents' knowledge of links between diet and disease.

USDA's 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII) is useful for exploring the association between parental nutrition knowledge and the prevalence of overweight children. The CSFII gathered the self-reported Body Mass Index (BMI) of household members, including children. BMI is a weight-for-height measure calculated as the ratio of weight in kilograms to the square of height in meters. An adult's BMI value can be compared with standard BMI cutoff

The prevalence of overweight children is significantly lower among fathers who use nutrition labels to determine ingredients, nutrient amounts, and serving sizes.

Credit: Ken Hammond, USDA.

The author is an agricultural economist with the Food and Rural Economics Division, Economic Research Service, USDA.

values established by health authorities to determine his or her weight status. Adults with BMI at or above 30 are classified as obese and adults with BMI at or above 25, but less than 30, are classified as overweight. Children and adolescents are identified as overweight or at risk of becoming overweight if their BMI values exceed age- and sex-specific BMI cutoff values in growth charts published by the Centers for Disease Control and Prevention (CDC).

The Diet and Health Knowledge Survey (DHKS), a followup to the CSFII, collected information on the nutrition knowledge, health awareness, and dietary attitudes of an adult member from a subset of CSFII households. For this study, we matched 1,825 children between 6 and 17 years of age with one of their parents or grandparents who answered the DHKS questions. Approximately 54 percent of the matched parents were mothers and 42 percent were fathers. Grandmothers or grandfathers made up the remaining 4 percent. Because many households had multiple children in the 6-17 age range, some parents were matched with more than one child. We did not examine the parental influence separately on each sibling. However, we did account for the sampling design features and weights to make our estimates representative for the U.S. population. Our findings indicate that greater parental nutrition knowledge is associated with lower prevalence of overweight conditions among children.

More Children Are Overweight

Based on recommendations in the *Pediatrics* article, we categorized children with BMI values at or above the 95th percentile of CDC's age- and sex-specific BMI cutoffs as overweight. Children with BMI values at or above the 85th percentile cutoff, but below the 95th percentile cutoff, were categorized as at risk of being overweight. *Pediatrics* recommended evaluating the at-risk group for complications related to obesity by screening for such factors as family history, hypertension, and total cholesterol. Using these criteria, 15 percent of the children in our study were overweight and an additional 14 percent were at risk of being overweight (table 1).

We also compared our findings with a study by Richard Troiano and Katherine Flegal, who used the National Health and Nutrition Examination Surveys (NHANES II & III) and CDC's age- and sex-specific BMI cutoffs to estimate the prevalence of overweight children in 1976-80 and 1988-94. Troiano and Flegal estimated that 10.6 percent of children age 6-17 were overweight during 1988-94 and an additional 14 percent of children were at risk of being overweight. (Troiano and Flegal provided only an overall figure and did not provide the percentage of children at risk of being overweight by age- and sex-specific groups.) Thus, between 1988-94 and 1994-96, the percentage of children among all 6 to 17 year-olds who were overweight or were at risk of being overweight appears to have increased from about 25 percent to more than 29 percent.

A word of caution: The 1976-80 and the 1988-94 prevalence rates reported by Troiano and Flegal are based on clinically measured height and weight. By contrast, the 1994-96 CSFII-based prevalence rates are based on self-reported height and weight. Self-reported measures tend to be less accurate than clinical measures. Therefore, the 1994-96 data should be interpreted with caution. However, the CSFII-DHKS surveys are the only available sources of nationally representative data by which to examine the link between parental nutrition knowledge and the prevalence of overweight conditions in children. For the rest of the article, we will use the term "overweight" to refer to children who are overweight or are at risk of being overweight.

Parents' Perception of Their Own Weight Status Is Important

How does the parents' weight status, as well as their perception of it, relate to the weight status of their children? To find out, we applied

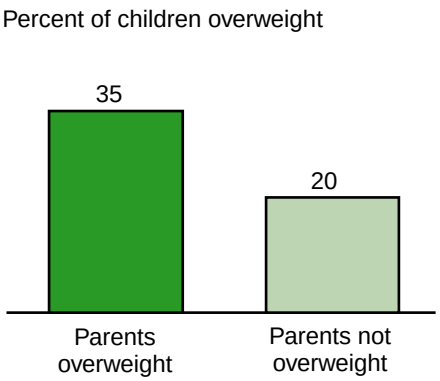
Table 1
Children and Adolescents Are at Greater Risk of Being Overweight

Age group/gender	Overweight 1976-80[2]	Overweight 1988-94[3]	1994-96[1] Overweight	1994-96[1] At risk of being overweight
	Percent			
Age 6-17	NA	10.6	15.1	14.3
Age 6-11	NA	10.6	19.0	15.0
Male	6.5	11.2	19.8	15.1
Female	5.5	10.0	18.0	15.0
Age 12-17	NA	10.6	11.4	13.6
Male	4.7	11.3	14.1	14.1
Female	4.9	9.8	8.7	12.7

NA = Not available.
[1]From 1994-96 CSFII.
[2]From 1976-80 NHANES II.
[3]From1988-94 NHANES III.
Sources: Troiano and Flegal, 1998; USDA's Economic Research Service.

the adult BMI criteria to the parents and classified them as overweight if their BMI was at or above 25. (Therefore, parents identified as overweight in this study also included those who are obese.) In the CSFII 1994-96 data, 35 percent of the children of overweight parents were overweight, while only 20 percent of the children of parents not overweight were overweight (fig. 1). Thus, if the parent participating in the survey was overweight, there was a greater chance of his or her child being overweight. The parent-child overweight link is well documented, but no other study has examined the link between parents' perception of their own overweight status and the probability of their children being overweight. We found that, among parents who correctly perceived themselves as being overweight, 32 percent of their children were overweight (fig. 2). However, among parents who underestimated their weight status—that is, they did not perceive themselves to be overweight, when in fact their reported BMI was at or above 25—42 percent of their children were overweight.

Figure 1
Overweight Parents Are More Likely To Have Overweight Children



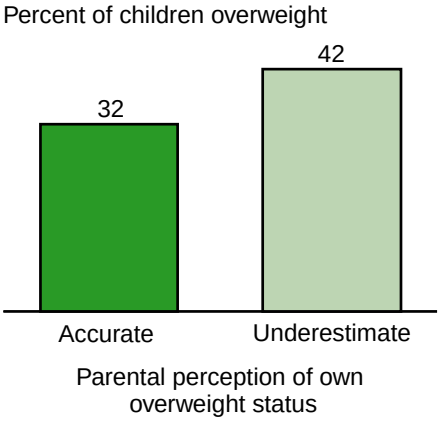
Source: 1994-96 CSFII-DHKS, USDA.

Parental Nutrition Knowledge Is a Factor…

Children's food preferences are influenced by parental eating habits. Once acquired in early childhood, healthful dietary habits tend to be carried into adulthood. Therefore, obesity prevention and/or treatment should focus on early attention and involvement of parents and promotion of healthful eating and exercise. Parental nutrition knowledge is essential for monitoring eating habits of children, identifying high-calorie foods, and understanding the long-term risks of obesity. To assess the link between parental nutrition knowledge and the prevalence of overweight conditions in children, we calculated the percentage of children who were overweight among parents who correctly and incorrectly answered DHKS questions related to nutrition knowledge, beliefs, and nutrition label use. While the DHKS included many questions, we present only nutrition-related questions whose answers of which showed a statistically significant difference.

We found that greater parental nutrition knowledge is associated with lower prevalence of overweight children (table 2). Most parents responding to the survey were knowledgeable about recommended servings and aware of health problems related to nutrient intake. For example, 84 percent of parents knew that a person should eat at least two to four servings of fruit each day (this includes about 10 percent of

Figure 2
Children of Parents Who Underestimate Their Own Weight Status Have a Greater Likelihood of Being Overweight



Source: 1994-96 CSFII -DHKS, USDA.

Table 2
Greater Parental Nutrition Knowledge Is Related to Lower Prevalence of Overweight Children

Survey items	Share of children overweight or at risk of being overweight[1] — Parent answered: Incorrectly	Correctly
	Percent	
Knowledge of recommended fruit servings a person should eat each day.	39.7	26.9
Knowledge of recommended vegetable servings a person should eat each day.	32.7	25.4
Awareness of any health problems caused by not eating enough fiber.	34.1	26.1
Knowledge of which foods have more fat, fiber, or cholesterol.	33.7	25.2

[1]Represents children of parents responding to DHKS.
Source: 1994-96 CSFII-DHKS, USDA.

the parents who gave an answer of more than four servings). Seventy percent of parents were aware of health problems caused by not eating enough fiber. Among this group of parents, the prevalence of overweight children was around 26 percent. Among the parents who were not aware of the health problems caused by not eating enough fiber, the prevalence of overweight children was 34 percent.

… And So Are Dietary Attitudes and Nutrition Label Use

Parental nutrition knowledge represents just one dimension of the prerequisites for improving the parents' own eating habits as well as those of their children. Health authorities note that parents unwilling to change may express a lack of concern about a child's obesity or believe the obesity is inevitable and cannot be changed. Our data support this observation. Among parents responding to the survey who agreed with the statement "Some people are born to be fat and some thin; there is not much you can do to change this," 33 percent of their children were overweight (table 3). In contrast, among parents who disagreed with that statement, only 22 percent of the children were overweight—an 11 percentage-point difference in prevalence. A similar contrast exists between parents who expressed frustration with dietary recommendations—believing there is too much conflicting advice—and those who did not. The difference in the proportion of overweight children between the two groups is 14 percentage points.

In general, recommendations in the *Dietary Guidelines for Americans* were important to parents responding to the survey. For example, 94 percent of the parents felt that choosing a diet with plenty of fruits and vegetables was personally important to them and only 6 percent of parents expressed a lack of interest in this recommendation. However, a relatively high 25 percent of parents felt that choosing a diet with plenty of grains (breads, cereals, rice, and pasta) was not important to them. The recommended 6-11 daily servings from the grains group form the "base" of the Food Guide Pyramid. Parents who are not attuned to this recommendation may have difficulty putting together healthful menus. Indeed, the prevalence of overweight children among this group of parents was about 14 percentage points higher than among parents who felt the grains recommendation was important to them.

Table 3
Parents' Beliefs Are Associated With Children's Probability of Being Overweight

Survey statements	Share of children overweight or at risk of being overweight[1] — Parent: Agreed	Parent: Disagreed
	Percent	
Some people are born to be fat and some thin; there is not much you can do to change this.	33.1	21.9
There are so many recommendations about healthy ways to eat, it's hard to know what to believe.	31.1	17.5
	Parent believed: Not important	Important
	Percent	
To you personally, how important is it to choose a diet with plenty of breads, cereals, rice, and pasta?	39.2	24.9

[1]Represents children of parents responding to DHKS.
Source: 1994-96 CSFII-DHKS, USDA.

Nutrition labeling on processed foods has been in effect since mid-1994. Consumer surveys indicate that the labeling influences food choice. For example, a 1995 American Dietetic Association survey showed that 56 percent of people interviewed claimed to have modified their food choices due to nutrition labeling. Among the parents in our sample, one-half to two-thirds reported using some aspect of nutrition labels at least some of the time. However, a substantial proportion of parents reported that they rarely or never used nutrition labels. Among this group of label nonusers, the prevalence of overweight children was consistently higher (table 4). On average, the prevalence of overweight children was 6 percentage points higher among parents who did not use an aspect of nutrition labels than among parents who did.

We examined whether the relationship between parents' nutrition knowledge and the prevalence of overweight children varied depending on whether the parent responding to the survey was the mother or the father. We found no statistically significant difference in prevalence of overweight children by nutrition knowledge, beliefs, or attitudes between mothers and fathers. However, the prevalence of overweight children was significantly lower among fathers who used three aspects of nutrition labels (list of

Table 4
Prevalence of Overweight Children Is Lower Among Parents Who Use Nutrition Labeling

Survey questions	Share of children overweight or at risk of being overweight[1]	
	Parent	
Think about food labels. When you buy foods, do you use ...	Did not use	Used
	Percent	
The list of ingredients?	32.1	26.6
The short phrases on the label like "low-fat" or "light" or "good source of fiber?"	32.9	26.1
The nutrition panel that tells the amount of calories, protein, fat, and such in a serving of the food?	33.5	25.9
The information about the size of a serving?	30.2	27.0
Statements on the label that describe health benefits of nutrients or foods?	31.9	25.2

[1]Represents children of parents responding to DHKS.
Source: 1994-96 CSFII-DHKS, USDA.

ingredients, amount of nutrients in a serving, and size of a serving), compared with mothers who used these same aspects of nutrition labels. For example, among fathers who reported using the list of ingredients on nutrition labels, only 22 percent of children were overweight. Among mothers who reported using the list of ingredients on nutrition labels, 29 percent of children were overweight. This finding suggests that nutrition awareness among fathers may play a greater role in the prevalence of overweight children than generally believed.

Assessing Parental Nutrition Knowledge, Attitudes, and Habits Is An Important First Step

It is understandable that health authorities consider obesity in children and adolescents a frustrating and difficult condition to treat. A successful approach toward weight control treatment for children requires parental readiness for change. A lack of parental readiness could cause weight control efforts to fail. Lack of readiness can range from the belief that obesity is inevitable and nothing can be done about it to the nonuse of appropriate tools, such as nutrition labels. Our findings show how some aspects of parental readiness are related to the prevalence of overweight conditions among children. Besides readiness, a parent's own weight status, and, more importantly, his or her perception of that status, can also factor into a child's weight condition. Parents who are overweight are more likely to have overweight children; the prevalence rate among overweight parents who underestimate their own weight status is even higher. Clearly, assessing parental and family readiness is an important step in addressing obesity in children.

While parental readiness may be an important factor in weight control efforts of children, nutrition knowledge alone is not a panacea. Large percentages (around 20 in almost every case) of children whose parents have appropriate attitudes and knowledge are overweight. Nutrition knowledge has to be translated into actual behavior and accompanied by other changes, particularly increased physical activity and exercise. In addition, weight control efforts must take into account the obesity status and nutrition knowledge of the other parent or adults in the family. Thus, much work remains in gaining a full understanding of the factors associated with childhood and adolescent obesity.

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The Economic Benefits of Breastfeeding

Jon P. Weimer

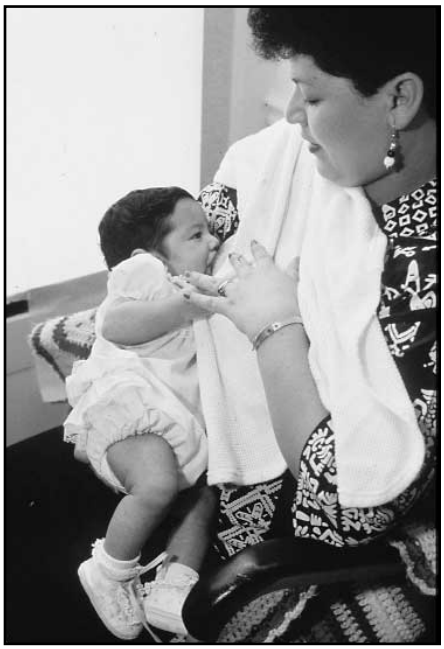
In 1990, the U.S. Surgeon General proposed a goal for the Nation: increase the proportion of mothers who breastfeed their babies in the early postpartum period to 75 percent by 2000. The goal also sought an increase in the proportion of mothers who continue breastfeeding until their babies are 5-6 months old to at least 50 percent. According to the latest data, about 64 percent of women giving birth in a hospital breastfeed, and approximately 29 percent still breastfeed at 6 months. A recent study by USDA's Economic Research Service (ERS) found that a minimum of $3.6 billion could be saved if the prevalence of exclusive breastfeeding increased from current levels to those recommended by the U.S. Surgeon General. This $3.6 billion is based on reduced incidences of only three childhood illnesses and reflects savings in terms of medical expenditures, wages lost by parents attending to an ill child, and the prevention of premature deaths.

Breastfeeding generally refers to a mother feeding an infant at her breast but may refer also to feeding breastmilk from a bottle. However administered, it is widely believed to be the most beneficial method of feeding for the health and well-being of most infants. (Breastfeeding is not recommended for all mothers, such as those who use illegal drugs, receive chemotherapy, or test HIV-positive.) Public health experts, such as the American Academy of Pediatrics (AAP), the American Dietetic Association (ADA), and the U.S. Surgeon General, endorse breastfeeding as the preferred infant-feeding method in most cases. The AAP recommends that infants be breastfed throughout their first year of life. USDA, which oversees the Special Supplemental Nutrition Program for Women, Infants and Children (WIC), actively promotes breastfeeding, both inside and outside of WIC.

Breastfeeding Trends Have Fluctuated

Until around 1950, almost all U.S. newborns were nursed. In the last 50 years, however, infant feeding has changed markedly. After World War II, with the development and large-scale manufacture of infant formula, formula feeding became the standard. The percentage of infants being breastfed fell by half between 1946 and 1956; by 1967, only 25 percent of American infants were being breastfed at the time of hospital discharge. The percentage of newborns being breastfed then fluctuated over the next 30 years: it rose to 62 percent in 1982, declined approximately 16 percent from 1982 to 1990, and increased to 64 percent by 1998 (fig. 1). The prevalence of breastfeeding for 6-month-old infants paralleled that of newborns, although at a considerably lower level. In 1998, about 29 percent of 6-month-old infants were being breastfed.

Mothers may refrain from breastfeeding for a number of reasons: aggressive formula product marketing, lack of support from family and friends, insufficient knowledge

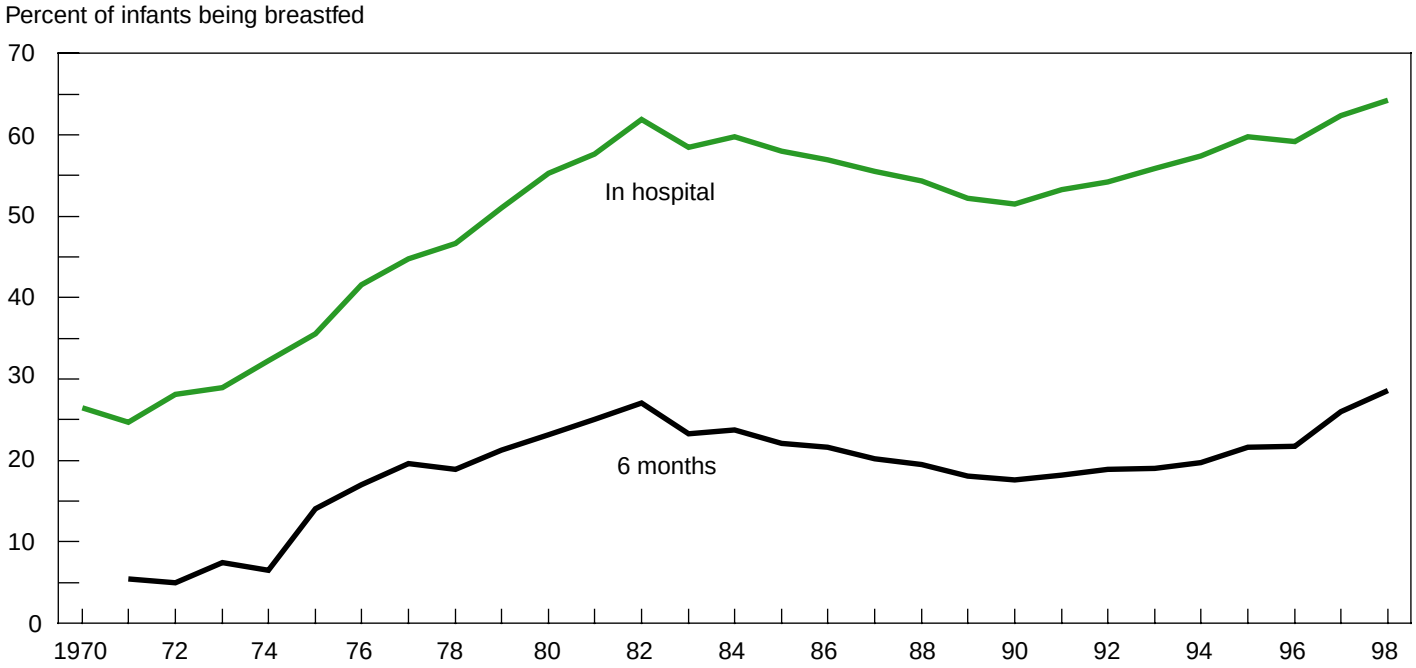


Breastfeeding protects children against a number of acute or chronic diseases and improves their general health, growth, and development.

Credit: Ken Hammond, USDA.

The author, now retired, was an agricultural economist with the Food and Rural Economics Division, Economic Research Service, USDA.

Figure 1
Breastfeeding in the United States Has Rebounded From Low Rates in the 1970s



Note: The percentage of infants breastfed at 6 months was not measured in 1970.
Source: Ross Laboratories Mothers' Survey, Ross Products Division, Abbott Laboratories,1998.

among medical professionals about breastfeeding techniques and challenges, maternity hospital practices (short maternal stays, for example), religious beliefs, cultural attitudes, and lack of public acceptance.

Employment, however, may be the leading cause of women's reluctance to breastfeed. Increased formula feeding parallels the rapid increase in the number of working women. Breastfeeding and working outside the home are commonly believed to be incompatible. A woman who works outside the home must have a place and time to nurse her baby or express and store her milk for bottle feeding. Many workplaces seem not to support breastfeeding or extraction of breastmilk in the workplace, inhibiting breastfeeding after women return to work. Increased participation of women in the labor force is frequently cited for the low rates of breastfeeding.

Breastfeeding Provides Health Advantages

In their endorsement of breastfeeding, the AAP and ADA cite studies that show breastfeeding improves infants' general health, growth, and development and protects against a number of acute or chronic diseases. In a 1997 policy statement, the AAP reported that research in the United States, Canada, Europe, and other developed countries indicates that breastfeeding decreases the incidence and/or severity of diarrhea, lower respiratory infection, otitis media, bacterial meningitis, botulism, urinary tract infection, and necrotizing enterocolitis. Other studies show that breastfeeding may protect against sudden infant death syndrome, insulin-dependent diabetes mellitus, Crohn's disease, ulcerative colitis, lymphoma, allergic diseases, and other chronic digestive diseases.

These health benefits from breastfeeding can, in some instances, be translated into economic benefits in terms of medical costs and wages lost by parents (primarily mothers) attending to an ill child. Many women return to work before a child is 1 year old. When these women miss work, it often is because their infants are ill. As breastfed infants have been shown to be less likely to catch common infectious illnesses than formula-fed infants, it is possible that mothers who breastfeed will miss fewer days from work to care for a sick child than mothers who formula feed. Another economic benefit to a family is reduced formula purchases for a child's first year after birth.

Earlier Studies Limited in Scope

Relatively few studies have assessed the economic benefits of breastfeeding. Some studies have

looked at the economic effect of breastfeeding within the context of a State-specific WIC program, with net savings expressed in terms of reduced overall Medicaid expenditures for infants, reduced formula purchases, or decreased infant morbidity and health care costs associated with a specific illness. For example, a 1997 study looked at whether breastfeeding of infants enrolled in Colorado's WIC program was associated with reduced Medicaid expenditures and WIC expenditures on infant formula. Compared with formula feeding, breastfeeding was found to result in a net benefit of $478 during the first 6 months of the infant's life—$102 in Medicaid savings and $376 in WIC savings. The WIC savings decreased to $59 after considering the rebate given to USDA by the formula manufacturer.

Other studies have analyzed the economic advantages of breastfeeding outside the WIC program. Generally, these studies used data from specific locales (for example, clinics or local hospitals) and concentrated on cost savings for individual families. For example, a 1997 pilot study looked at infants born to mothers in a health maintenance organization (HMO) in North Carolina. The study compared medical costs for the first 12 months for infants breastfed for at least 6 months and for infants formula-fed since birth. The study found that breastfed infants had fewer inpatient admissions and their total medical costs averaged $200 less than those of formula-fed infants.

ERS Examines Economic Benefits

Prior studies have tended to focus on the economic effects of breastfeeding at specific sites, such as local HMOs or State WIC clinics, and from an individual family's perspective. ERS expanded this analysis by measuring the reduced costs to society as a whole from the prevention of childhood illnesses and premature deaths. We looked at three childhood diseases that commonly afflict children under 2 years of age—otitis media, gastroenteritis, and necrotizing enterocolitis. Otitis media is an inflammation of the ear and is the most frequently reported diagnosis for children under the age of 2. Gastroenteritis refers to vomiting or diarrhea as a discrete illness for a 24-hour period. Necrotizing enterocolitis is a gastrointestinal tract disease and the leading cause of emergency surgical treatment in newborns. Necrotizing enterocolitis is a cause of neonatal death, particularly among premature infants.

While breastfed infants suffer bouts of otitis media and gastroenteritis, research indicates that they do so less frequently than formula-fed infants. According to a published study, the incidence of otitis media at 6 months for exclusively breastfed infants is 25 percent, compared with 53 percent for formula-fed infants. Similarly, published data indicate that the incidence of gastroenteritis in the first year for exclusively breastfed infants is 14 percent, compared with 31 percent for formula-fed babies. We applied these illness incidence rates to the 3.9 million U.S. births in 1998 to calculate the number of cases of otitis media and gastroenteritis at the current breastfeeding levels of 29 percent at 6 months and at the U.S. Surgeon General's recommendation of 50 percent at 6 months.

Over 90 percent of necrotizing enterocolitis cases affect premature infants, generally within 10 days of birth. Incidence approaches 12 percent of all premature infants weighing less than 3 ½ pounds at birth. According to a published report, the incidence of necrotizing enterocolitis in low-birthweight infants that were exclusively breastfed was 1 percent, compared with 7 percent for formula-fed infants. In 1997, 291,000 low-birthweight infants were born in the United States. Using this figure, we applied the two incidence rates for necrotizing enterocolitis to calculate the number of cases at the current breastfeeding prevalence rate at hospital discharge of 64 percent and at the U.S. Surgeon General's recommendation of 75 percent.

Data for both direct and indirect costs were derived from published reports and U.S. Government sources. Direct costs relate to expenditures on physician, clinic, hospital, and procedural fees, while indirect costs relate to time and wages lost by parents attending to an ill child. For necrotizing enterocolitis, which results in death within the first year for between 15 and 25 percent of cases, we estimated the cost of those deaths using a traditional economic approach to valuing premature deaths.

Our analysis indicated that a minimum of $3.6 billion would be saved if the prevalence of exclusive breastfeeding increased from current levels to those recommended by the U.S. Surgeon General (table 1). This figure reflects approximately $3.1 billion attributable to preventing premature deaths from necrotizing enterocolitis and an additional $0.5 billion in annual savings for the three illnesses from reduced medical expenditures and indirect costs such as forgone earnings of parents.

The $3.6 billion underestimates the potential economic benefits likely from breastfeeding because it reflects the savings in treating only three childhood illnesses. The estimated savings also exclude the cost of purchasing over-the-counter medications for otitis media and gastroenteritis symptoms, physician charges for treatment of necrotizing enterocolitis, and savings due to reduced long-term morbidity. Breastfeeding reduces the incidence rates of several chronic illnesses with associated costs that could accrue over several years and, in some cases, over a lifetime. Otitis

Table 1
Increased Rates of Exclusive Breastfeeding Lower Costs of Illnesses

Rate	Cost of illnesses		
	Otitis media[1]	Gastroenteritis[1]	Necrotizing enterocolitis[2]
	Million dollars		
Prevalence of exclusive breastfeeding for 6 months:			
29 percent[3]	2,786.5	72.6	NA
50 percent[4]	2,421.4	62.7	NA
Prevalence of breastfeeding at hospital discharge:			
64 percent[3]	NA	NA	15,704.0
75 percent[4]	NA	NA	12,424.9
Savings from increased breastfeeding	365.1	9.9	3,279.1

NA = Not available.
[1]Excludes costs related to over-the-counter medications and long-term sequelae.
[2]Excludes costs related to physician charges and long-term sequelae. Using the labor market approach to valuing a premature death, we used $8.3 million as the value of an infant's premature death.
[3]Current rate.
[4]U.S. Surgeon General's recommended rate.
Source: USDA's Economic Research Service.

media, for example, if recurrent or not promptly treated, may lead to hearing loss, tinnitus, and brain abscess. However, our study looked at benefits or costs that could be assessed by the end of the first or second years of life when morbidity rates for toddlers breastfed during infancy can best be compared with those of formula-fed children.

Further research on health and economic benefits and costs of breastfeeding is needed. Ideally, large-scale studies should be conducted for the entire range of child-related illnesses, focusing on differences in rates of hospitalization, duration of hospitalization, health service use, and medical costs between breastfed and formula-fed infants. Such studies could provide employers, insurance companies, health care providers, and Federal health policymakers with further incentives to encourage breastfeeding and provide better support and care for breastfeeding mothers.

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USDA Subsidizes Meals and Snacks for Children in Child Care

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The Child and Adult Care Food Program (CACFP) is a Federal program that subsidizes healthy meals and snacks for children and adults receiving day care. In the child care portion of CACFP, participating centers and child care homes are reimbursed at various rates for up to two meals and one snack per day served to eligible children. Child care homes are defined as child care providers' homes in which the providers care for children other than their own or a combination of others' children and their own children. CACFP eligibility is primarily restricted to children age 12 and younger, with some extended eligibility for older migrant, disabled, and after-school-program children. In fiscal 1999, CACFP subsidized meals for an average of 2.6 million children per day through about 38,000 child care centers and 175,000 child care homes.

The child care portion of CACFP was originally targeted exclusively to child care centers in poor economic areas. Over time, program participation was extended to centers and family child care homes nationwide. CACFP's primary focus is providing meals for low-income children; however, the eligibility extensions allowed many homes serving higher income children to join the program (see box). The 1996 welfare reform act re-focused the child care homes portion of the CACFP on low-income children by implementing a two-tiered reimbursement structure.

CACFP Meal Reimbursements Flow Through Several Intermediaries

USDA's Food and Nutrition Service (FNS) administers CACFP at the Federal level. State education or health departments administer CACFP in most States. Licensed or approved child care homes may participate in the program when

CACFP is open to licensed child care centers and homes nationwide. Meal reimbursements vary by income levels of participants.

Credit: Ken Hammond, USDA.

The author is an economist with the Food and Rural Economics Division, Economic Research Service, USDA.

sponsored by a public or private nonprofit organization that enters into an agreement with the State agency to administer the program. Sponsoring organizations recruit homes; provide training and technical assistance; monitor compliance with program rules; receive, review, and submit meal claim forms to the State agency; and distribute food reimbursements.

Public or private nonprofit child care centers, Head Start programs, and some for-profit centers, which are licensed or approved to provide day care, may participate in CACFP, either directly through an agreement with the State agency or through a sponsoring organization. Federal food reimbursements flow from FNS through State CACFP offices through sponsoring organizations to all participating child care homes and sponsored centers. Independent centers get reimbursements directly from State CACFP offices.

Reimbursements Vary by Meal and Type of Provider

Child care homes receive reimbursements for meals and snacks at two rates. Homes that are either located in low-income areas or run by a provider whose family income is at or below 185 percent of the Federal poverty guideline receive higher (tier I) rates (table 1). An area is considered low-income if 50 percent or more of the children at the local elementary school have applied and been approved for free or reduced-price school meals, or if 50 percent or more of the children in the area are in families with incomes at or below 185 percent of the Federal poverty guideline as measured by the most recent decennial census. Other homes receive lower (tier II) rates, with meals and snacks served to low-income children reimbursed at the tier I rates, given appropriate documentation.

Child care centers are also reimbursed by type of meal served, but at three different rates depending on the family incomes of the children in care. In addition, centers receive an average of $0.15 in commodities (or cash in lieu of commodities) for each lunch or supper they serve.

Family child care home sponsoring organizations receive separate administrative cost reimbursements, so homes receive the entire amount

CACFP Legislative History

From its inception, the goal of the child care portion of CACFP has been to provide nutritious meals to low-income children in child care. When Congress first established the program in 1968 under the National School Lunch Act, participation was limited to center-based child care in areas with poor economic conditions. In 1976, eligibility was broadened to allow child care homes to participate in the program, provided the homes were sponsored and met licensing/approval standards.

Initially, participating homes received the same three reimbursement rates for meals and snacks served as centers, based on the family incomes of individual children. Child care home providers complained that documenting the family incomes of children in their care was an overly burdensome and invasive process. In addition, sponsors claimed that meal reimbursements were insufficient to cover their administrative costs and allow for adequate reimbursement to the homes. Meal reimbursements generated by participating homes were paid directly to the sponsoring agency. The sponsor was permitted to deduct administrative costs before passing the remaining reimbursement on to the providers. As a consequence, few homes participated in the program; by December 1978 fewer than 12,000 participated.

The 1978 Child Nutrition Amendments incorporated wide-ranging changes to the program with the purpose of expanding participation, particularly among family child care homes. Most significantly, the amendments eliminated the requirement for child care home operators to document children's family incomes. The three-level reimbursement structure was replaced with a single reimbursement rate for all participants, at a level slightly below the free-meal reimbursement rate in child care centers. In addition, the reimbursement of sponsors' administrative costs was separated from the meal reimbursement for family child care homes. Other changes included the establishment of alternative procedures for approving homes and the provision of startup and expansion funds for family child care sponsors.

Those financial incentives led sponsoring agencies to recruit more child care homes and made participation by homes serving higher income children (those from families with incomes above 185 percent of the poverty guideline) more attractive. In June 1980, 17,000 homes participated in CACFP; by March 1981, 43,000 homes participated. In March 1980, when reimbursements were still tiered, only 32 percent of children cared for by participating homes were from higher income families. By January 1982 after the single rate was adopted, 62 percent of the children in participating homes were from higher income families. By 1995, over 190,000 homes were participating and more than 75 percent of the children served in these homes were from higher income families.

The 1996 welfare reform act refocused the family child care component of the CACFP on low-income children by implementing the two-tiered reimbursement structure shown in table 1. The new rate structure took effect July 1, 1997.

of their food reimbursements. Child care center sponsoring organizations do not receive separate administrative cost reimbursements, so they keep a part of the centers' food reimbursements to cover the costs of their administrative services.

Participation in the CACFP Varies Across FNS Regions…

In fiscal 1999, CACFP subsidized meals for an average of 2.6 million children per day through about 38,000 child care centers and 175,000 child care homes. The number of participating child care homes ranges from 14,000 in FNS's Mid-Atlantic region to 38,000 in the Western region (fig. 1). The number of participating child care centers ranges from 3,500 in the Mountain Plains to 7,100 in the Southeast. And, average daily attendance in centers and homes combined ranges from 234,000 children in the Mid-Atlantic to 479,000 children in the Southeast.

Table 1
CACFP Meal Reimbursement Rates Are Higher for Low-Income Children

Meal type	Child care homes[1]		Child care centers[2]		
	Tier I	Tier II	Free	Reduced-price	Paid
	Dollars				
Breakfast	.94	.35	1.12	.82	.21
Lunch or supper	1.72	1.04	2.02	1.62	.19
Snack	.51	.14	.55	.27	.05

Note: These rates for July 1, 2000, through June 30, 2001 apply to the contiguous 48 States. Rates in Alaska and Hawaii are higher.
[1]Tier I rates are for all meals served in tier I homes and for meals served to low-income children in tier II homes, given appropriate income documentation. Tier II rates are for all other meals served in tier II homes.
[2]Free rates are for meals served to children with family incomes ≤130 percent of the Federal poverty guideline, reduced-price rates are for meals served to children with family incomes that are 131-185 percent of the Federal poverty guideline, and paid rates are for meals served to children with family incomes >185 percent of the Federal poverty guideline, given appropriate income documentation.
Source: USDA's Food and Nutrition Service.

Table 2
Ratios of CACFP Participants to Possibly Eligible Groups Suggest Widespread Access

FNS region	Participating homes to all licensed homes	Participating centers to all licensed centers	Average daily attendance to estimate of children age 0-5 in child care
	Ratio		
Northeast	.48	.52	.39
Mid-Atlantic	.43	.31	.20
Southeast	.47	.32	.24
Midwest	.62	.39	.25
Southwest	.84	.29	.23
Mountain Plains	.77	.40	.40
Western	.63	.31	.24
United States	.59	.32	.33

Sources: Fiscal 1999 CACFP data are from FNS administrative files; 1999 licensed child care homes and 2000 licensed child care centers are from the Children's Foundation; and 1999 estimates of children age 0-5 in child care are based on U.S. Census Bureau population estimates and 1995 National Household Education Survey estimates of children in child care.

…As Do Estimates of Eligible Populations

Estimated CACFP-eligible populations also vary by region. When participating homes are compared with licensed child care homes in the regions, the ratio of CACFP homes to licensed child care homes ranges from 0.43 to 0.84 (table 2). The high ratios of participating-to-licensed homes in the Southwest and Mountain Plains are partly due to much larger numbers of CACFP homes than licensed child care homes in Utah and New Mexico. CACFP allows licensed, registered, certified, or alternately approved homes to participate. In both Utah and New Mexico, large numbers of small day care homes serving four or fewer children are registered, not licensed. It is likely that differences among the States in the types of homes they license, register, or otherwise approve are responsible for much of the regional variation in the ratio of CACFP homes to all licensed homes.

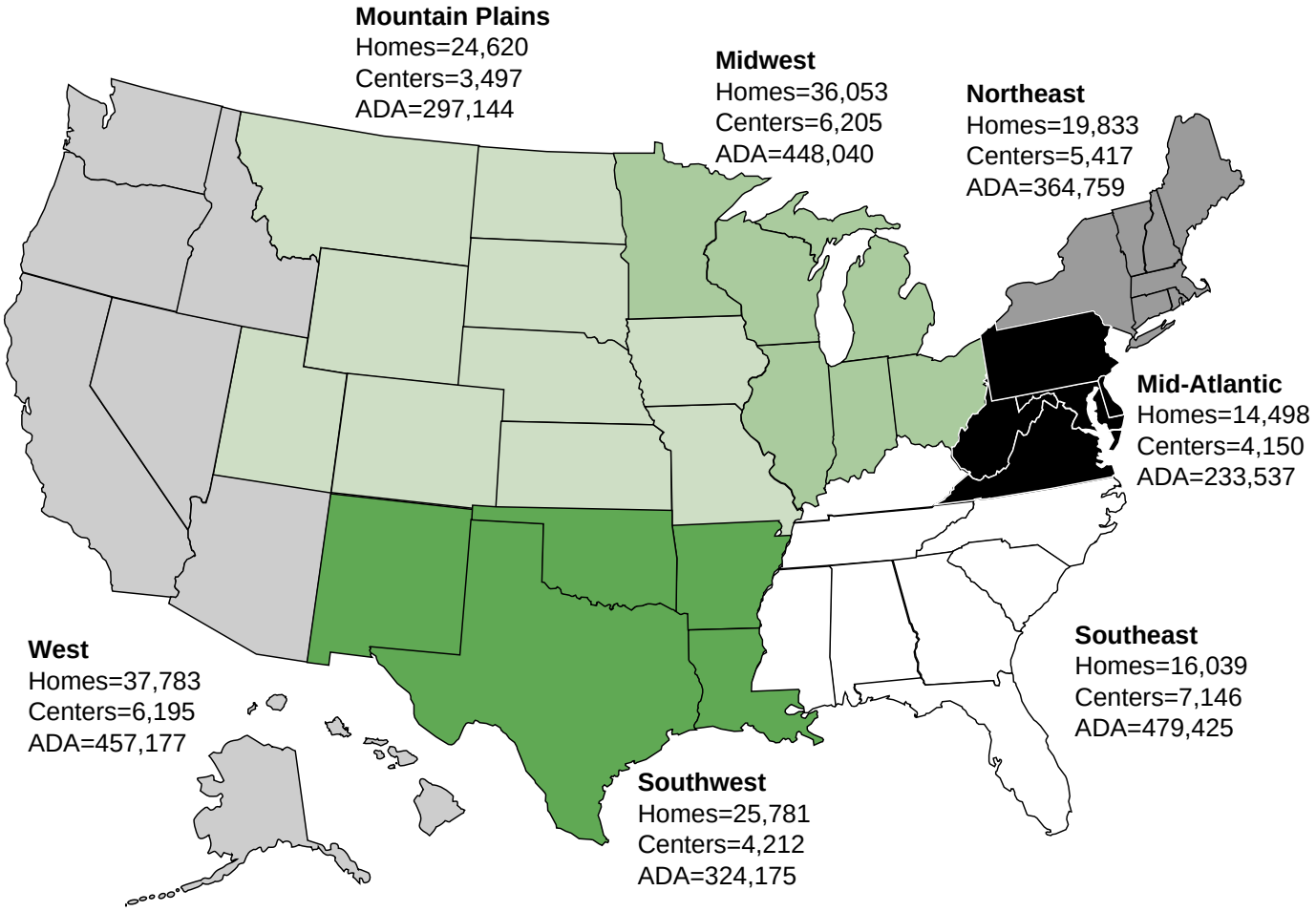
A comparison of the number of CACFP-participating child care centers with the number of licensed centers in each region also shows that centers across the country are likely to participate. The ratio of CACFP-participating centers to licensed centers ranges from 0.31 to 0.52. Nationwide, for-profit child care centers that serve mostly higher income children are not eligible to participate in the CACFP, a restric-

tion that contributes to keeping the CACFP child care center population smaller than the licensed population.

The highest regional ratio is in the Northeast, partly due to New York's having about the same number of CACFP-participating centers as it has licensed child care centers. Comparison of fiscal 1999 CACFP centers with the 2000 number of licensed centers causes that anomaly. New York moved after-school snack programs run by schools from CACFP to the National School Lunch Program in late 1999. Those schools had been counted as CACFP centers in the fiscal 1999 data. When those schools are excluded from the CACFP center count, the ratio of CACFP-participating centers to licensed centers in New York falls from 1.0 to about 0.5, much more in line with other States' ratios. After the New York adjustment, the Northeast ratio falls from 0.52 to 0.35, more in line with other regions' ratios.

While children up to 12 years old are eligible to receive meals subsidized by CACFP, most participants are preschool age or younger. In a 1995 study, Glantz and others found that 83 percent of the children in CACFP family child care homes and centers were age 5 or younger. Infants and toddlers 1 to 2 years old are a larger share of the children cared for by child care homes, while preschoolers 3 to 5 years old are a larger share of the children cared for by centers.

Figure 1
Child Care Homes and Centers Participating in the CACFP Vary by Region, Fiscal 1999



Note: ADA is average daily attendance of qualifying children in participating homes and centers.
Source: USDA's Food and Nutrition Service.

With attendance concentrated among very young children, population estimates for all children under 6 are compared with CACFP average daily attendance. The population numbers are adjusted by the percentages of young children reported to be in family child care, center-based child care, or Head Start programs in each census region, according to the 1995 National Household Education Survey. The number of children 0-5 in each State was multiplied by the share of children in such care in the respective region (Northeast 0.38, Midwest 0.45, South 0.48, and West 0.35), and the resulting numbers were summed to the seven FNS regions. Some of the young children reported to be in family child care are cared for by unlicensed providers and some of those reported to be in center care are in for-profit higher income centers, so not all children in those types of care are eligible for CACFP. However, children older than 5 are not counted in this estimate, and the number of older children eligible for CACFP may be larger than the "overestimated" portion of young children.

Among the seven FNS regions, the ratio of average daily attendance of children in CACFP to the adjusted number of eligible young children ranges from 0.20 to 0.40. The Mid-Atlantic region is at the lower end of the CACFP-attendance-to-young-children ratio range and the Mountain Plains and Northeast regions are at the higher end. Without more specific regional information on the shares of young children cared for by child care providers who would qualify for CACFP participation, the reasons for the regional differences cannot be determined. This comparison, along with the homes and centers comparisons, simply suggests that substantial shares of children in child care in all regions are benefiting from CACFP.

Research on CACFP Forthcoming

When the tiered reimbursement system mandated by the 1996 welfare reform act was instituted in the child care homes portion of CACFP in 1997, FNS and USDA's Economic Research Service jointly funded a study of that change's effects. Surveys of sponsoring organizations, participating tier I and tier II providers, providers who dropped out of the program, and the parents of children cared for by participating homes were conducted in 1999. The results of those surveys are expected to be released in a series of reports in fall 2001.

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Children and Microbial Foodborne Illness

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Consumption of food contaminated with microbial pathogens (bacteria, fungi, parasites, viruses, and their toxins) causes an estimated 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths each year in the United States. People who face relatively higher risks from foodborne illness and associated complications, such as kidney failure, include the very young, the very old, and the immunocompromised, such as those with AIDS and cancer.

Children deserve added attention in the study of microbial foodborne illness because the risks of some foodborne illnesses, such as salmonellosis, are relatively higher for children than for other demographic groups. Children's immune systems are not fully developed, placing them at a relatively higher risk for some foodborne illnesses. A child's lower weight means that it takes a smaller quantity of pathogens to make a child sick than it would a healthy adult. Also, children have limited control of food safety risks because their meals are usually prepared by others.

This article focuses on some of the more common or serious foodborne illnesses, namely illnesses from *Campylobacter*, *Salmonella*, *E. coli* O157:H7, *E. coli* non-O157:H7 STEC, *Listeria*, and *Toxoplasma gondii*. Children are usually exposed to these pathogens not only by contaminated food but also by secondary sources of exposure, such as ill family members or ill classmates in a day care center. A pregnant woman who becomes newly infected with *Listeria* or *Toxoplasma gondii* can pass the infection to her fetus.

USDA's Economic Research Service (ERS) estimates that the five foodborne illnesses covered in this article cause $6.9 billion in medical costs, lost productivity, and premature deaths in the United States each year. Using FoodNet data on the proportion of all confirmed and reported illnesses attributed to children for the different pathogens, our preliminary estimate is that about one-third of total costs—$2.3 billion—are the result of illnesses in children under the age of 10.

Children's low body weights and underdeveloped immune systems increase their risk of some foodborne illnesses.

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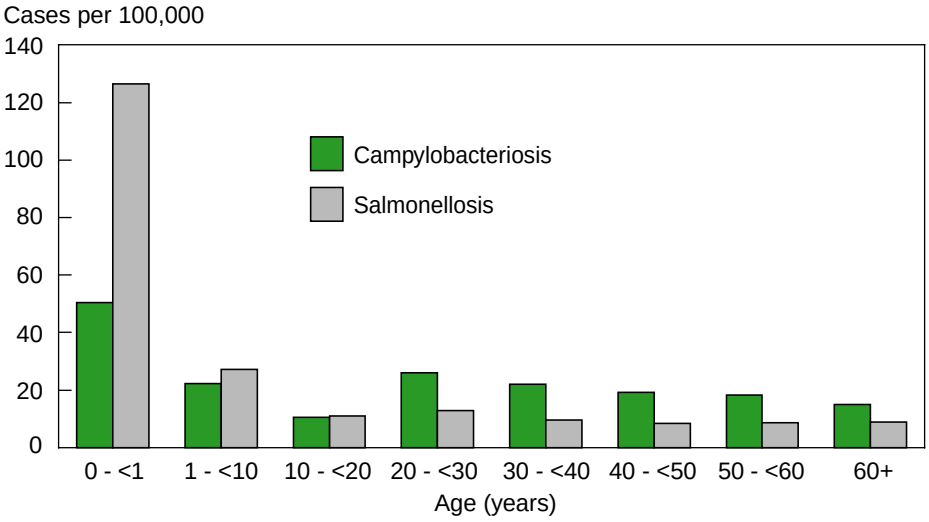
Foodborne Illnesses Can Develop Chronic Complications

Most cases of foodborne illnesses are classified as "acute." These cases are usually self-limiting and of short duration, although they can range from mild to severe. Gastrointestinal problems and vomiting are common acute symptoms of many foodborne illnesses. Deaths from acute foodborne illnesses are relatively uncommon and more typically occur in the very young, the elderly, or patients with compromised immune systems. However, the U.S. Food and Drug Administration (FDA) estimates that 2-3 percent of all acute cases develop secondary long-term illnesses and complications called chronic sequellae.

Chronic sequellae of foodborne illness can occur in any part of the body, such as the joints, nervous system, kidneys, or heart. Examples of chronic sequellae of foodborne illness include Guillain-Barré Syndrome (GBS) following some *Campylobacter* infections, hemolytic uremic syndrome (HUS) following some *E. coli* O157:H7 infections, and mental retardation following some congenital *Listeria* infections. These chronic illnesses may afflict the patients for the remainder of their lives and may result in premature death.

Figure 1
Infants Have the Highest Reported Incidence Rate of Campylobacteriosis and Salmonellosis



Source: CDC/USDA/FDA Foodborne Diseases Active Surveillance Network, 1998 Annual Report.

Infants Have the Highest Reported Incidence of Campylobacteriosis…

Campylobacter is the most commonly reported cause of foodborne illness in the United States. Each year it causes around 2 million cases of foodborne illness, 10,000 hospitalizations, and 100 deaths. In the United States, infants (under 1 year old) have the highest reported incidence of campylobacteriosis; young adults age 20 to 29 are the illness's second highest risk group (fig. 1). According to Dr. Robert Tauxe at the Centers for Disease Control and Prevention (CDC), the peak isolation rate in infants is partly attributed to the increased susceptibility on the first exposure and partly because medical care is quickly sought for infants and incidents are reported.

Outbreaks of campylobacteriosis in child care facilities are rare, and most children are believed to have acquired their infections from contaminated food. The incubation period is 1 to 10 days with most cases occurring 3 to 5 days after exposure. Campylobacteriosis symptoms can range from diarrhea and lethargy that lasts a day to severe diarrhea and abdominal pain (and occasionally fever) that lasts for several weeks. Diarrhea and abdominal pain are the most common symptoms and most cases are relatively mild.

Some people ill with campylobacteriosis develop secondary complications, such as reactive arthritis and Guillain-Barré Syndrome. GBS is an autoimmune reaction of the body that affects the peripheral nerves and causes weakness, paralysis, and, occasionally, death. About 1,100 GBS cases are caused by *Campylobacter* infections each year. Although paralysis from GBS is generally reversible over time, some patients are bedridden for life and others die prematurely. Patients with GBS have ranged in age from 9 months to 97 years, though most cases are among adults.

…and Salmonellosis

Infants also have the highest risk of contracting salmonellosis; children under 10 years of age are the second highest risk group. Children, as well as the immunocompromised and the elderly, also face a relatively higher risk of death from salmonellosis than other demographic categories. Salmonellosis occurs much more frequently in infants than does campylobacteriosis. Most children who contract salmonellosis are believed to have been infected from contaminated food—outbreaks in child care facilities are rare. Poultry, meat, eggs, and milk are some of the major food vehicles of transmission.

Most salmonellosis cases are relatively mild.

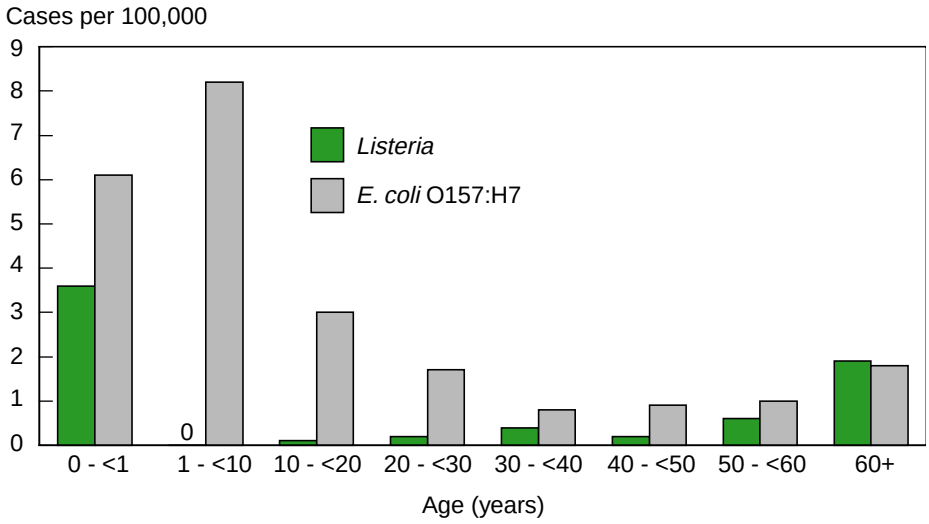
E. coli O157:H7 Disease Can Lead to HUS in Children

E. coli O157:H7 and its link to food became well known to the public as a result of the 1993 *E. coli* O157:H7 disease outbreak caused by contaminated hamburger. Over 700 people became ill from this outbreak (primarily children) and 4 children died. In recent years, an increasing number of *E. coli* O157:H7 outbreaks and sporadic cases have been documented and linked to hamburger, unpasteurized apple cider and apple juice, hot dogs, raw milk, raw potatoes, and salad bar items, such as ranch dressing, pea salad, and cantaloup. In addition to contracting the disease from eating contaminated food, people can become ill from this bacteria through person-to-person contact (for example, at day care centers) and swimming in contaminated water. The incubation period for *E. coli* O157:H7 in humans is typically 3 to 5 days.

E. coli O157:H7 causes human illnesses through the toxins that it produces. Illness from *E. coli* O157:H7 ranges from mild cases of acute diarrhea to premature death. Acute illness from *E. coli* O157:H7 disease is manifested by abdominal cramps, vomiting, diarrhea (often bloody), and sometimes fever. Although most *E. coli* O157:H7 infections are relatively mild and do not require medical care, *E. coli* O157:H7 infections can result in hemorrhagic colitis (bloody inflammation of the colon). A small percentage of cases go on to develop hemolytic uremic syndrome (HUS). HUS is a life-threatening disease characterized by red blood cell destruction, kidney failure, and neurological complications, such as seizures and strokes. People who develop chronic kidney failure may require lifelong dialysis or a kidney transplant.

Several studies have identified age less than 4 or 5 years as a risk factor for HUS from *E. coli* O157:H7 disease. *E. coli* O157:H7 disease may be the leading cause of acute kidney failure and HUS in young children and infants. The high incidence of HUS in children could reflect the smaller infective dose by weight, social behavior, immune system development, and other factors affecting the risk of acquiring *E. coli* O157:H7 and HUS infections. According to CDC data, the infection rate for *E. coli* O157:H7 is 6.1 per 100,000 infants and 8.2 per 100,000 children between 1 and 9 years old, the highest infection rate for any age group (fig. 2).

Figure 2
Children 10 and Under Have Higher Reported Incidence Rates of Listeriosis and *E. coli* O157:H7 Disease Than Other Age Groups[1]



[1]Risk from listeriosis in children under 10 years of age is predominantly for newborns.
Source: CDC/USDA/FDA Foodborne Diseases Active Surveillance Network, 1998 Annual Report.

Congenital Listeriosis Can Lead to Lifelong Complications…

Listeriosis is the acute illness caused by an infection from the bacteria *Listeria monocytogenes*. Raw milk products, vegetables, seafood, poultry, red meat, liquid whole egg, and ready-to-eat foods, such as hot dogs and luncheon meats, are foods typically linked to this bacteria. The incubation period for listeriosis is 4 days to several weeks. Milder cases of listeriosis are characterized by a sudden onset of fever, severe headache, vomiting, and other influenza-type symptoms. *Listeria monocytogenes* infection rates are highest for the very young and the very old.

Listeriosis in pregnant women is usually relatively mild and may be manifested as a flu-like syndrome or placental infection. However, listeriosis may cause premature death or cause developmental complications for fetuses and newborns. Babies may be stillborn, develop meningitis (inflammation of the tissue surrounding the brain and/or spinal cord) in the neonatal period, or be born with septicemia (blood poisoning). A portion of babies with meningitis will develop chronic neurological complications.

...As Can Congenital Toxoplasmosis

As with listeriosis, when a pregnant woman becomes newly infected with *Toxoplasma gondii*, she can pass the infection to her unborn fetus. This transmitted illness is known as congenital toxoplasmosis. The pathogens discussed earlier in this article are bacteria; *Toxoplasma gondii* is a parasite. It can cause mental retardation, epilepsy, and blindness in an infected fetus. About 400-4,000 cases of congenital toxoplasmosis occur each year. Toxoplasmosis can also afflict people of other ages, particularly the immunosuppressed, such as people with AIDS.

Pregnant women may become affected if they eat raw or undercooked meat that is contaminated with this parasite or if they inadvertently consume *oocysts*, an environmentally resistant form of the organism that cats pass in their feces. Pregnant women may be exposed to the oocysts when they handle cat litter or soil, such as from unwashed fruits or vegetables or from gardening. According to the CDC, with rare exceptions, women infected with this parasite before conception do not transmit the infection to their fetus.

Economic Costs Accompany Foodborne Illnesses

ERS estimates that, in the United States, annual human illness costs from foodborne *Campylobacter*, *E. coli* O157:H7, *E. coli* non-O157:H7 STEC, *Listeria*, and *Salmonella* total $6.9 billion in August 2000 dollars (table 1). Updated estimates of the costs from *Toxoplasma gondii* are not currently available, though previous estimates of foodborne congenital toxoplasmosis are in the billions of dollars.

The annual ERS cost estimates are calculated from the number of foodborne-illness cases and deaths caused by each pathogen and the

Table 1
Estimated Costs of Foodborne Illness in Children Totaled $2.3 Billion in 2000[1]

Pathogen	Estimated annual foodborne illnesses: Cases[2]	Hospitalizations[2]	Deaths[2]	Preliminary estimated annual costs: All cases[3]	Children under 10 years[3]
	Number			Billion dollars	
Campylobacter spp.	1,963,141	10,539	99	1.2	.2[4]
Salmonella, nontyphoidal	1,341,873	15,609	553	2.4	.9[5]
E. coli O157:H7	62,458	1,843	52	.7	.3[6]
E. coli non-O157:H7 STEC	31,229	921	26	.3	.1[7]
Listeria monocytogenes	2,493	2,299	499	2.3[8]	.8[9]
Total	3,513,694	33,711	1,604	6.9	2.3

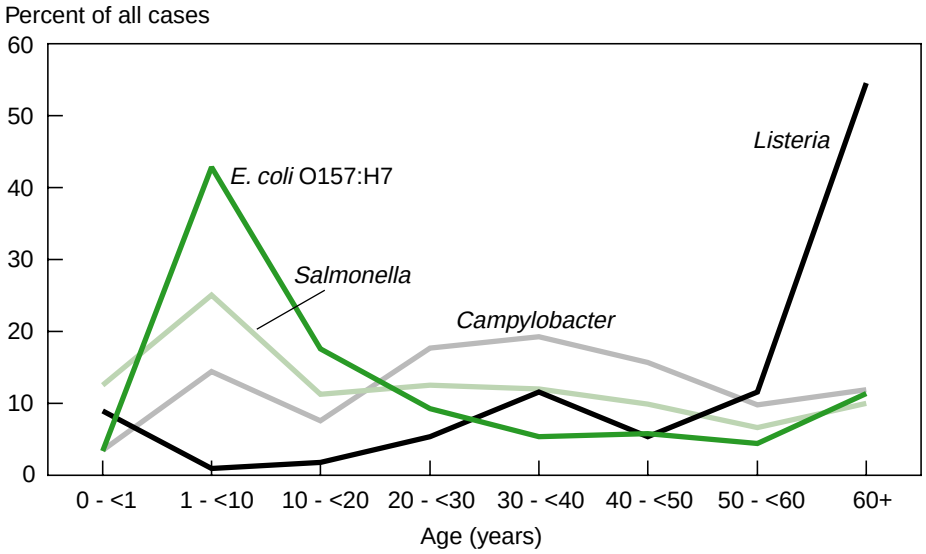
[1]As these new estimates of foodborne illness costs are based on new data and improved methodologies for valuing these costs, the estimates presented here are not directly comparable with earlier ERS estimates of the costs of foodborne disease. Note that estimates for congenital toxoplasmosis have not been included but would raise total costs. Children with foodborne illness are more likely to be cultured than adults with foodborne illness, inflating the share of cases and costs due to children. Also, this preliminary calculation assumes that there is no difference in costs per case by age for *Campylobacter* and *Salmonella*. All costs are in August 2000 dollars.
[2]Data from the U.S. Centers for Disease Control and Prevention Web site (www.cdc.gov/ncidod/eid/vol5no5/mead.htm).
[3]The total estimated costs include specific chronic complications in the case of *Campylobacter* (Guillain-Barré Syndrome), *E. coli* O157 and STEC (hemolytic uremic syndrome), and *Listeria monocytogenes* (congenital and newborn infections resulting in chronic disability or impairment).
[4]The share of *Campylobacter* costs attributed to children under 10 years of age is assumed to be 17.9 percent using 1998 FoodNet data on the age distribution of campylobacteriosis cases (3.5 percent aged 0 - <1 plus 14.4 percent aged 1 - <10).
[5]The share of *Salmonella* costs attributed to children under 10 years of age is assumed to be 37.5 percent using 1998 FoodNet data on the age distribution of salmonellosis cases (12.5 percent aged 0 - <1 plus 25.0 percent aged 1 - <10).
[6]The share of *E. coli* O157:H7 costs attributed to children under 10 years of age is assumed to be 46.2 percent using 1998 FoodNet data on the age distribution of *E. coli* O157:H7 disease cases (3.4 percent aged 0 - <1 plus 42.8 percent aged 1 - <10).
[7]ERS also estimated, for the first time, the costs due to other strains of *E. coli* that produce shiga toxins (STEC). These strains are collectively known as *E. coli* non-O157:H7 STEC. The average costs of medical care and time lost from work due to *E. coli* non-O157:H7 STEC are assumed to be the same as for *E. coli* O157:H7, based on reports in the medical literature. Similarly, the assumption of the share of costs incurred by children under 10 years of age is assumed to be the same as for *E. coli* O157:H7.
[8]The total estimated costs for foodborne *Listeria* are underestimates as they exclude less severe cases not requiring hospitalization. ERS focused its estimates on illnesses in three categories of hospitalized patients: (1) 311 infected pregnant women (all survived), (2) 368 newborns/fetuses who survived and 77 stillbirths and infant deaths, and (3) 1,120 "other adults" who survived and 422 other adults who died.
[9]This $0.8 billion estimate is only for congenitally acquired cases (that is, newborn/fetal cases) and does not cover listeriosis cases acquired by children.

corresponding costs of medical treatment, lost productivity, and premature deaths, and other illness-specific costs, such as special education and residential-care costs. Societal costs have not been estimated for most chronic complications associated with foodborne illnesses. Specific chronic complications covered in our analysis include GBS following *Campylobacter* infections, HUS following *E. coli* infections, and chronic disability or impairment following congenital and newborn infections from *Listeria monocytgenes*.

ERS measures the productivity losses for survivors of a foodborne illness as the value of foregone or lost wages, whether for a few days absent from work or for a lifetime of disability that prevented the individual from returning to work. In 2000, ERS revised the methodology for valuing premature deaths due to foodborne illness. ERS previously assigned all deaths the same value regardless of age at time of death, based on information about the higher wages paid for dangerous jobs. Now, ERS uses information about the age distribution of deaths to adjust this value to account for age at death. The assumed cost of each death ranges from $8.9 million in August 2000 dollars for individuals who died before their first birthday to $1.7 million for individuals who died at age 85 or older. The higher value placed on deaths of children reflects that more years of life are lost.

We estimate that medical costs, productivity losses, and the value of premature deaths due to foodborne illnesses that afflict children under 10 years of age total $2.3 billion in August 2000 dollars. These preliminary calculations are based on specific assumptions about how the cases are distributed by age. For each pathogen, the share of total costs attributed to children under 10 years of age is assumed to be the same as the share of total cases attributed to children under 10 years of age in the 1998 FoodNet age distribution data (fig. 3). Children under 10 years of age account for 33 percent of total costs for all age groups.

Figure 3
Age Distribution of Foodborne Illness Varies by Pathogen



Source: CDC/USDA/FDA Foodborne Diseases Active Surveillance Network, 1998 Annual Report.

Of the pathogens discussed in this article, foodborne *Salmonella* posed the greatest annual cost to society for children under 10 years of age—$0.9 billion. Although campylobacteriosis is more common in the U.S. population, salmonellosis is more common in infants and a higher proportion of all salmonellosis cases require hospitalization. The second most costly foodborne pathogen for children under age 10 is *Listeria* ($0.8 billion). The high ranking of *Listeria* is due to the severity of listeriosis in fetuses and newborns, which causes a relatively high proportion of deaths and lifetime health complications.

More Research Needed To Refine Estimates

The ERS estimates undervalue the true social costs of foodborne illness. Some costs are omitted, notably the human illness costs of certain other chronic complications (such as reactive arthritis in the case of *Salmonella*), as well as the costs of travel to obtain medical care, lost leisure time, and pain and suffering.

The foodborne illness costs for children are preliminary. We used the 1998 FoodNet age distributions for illnesses confirmed by laboratory tests to identify the rough percentage of total estimated costs for each foodborne illness that can be attributed to children under 10 years of age. However, these distributions of culture-confirmed illnesses may not be representative of the distribution of cases across the U.S. population. Children with foodborne illness are more likely to be tested than adults with foodborne illness, inflating the share of cases and costs due to children.

This preliminary calculation assumes that there is no difference in costs per case by age for *Campylobacter* and *Salmonella*. More accurate estimates for each pathogen need to be calculated using the age distribution of each severity category (for example, the number of children under 10 years of age who were hospitalized and died). Additionally, cost of illness estimates for congenital toxoplasmosis would enhance this analysis.

On the positive side, many cases of foodborne illness in children can be prevented. For example, pregnant women can help prevent congenital toxoplasmosis by avoiding changing cat litter. Pregnant women can also help prevent both toxoplasmosis and listeriosis by not eating raw or undercooked meats. Children who go to day care can be kept at home if they are experiencing diarrhea. Child care providers must wash their hands after changing diapers and before preparing food or bottles. These actions, along with good food sanitation and handling practices, can help prevent foodborne illness in children.

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Low-Income Families Participating in Fewer Assistance Programs

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In fiscal 2000, USDA spent about $32.5 billion on food assistance programs. The three largest of these programs—the Food Stamp Program, the National School Lunch Program, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)—make up over 90 percent of the expenditures. Benefits from WIC and free lunches from the National School Lunch Program go to low-income families (or expecting families), as do approximately 80 percent of benefits from the Food Stamp Program. Low-income families can also participate in other USDA programs, such as the Summer Food Service Program, the School Breakfast Program, and the Child and Adult Care Food Program (see "USDA Subsidizes Meals and Snacks for Children in Child Care" elsewhere in this issue).

In addition to participating in food assistance programs, low-income households with children may also receive benefits and/or cash assistance from Temporary Aid to Needy Families (TANF), formerly Aid to Families with Dependent Children (AFDC), Medicaid, and Supplemental Security Income. Other Federal programs provide low-income families with housing subsidies, energy subsidies, education grants, and child care subsidies.

This article focuses on benefits provided by the Food Stamp Program, the National School Lunch Program, and WIC, along with cash assistance provided by TANF (or AFDC). These four programs alleviate problems associated with poverty by providing in-kind transfers of food or by providing cash. The average monthly benefit per participant in 1999 was $72 in food stamps, $40 worth of free lunches, and $32 in WIC vouchers. Average monthly TANF benefits vary by State depending on the cost of living, legislative policy, and other factors. For example, the maximum monthly benefit in 1998 for a family of three (parent and two children) in Alaska was $1,025, whereas the monthly maximum for a family of three in Mississippi was $120. On a national basis, average monthly TANF benefits in 1999 were $357

At-risk family participation in USDA's National School Lunch Program remained stable from 1995 to 1999. Overall, the program provides 15.5 million free or reduced-price lunches out of the 27 million lunches served each schoolday.

Credit: USDA.

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per family. Because of the nature of the programs, most low-income households with children participate in more than one program at a time.

In 1995, approximately 86 percent of low-income families with children participated in at least one program, and approximately 65 percent participated in at least two programs. By 1999, approximately 82 percent participated in at least one program, and approximately 56 percent participated in at least two programs. The decline in multiple program participation shown by these households was primarily in food stamps and cash assistance.

The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 changed cash welfare, and, to a lesser extent, food stamps. The act slightly reduced food stamp benefits and added restrictions to eligibility, making most noncitizens ineligible. The welfare reform act also replaced AFDC, the largest Federal cash-assistance entitlement program, with TANF, a nonentitlement program administered at the State level (see box).

Changes in the way TANF is administered may have unintentionally affected participation levels in other programs. For example, some States now require TANF participants to attend job fairs to receive program benefits. Some low-income families eligible for food stamps may incorrectly believe that job fair attendance is required for receiving food stamps as well. Aside from a small number of low-income households with children whose assets or noncitizenship status make them ineligible for food stamps, low-income households are eligible and can be participating in three, and possibly four, of the programs. Examining how low-income household participation in multiple programs has changed in the post-welfare reform years begins to uncover any unintended effects of welfare reform, if any, on participation.

Measuring Participation Where Need Is Greatest

While much can be learned from examining overall participation rates in welfare programs, it is also important to look at participation patterns of the neediest participants—families with children whose household incomes are below the poverty level. (Poverty is defined as an annual income below a certain amount, depending on the number of people in the household. For example, in 1999 the poverty level was $17,000 for a family of four.) These "at-risk" households—the intended target population for many Federal assistance programs—include single-parent, female-headed, and dual-parent households. Along with many other U.S. households, at-risk households often juggle work, day care, and managing a home, but under severe financial constraints.

To examine at-risk households, this study uses the Bureau of Labor Statistics' Current Population Survey (CPS). The CPS is a nationally representative survey of about 50,000 households that includes details on household income and participation in assistance programs, including the Food Stamp Program, TANF (or AFDC), the National School Lunch Program, and WIC. Our analysis covers 1995 to 1999, the latest CPS data available at the time of this study.

During 1995-1999, two notable events took place that affected participation rates in Federal assistance programs. First, in 1996, Congress passed the welfare reform act, which changed AFDC—the major cash assistance program for low-income families—in profound ways. Second, the U.S. economy experienced unprecedented growth. As a result, unemployment plummeted, wages increased, and welfare rolls declined as many people's economic situations improved.

Participation in Multiple Programs Is Common…

In 1995, approximately 86 percent of at-risk households, those below poverty with children, received assistance from one or more of the four programs included in this study—the Food Stamp Program, free lunches from the National School Lunch Program, WIC, and TANF (or AFDC). In contrast, approximately 15 percent of all U.S. households and approximately 56 percent of U.S. households below poverty (with or without children) received assistance from one or more of these programs.

In 1995, 67 percent of at-risk households participated in the Food Stamp Program, slightly fewer received free school lunches, 45 per-

Table 1
At-Risk Households' Participation Down in Some Assistance Programs, Steady in Others

Program	Participation rate for at risk households[1] 1995	1997	1999
	Percent		
TANF/AFDC	45	41	31
Food Stamp Program	67	62	54
Free lunches from National School Lunch Program	64	64	63
WIC	20	22	24

[1]At-risk households are households with children whose household incomes are below the Federal poverty guideline.
Source: Calculated by USDA's Economic Research Service using data from CPS March and April Supplements.

cent received cash assistance from AFDC, and about 20 percent received WIC benefits (table 1).

Many at-risk households participate in multiple assistance programs. For example, 99 percent of at-risk households that participated in AFDC in 1995 participated in at least one of the other three programs, and 95 percent of at-risk households that received food stamps participated in at least one of the other programs.

While at-risk households receiving food stamps or cash assistance nearly always participate in another program, households receiving free school lunches or WIC benefits are not as likely to participate in one of the other three programs. One-fifth of the at-risk households that receive free school lunches do not participate in any of the other programs. Likewise, one-tenth of at-risk households receiving WIC benefits did not receive any benefits from the other three programs.

At-risk households receiving cash assistance or food stamps are, on average, poorer than households receiving free lunches or WIC, and, therefore, have a greater need for the benefits provided by multiple programs. Additionally, the application and certification processes for cash assistance and food stamps may have become more burdensome than those for WIC and free school lunches since welfare reform was enacted. Due to the effort required to qualify, some at-risk families may opt not to participate in TANF or the Food Stamp Program.

...But Declining

According to administrative data, the overall number of people that received food stamps declined by approximately 19 percent from 1997 to 1999, and the overall number of people that received cash assistance declined by approximately 34 percent over the same time period. Participation of at-risk households also declined. From 1997 to 1999, the proportion of at-risk households participating in the Food Stamp Program declined 24 percent, and the proportion of at-risk households participating in TANF declined 13 percent.

In contrast to the decline in food stamp and cash assistance participation, at-risk participation in WIC and free school lunches was rela-

Four Major Programs Assist Families with Children

This study examines welfare participation patterns of households below poverty with children. Food assistance programs that target families—the Food Stamp Program, the National School Lunch Program, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)—were examined along with Temporary Aid to Needy Families (formerly Aid to Families with Dependent Children), which provides cash assistance.

Food Stamp Program. The Food Stamp Program provides monthly benefits for eligible households. The Food Stamp Program is an entitlement program, meaning that all eligible people are entitled to the benefits and the benefits cannot be curtailed by Federal budget constraints. To be eligible, most families must have gross household incomes at or below 130 percent of the Federal poverty level (and income after a set of deductions less than poverty). Local welfare offices process and verify eligibility. Food stamp benefits vary depending on family income and size. For example, the maximum monthly benefit in 1999 for a family of four was $450; the minimum benefit for a family of two was $10.

Welfare reform mandated that States use an electronic benefits transfer (EBT) system to issue food stamp benefits by 2002. Currently, 41 States plus the District of Columbia use the EBT system. EBT systems replace food stamp coupons with ATM-like cards. Participating families use benefits much the same way they would use a debit card. Once a month, food stamp benefits are posted to a participant's EBT account. Funds are then transferred to the retailer's account when the food stamp participant purchases food.

National School Lunch Program. The National School Lunch Program provides subsidized lunches to children attending participating schools. Both public and private schools can participate in the school lunch program. The lunches must meet nutritional guidelines in the *Dietary Guidelines for Americans.* Approximately 27 million lunches are served each schoolday. Lunches are subsidized with Federal funds, food commodities, or a combination of both.

Eligible students can apply to receive free or reduced-price lunches. At the beginning of each school year, applications for free or reduced-price lunches are sent out to parents. A student is eligible for free lunches if his or her household income is at or below 130 percent of the Federal poverty level. A student whose household income is at or below 185 percent and above 130 percent of the Federal poverty level is eligible for reduced-price lunches. Students whose families receive either food stamps or TANF benefits are not required to report family size and income on the free/reduced-price lunch application. They only have to report their case numbers to be certified as eligible for free lunches. In fact, many school districts directly certify these students by comparing local welfare rolls with student enrollment data. Like the Food Stamp Program, the National School Lunch Program is an entitlement program.

tively stable from 1995 to 1999. In fact, WIC participation increased slightly for at-risk households.

The proportion of at-risk households participating in all four programs remained steady over this time period (fig. 1). However, the proportion of at-risk households bundling cash assistance, food stamps, and free school lunches decreased by approximately 2 percentage points from 1995 to 1997 and decreased another 7 percentage points from 1997 to 1999. Similar decreases in the proportion of at-risk households bundling cash assistance and food stamps can be seen in other bundles. Bundling of cash assistance, food stamps, and WIC and bundling of cash assistance and food stamps by at-risk households decreased between 1995 and 1999.

Decreasing participation in the Food Stamp Program and TANF increased the proportion of households whose bundles of assistance did not include cash assistance or food stamps. For example, the proportion of at-risk households bundling free school lunches and WIC increased from 1995 to 1999, as did the proportions participating in free school lunches only and WIC only.

In addition to the proportion of at-risk households bundling without cash assistance and food stamps, the proportion not participating in any of the four programs also increased. In 1995 and 1997, the nonparticipating proportion remained fairly steady at just under 15 percent; in 1999, it increased to approximately 18 percent.

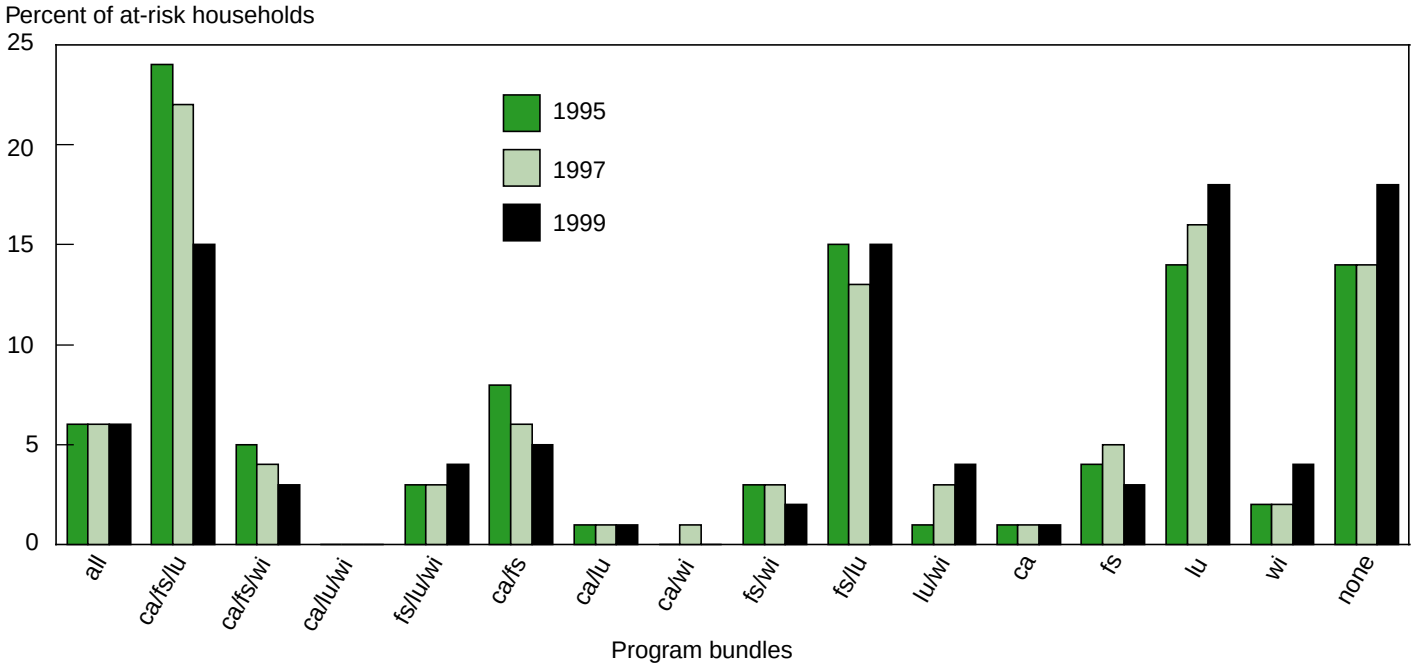
The decline in the proportion of at-risk households participating in programs bundled with food stamps and/or cash assistance raises concerns. These households represent the most needy. They have dependents to support and limited resources for food. Some of the decline in program participation may come from families opting not to "use" their limited cash benefits, which now have a 5-year lifetime limit. The decline in the proportion of at-risk households participating in food stamps is harder to explain. Except for a relatively small number of at-risk households who are asset ineligible (assets exceed the $2,000 limit), virtually all households below poverty with children are eligible for substantial food stamp benefits.

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). WIC provides vouchers for nutritionally dense foods to eligible pregnant or breastfeeding women, infants, or children under 5 years of age. Vouchers are distributed based on each participant's category. For example, vouchers for formula are given to the mothers or caregivers of nonbreastfeeding infants. WIC also provides nutrition education services and health referrals to participants. To be eligible, a woman, infant, or child must be determined to be at nutritional risk by a medical doctor, nurse, or health care practitioner. Also, WIC participants' household incomes must be less than 185 percent of the Federal poverty level. Like the National School Lunch Program, WIC classifies families as income eligible if they currently receive food stamps or TANF benefits. Additionally, children who participate in the Child Health Insurance Program are income eligible for WIC. Regardless of income eligibility, applicants must still be deemed as at nutritional risk to receive benefits. WIC offices tend to be located in community health care centers or hospitals.

Unlike the Food Stamp Program and the National School Lunch Program, WIC is not an entitlement program. Each State receives block grants from USDA that are designed to cover all WIC-related expenses. If grant money starts to run out, a State can either contribute State funds to the program or disallow participants in lower nutritional-risk categories from receiving benefits for the remainder of the fiscal year. As a precaution to funding shortfalls, some States institute cost-containment procedures. For example, a State can require participants to purchase the lowest priced product on the day that they are shopping, as opposed to any priced product. In the case of infant formula, States negotiate product rebates with manufacturers and stipulate those products on the WIC vouchers. In recent years, WIC has been fully funded—all eligible applicants have been able to participate.

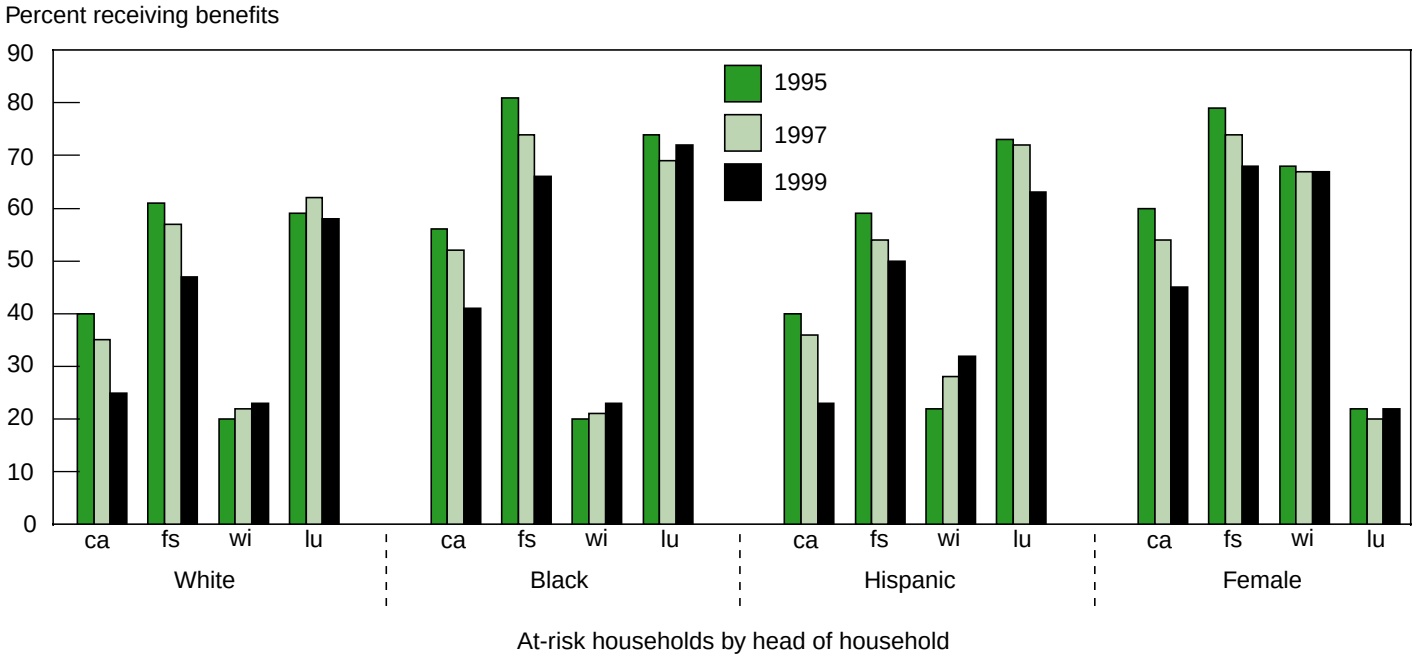
Temporary Aid to Needy Families (TANF). TANF provides cash benefits and employment and training assistance to eligible families. Family eligibility is based on household income and composition. The 1996 welfare reform act changed this program from a Federal program administered by the States to a series of block grants given to each State, giving individual States more regulatory control, within limited guidelines. For example, States set benefit levels, work requirements, and other regulations, within Federal guidelines. New regulations enacted with the 1996 welfare reform act limit lifetime benefits using Federal funds to a maximum of 5 years, with some exceptions. Also, beneficiaries are required to be working or in an employment-related activity within 24 months of receiving benefits, with some exceptions. Work-requirement exceptions usually apply to people living in areas of high unemployment. Many States distribute the cash benefits through the same EBT card used for food stamp benefits. A local welfare office processes, verifies, and recertifies TANF applicants.

Figure 1
Program Bundling of Cash Assistance and Food Stamps Declined Over 1995-1999



Note: ca = cash assistance; fs = food stamps; lu = free school lunches ; wi = WIC.
Source: Calculated by USDA's Economic Research Service using data from CPS March and April Supplements.

Figure 2
Decline in Hispanic Participation in Cash Assistance Mirrored by Increase in Hispanic WIC Participation



Note: ca = cash assistance; fs = food stamps; lu = free school lunches; wi = WIC.
Source: Calculated by USDA's Economic Research Service using data from CPS March and April Supplements.

Participation Similar Across Races and Household Types

The decrease in participation in the Food Stamp Program and TANF/AFDC was not isolated to one race or type of household. The pattern was fairly consistent across at-risk households headed by Whites, Blacks, Hispanics, and single females. The proportion of households receiving food stamps and cash assistance decreased significantly, while the proportion participating in WIC and free lunches from the National School Lunch Program remained steady or increased slightly. The main difference in these populations was the overall proportion that participated in the programs.

The proportion of at-risk households headed by single females receiving cash assistance was 60 percent in 1995, compared with 40 percent of White and Hispanic at-risk households (table 2). (The different race categories do not exclude single female-headed households, so a household headed by a White single female would occur in both the White and single female-headed household portions of the table.) This 20-percent differential may be due to greater need. For example, a single female-headed household's income, on average, is lower than a dual-parent household's income. Despite these differences in program participation rates, each group of at-risk households demonstrates a similar rate of decrease in cash assistance and Food Stamp Program participation.

The program participation patterns of at-risk Hispanic households are similar to those of other household types, but the changes are dramatic. For example, the proportion of at-risk Hispanic households receiving cash assistance fell by 43 percent, or 17 percentage points, from 40 percent in 1995 to 23 percent in 1999 (fig. 2). This change may have resulted from welfare reform prohibiting most noncitizen populations from participating in Federal assistance programs. The proportion of at-risk Hispanic households receiving WIC benefits also had a notable swing, increasing by 45 percent, or 10 percentage points.

Implications for the Needy

Low-income households with children participated in multiple programs at a lower rate in 1999 than before welfare reform. The decline in multiple program participation for at-risk households was primarily in food stamps and cash assistance. At-risk participation in WIC and free lunches from the National School Lunch Program remained constant or increased slightly.

Both the Food Stamp Program and TANF are administered out of local welfare offices, where most of the changes from welfare reform were instituted. Furthermore, both programs require applicants to complete large amounts of paperwork to qualify for benefits. Conversely, the smaller benefit programs, WIC and

Table 2
All At-Risk Household Types Had Declines in Cash Assistance and Food Stamp Participation

Program	Participation rate for at-risk households[1] 1995	1997	1999
		Percent	
White head of household			
TANF/AFDC	40	35	25
Food Stamp Program	61	57	47
Free lunches from National School Lunch Program	59	62	58
WIC	20	22	23
Black head of household			
TANF/AFDC	56	52	41
Food Stamp Program	81	74	66
Free lunches from National School Lunch Program	74	69	72
WIC	20	21	23
Hispanic head of household			
TANF/AFDC	40	36	23
Food Stamp Program	59	54	50
Free lunches from National School Lunch Program	73	72	63
WIC	22	28	32
Single female head of household			
TANF/AFDC	60	54	45
Food Stamp Program	79	74	68
Free lunches from National School Lunch Program	68	67	67
WIC	22	20	22

Note: Four categories are not exclusive.
[1]At-risk households are households with children whose household incomes are below the Federal poverty guideline.
Source: Calculated by USDA's Economic Research Service using data from CPS March and April Supplements.

free lunches from the National School Lunch Program, tend to be administered out of community-level offices that do not primarily administer welfare programs and have lower documentation needs.

Though the proportion of at-risk households receiving benefits from at least one program decreased only slightly from 1995 to 1999, at-risk households are participating in fewer of the four programs and the value of their bundle of benefits has declined. Based on CPS data, the value of an average bundle (of the four programs examined here) declined from approximately $385 per month in 1995 to $301 per month in 1999. The implications of this research is that since the welfare reform act of 1996, households below the Federal poverty line with children are participating in the large-benefit programs at lower rates, relying more heavily on the smaller-benefit programs.

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Using USDA's Thrifty Food Plan To Assess Food Availability and Affordability

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In recent years, a number of Federal and local efforts have been launched to help communities assess and improve their community food security situation. In a food secure community, residents of all income levels have access to sufficient, affordable foods that enable them to lead active, healthy lives. Developing a standard for assessing whether food is available and affordable in a community is complex because a variety of factors come into play. One possibility is to determine how much a family would have to spend in local area stores to buy a specific set of relatively lower cost foods that make up a nutritious diet. In this study, researchers with USDA's Economic Research Service (ERS) used a weekly menu meeting the nutritional and dietary requirements of the Thrifty Food Plan (TFP) to assess food availability and affordability in Washington, DC.

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The TFP serves as a national standard for a nutritious diet at a minimal cost and is used as the basis for food stamp allotments (see box). The District of Columbia was selected for this study because it provides a good case study area—it is a central city with a large percentage of food stamp households. Among all States/districts, Washington, DC, ranked first in the proportion of residents receiving food stamps (16 percent in 1999) and second in residents in households with incomes below the poverty line (20 percent in 1997-99).

ERS researchers surveyed 34 large food retailers in Washington, DC, authorized to accept food stamps—21 chain supermarkets, 7 independent supermarkets, and 6 discount food stores. The small sample size reflects a scope of effort typical of a community-level assessment effort and not that of a full-blown research study. As a consequence, study findings are less precise than would be desired for many research purposes. With these caveats in mind, the study found that food availability was greatest in the chain supermarkets where, on average, all but 1 of the 68 items on the TFP shopping list were available. At the independent supermarkets, all but 8 items were generally available; at the sampled discount food stores, 18 items, on average, were not in stock. Although limited in variety, the TFP shopping list items in the sampled discount food stores cost 16 percent less than in the supermarkets. For the 34 food stores surveyed, the cost of TFP shopping list items averaged $3.19 less than the estimated nationwide TFP cost of $101.70 per week in August 2000.

TFP Shopping List Allows Comparisons Across Stores

To determine the availability and affordability of the TFP shopping list in Washington, DC, ERS researchers developed a foodstore survey using the second of two TFP weekly shopping lists. The shopping list used for this study contains 68 food items plus food condiments (the condiments are used in small amounts to prepare recipes). The food items and condiments were assigned to one of eight food groups: (1) grains (bread, cereal, rice, and pasta), (2) vegetables, (3) fruits, (4) milk (milk, yogurt, and cheese), (5) meat and meat alternatives (meat, poultry, fish, dry beans, eggs, and nuts), (6) sugars and sweets, (7) fats and oils, and (8)

condiments. The TFP assumes that the foods needed for all meals and snacks eaten during the week are purchased at stores and that all meals are prepared at home. Convenience foods, such as frozen dinners and store-bought cookies, are not included. The quantities indicated on the list are based on the weekly caloric needs of a man and woman age 20-50 and two children age 6-11.

The TFP shopping list was developed as an example of how low-income families can provide nutritious meals at low cost. The items on the list were chosen to provide all the ingredients needed to prepare a set of recipes for a weekly plan of nutritious meals and snacks that are typical of American diets. The advantage of using the TFP

Thrifty Food Plan Represents a Minimal-Cost, Nutritious Diet

The TFP is a healthful and minimal-cost meal plan that demonstrates how a nutritious diet may be achieved on a limited budget or food stamp benefits. The TFP includes a variety of foods from the major food groups. Food stamp benefit levels are based on the nationwide cost of a TFP market basket developed for a representative family of four, including two adults with two school-aged children.

The present TFP is based on data from USDA's 1989-91 Continuing Survey of Food Intakes by Individuals (CSFII) and a Food Price Database assembled from various sources by ERS researchers. To calculate the food plan for a family of four, USDA's Center for Nutrition Policy and Promotion (CNPP) used a mathematical optimization model. The model minimizes deviations from average consumption patterns for food groups (to ensure that TFP foods are foods that people actually eat) and yields new consumption patterns that meet current dietary standards and maintain low cost levels. The dietary standards of the TFP foods are based on the 1989 Recommended Dietary Allowances, the 1995 *Dietary Guidelines for Americans*, the National Research Council's *Diet and Health* report, and the serving recommendations of the USDA Food Guide Pyramid.

To help implement the TFP, CNPP contracted with The Pennsylvania State University to convert the generic set of foods for a family of four into specific menus, recipes, and shopping lists that may be used by food stamp recipients or households with a limited food budget. Two

Food for a Family of Four[1]

Fruits and vegetables	
Fresh:	
Apples	(5 small) 1 lb 4 oz
Bananas	(11 medium) 2 lb 12 oz
Grapes	1 lb 8 oz
Melon	1 lb
Oranges	(22 small) 4 lb 12 oz
Carrots	1 lb
Celery	5 oz
Green pepper	4 oz
Lettuce, leaf	9 oz
Onions	1 lb 4 oz
Potatoes	10 lb 8 oz
Tomatoes	6 oz
Canned:	
Oranges	13 oz
Peaches, light-syrup	1 lb 10 oz
Mushrooms	4 oz
Spaghetti sauce	26 oz
Tomato sauce	8 oz
Frozen:	
Orange juice, concentrate	7 12-oz cans
Broccoli	6 oz
French fries	11 oz
Green beans	1 lb 7 oz
Peas	15 oz

Breads, cereals, and other grain products	
Bagels, plain, enriched	(4) 8 oz
Bread crumbs	3 oz
Bread, French	4 oz
Bread, white, enriched	2 lb
Bread, whole-wheat	1 lb
Hamburger buns	8
Rolls, dinner	4
Corn flakes	1 oz
Toasted oats	10 oz
Flour, white	1 lb 7 oz
Macaroni	1 lb 5 oz
Noodles, yolk-free	1 lb 2 oz
Popcorn, microwave	3 oz
Rice	3 lb 2 oz
Spaghetti	11 oz
Milk and cheese	
Evaporated milk	4 oz
Milk, 1 percent	9 qt
Milk, whole	4 qt
Cheese, cheddar	2 oz
Cheese, cottage	7 oz
Cheese, mozzarella	1 oz

[1]Provides food for a family of four. Amounts of food shown are for foods actually needed to prepare the Week 2 recipes in *Preparing Meals at Minimal Cost,* CNPP-7B, September 1999.

shopping list to gauge food availability is that the list contains specific items that can be identified and standardized across most food stores. The disadvantage is that the list may not be representative of food patterns in a particular area. For example, stores in low-income areas of the South, unlike similar stores in other areas, may stock cornbread but not bagels. A standardized list that includes only bagels could indicate an availability problem in the South when the situation is simply one of differing regional preferences.

Data collectors for the Washington, DC, survey were instructed to record whether the food items on the TFP shopping list were available in sampled food stores. No item

weekly menus and shopping lists, consisting of seven daily menus with three meals and usually one snack per day, were developed. The menus and recipes were evaluated and found acceptable by taste panelists and a representative group of food stamp households.

This study used the TFP shopping list associated with the second week of menus and recipes. That list contains 68 food items as well as a number of condiments. To ensure recommended consumption levels and prevent excess consumption, the quantities of the various foods were determined based on the Recommended Energy (calorie) level for a family of four. The shopping list assumes all foods are prepared at home. When possible, convenience was incorporated in the choice of food form included in the shopping list. For example, canned broth or bouillon was included rather than expecting a family to prepare soup from stock. However, menus still require that many foods, such as biscuits, be prepared from basic ingredients rather than purchased as boxed mixes or ready-to-eat foods. Soft drinks, coffee, tea, store-bought cookies and candies—foods that are commonly consumed by the general population—are not included.

The cost of the TFP is updated each month using the Consumer Price Indexes (CPI) for different food categories (CPI for bread, CPI for cheese, etc.). In August 2000, the cost of the TFP market basket for a family of four (male and female age 20-50, and two children age 6-8 and 9-11) was $101.70.

Meat and meat alternatives	
Beef, ground, lean	3 lb 15 oz
Chicken, fryer	1 lb 13 oz
Chicken, thighs	2 lb 12 oz
Fish, frozen	2 lb
Tuna fish, canned	12 oz
Pork, ground	1 lb 7 oz
Turkey, ground	1 lb
Turkey ham	11 oz
Beans, garbanzo (chickpeas)	15 oz
Beans, kidney	15 oz
Beans, vegetarian, baked	1 lb 9 oz
Eggs, large	17
Fats and oils	
Margarine, stick	15 oz
Shortening	4 oz
Salad dressing, mayonnaise-type	6 fl oz
Vegetable oil	9 fl oz
Sugars and sweets	
Sugar, brown	1 oz
Sugar, powdered	3 oz
Sugar, granulated	9 oz
Jelly	8 oz
Molasses	1 fl oz
Pancake syrup	2 oz
Chocolate chips, semi-sweet	2 oz
Fruit drink	1 gal
Fudgesicles	4

Condiments and spices	
Baking powder	.02 oz
Baking soda	.18 oz
Black pepper	.16 oz
Catsup	1.06 oz
Chicken boullion	.71 oz
Chili powder	.79 oz
Cinnamon	.08 oz
Chocolate drink powder	1.52 oz
Cumin	.05 oz
Onion powder	.22 oz
Garlic powder	.40 oz
Gelatin, unflavored	2.25 oz
Italian herb seasoning	.03 oz
Lemon juice, bottled	.54 oz
Oregano	.18 oz
Paprika	.11 oz
Salt	.13 oz
Soy sauce	2.26 oz
Vanilla	.52 oz

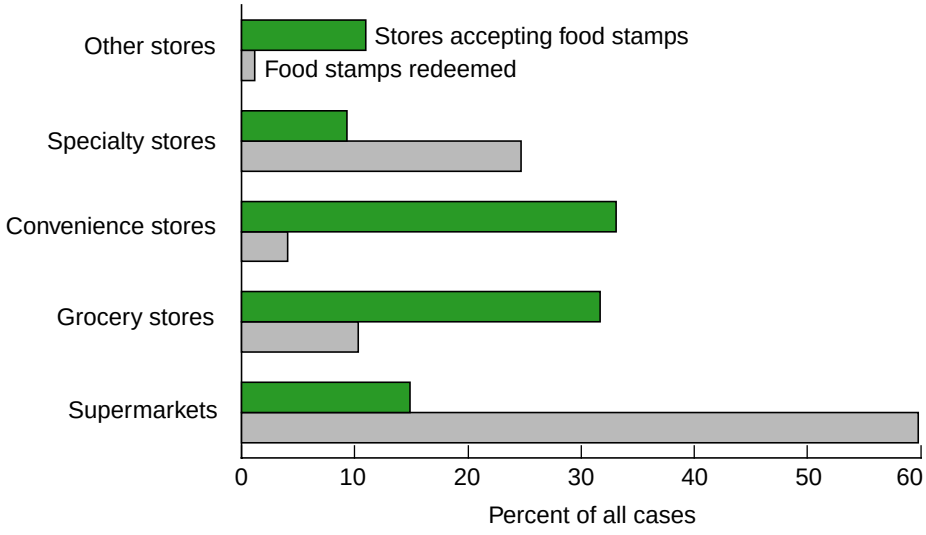
substitutions were allowed although a choice of variety was offered in some instances. For most items on the list, specific container sizes (but not brand) were suggested for pricing. National, store, and generic brands were all examined. Data collectors computed per unit costs for all products meeting the basic item specifications and recorded the lowest cost. Sale prices were used for products on sale, but coupon and other discounts were not included in the price computations.

When the list-specified sizes were not available, data collectors were instructed to determine whether an alternative package size or container for the food was available and to record the package size, type, and lowest unit price. Certain food items on the shopping list required the data collectors to examine different varieties of the food to determine the one with the lowest cost. For example, data collectors pricing melon checked watermelon, cantaloup, and all other varieties and chose the one with the lowest per unit cost.

The food retailers surveyed were chosen from a list of retailers authorized to accept food stamps provided by USDA's Food and Nutrition Service (FNS). The food retailers are self-classified according to a store-type identifier reported on their application for food stamp authorization. These identifiers include supermarkets, grocery stores, convenience stores, specialty stores (such as bakeries, butchers, and other stores specializing in a particular food product), and other stores that accept food stamps (gas/grocery combinations, health food stores, food cooperatives, farmers markets, and produce stands).

At the time of the study, 374 food retailers in Washington, DC, were authorized to accept food stamps. Small grocery stores and convenience stores accounted for 65 percent of the total number of stores accepting food stamps but for only 14 percent of actual food stamp redemptions (fig. 1). In contrast, the 15 percent of stores self-classified as supermarkets were responsible for 60 percent of redemptions. Specialty food stores (9 percent of stores) accounted for 25 percent of redemptions. Nationally, supermarkets account for about the same proportion of stores accepting food stamps but for 77 percent of food stamp redemptions. Likewise, specialty stores account for about 9 percent of stores nationally but for only 4 percent of redemptions.

Figure 1
Supermarkets Account for 60 Percent of Food Stamp Redemptions in the DC Area, January-June 2000



Source: USDA's Food and Nutrition Service, Food Stamp Redemptions Data.

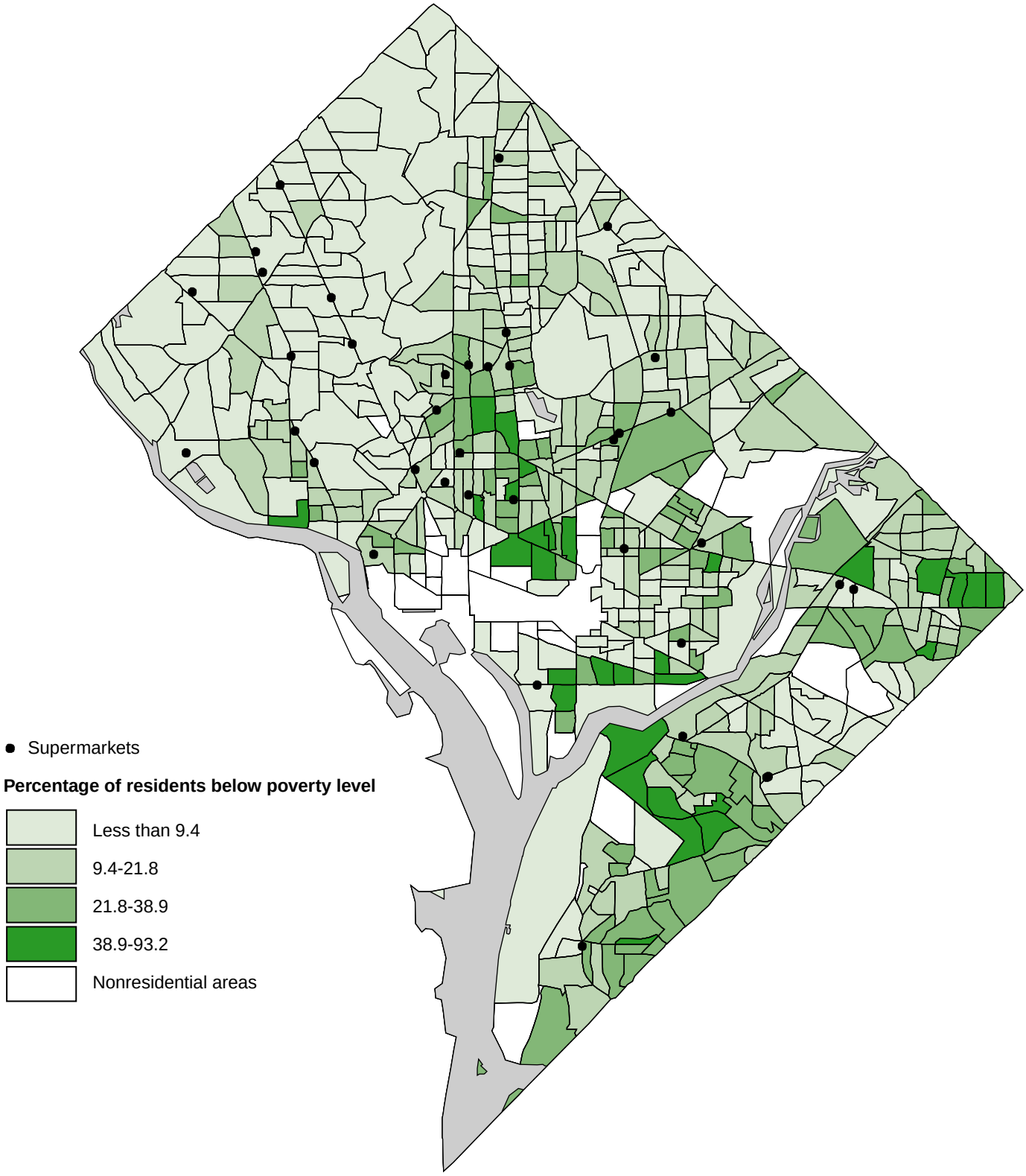
Survey Expanded Beyond Supermarkets

ERS initially planned to limit the survey to stores listed as supermarkets in the FNS list. Previous research indicated that food prices are usually lowest and availability greatest in these stores. However, closer inspection of food stamp redemption patterns in Washington, DC, and store categorizations in the FNS list led to some revisions of this strategy.

In addition to supermarkets, the study identified a chain of discount food stores (self-classified as specialty food stores in the FNS database) as an important outlet for food stamp participants. A significant portion of the food stamp benefits redeemed in Washington, DC, in June 2000 were spent at stores in this chain. Most of the stores reported sales volume similar to that of small supermarkets, and preliminary inspections indicated that the stores carried a variety of food items, including fresh meats, produce, and staple goods. Although these stores were not typical supermarkets, they clearly did not fall within the usual definition of specialty stores either. Because they fill an important market niche for local food stamp participants, six of these stores were included in the survey and given a unique category name—discount food stores—to highlight their special features.

Thirty-seven stores in the FNS list were classified as supermarkets. In general, these stores are located along main corridors in the central business district, northwest area, and northeast area of the city (fig. 2). Supermarkets are more sparsely located in the southeast area, where

Figure 2
High-Poverty Areas of DC Are Underserved by Supermarkets



Source: USDA's Economic Research Service, Geographic Information Systems Unit, from 2000 FNS administrative data and 1990 census data on individuals living below the poverty line by census block group.

some of the city's highest poverty neighborhoods are located. The discount food stores (not shown in the figure) are predominately located in the eastern parts of the city.

Among the 37 stores classified as supermarkets, 21 belonged to well-known regional or national supermarket chains and clearly met the conventional definition of a supermarket (that is, a large self-service grocery store, with annual gross sales exceeding $2 million, offering a variety of packaged foods, fresh produce, and meat). These stores were included in the survey and categorized as chain supermarkets. Two other stores belonging to a natural foods supermarket chain reported large sales volume but were excluded from the survey due to their low food stamp redemption levels. Of the remaining 14 nonchain stores listed in the supermarket category on the FNS list, 7 were included in the survey and categorized as independent supermarkets. The other seven were excluded based on low food stamp redemptions or factors indicating that they did not meet the conventional criteria for a supermarket.

In total, the ERS survey looked at availability and affordability of items on the TFP shopping list at 34 food retailers—21 chain supermarkets, 7 independent supermarkets, and 6 discount food stores. The survey was conducted in August 2000. Data collectors surveyed two to three retailers per day.

Food availability was assessed by determining how many of the 68 food items on the TFP shopping list were found in the stores. Condiments were not assessed. Food affordability was assessed by comparing the total cost of all items on the TFP shopping list in each store with the national cost of the TFP computed by USDA.

Total cost was computed by multiplying the price per unit of each item by the quantity specified on the TFP shopping list. (Costs for the condiment items were included based on amounts calculated from recipes and menu plans.) Unit prices were used because, in several instances, the item size identified for pricing in the survey did not correspond with the amount specified on the TFP shopping list. For example, the survey specified that the data collector price a 16-ounce bag of frozen peas although only 15 ounces were needed for the TFP shopping list. The cost computation for frozen peas would be based on 15 ounces priced at the per unit cost of the 16 ounce bag. It is thus assumed that any excess purchases would be available for future consumption and count toward food costs in another week's period. For nonperishable items, this assumption is realistic.

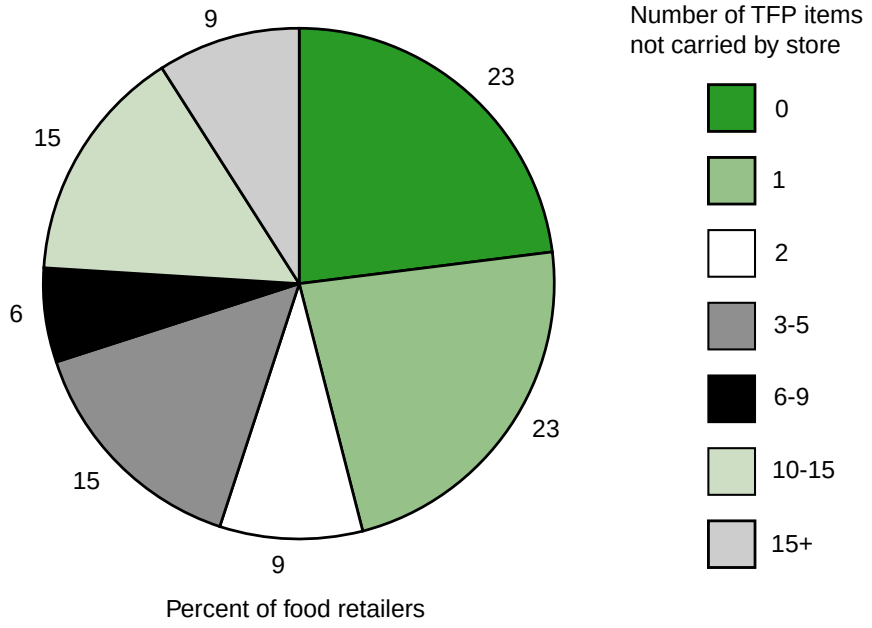
If a food item was not available at a food retailer, its cost was estimated as the average price from all other food retailers that had the item in stock when they were surveyed. This imputation procedure is necessary to estimate the cost of the complete TFP shopping list for each food retailer surveyed, though it results in an underestimate of the cost variation among the surveyed stores.

Eight of the 34 food retailers surveyed carried all 68 food items (fig. 3). Eleven of the food retailers sold all except 1 or 2 of the 68 food items. Seven of the food retailers did not sell 10 or more of the items. The food items that most often were not available were ground pork (not available at 79 percent of the food retailers surveyed), fudgesicles (not available at 41 percent of the food retailers surveyed), and yolk-free egg noodles (not available at 32 percent of the food retailers surveyed) (fig. 4).

Costs Lower Than Nationwide TFP Cost…

The average total cost of items on the TFP shopping list for a family of four (two adults age 20-50 and two

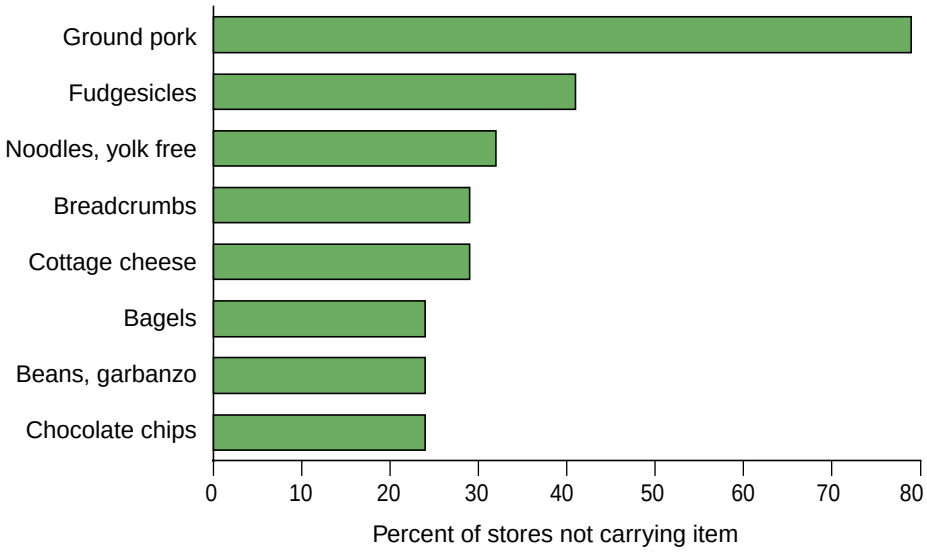
Figure 3
Nearly a Quarter of Surveyed Retailers Carried All TFP Items



Source: USDA/Economic Research Service, Food Store Survey, August 2000.

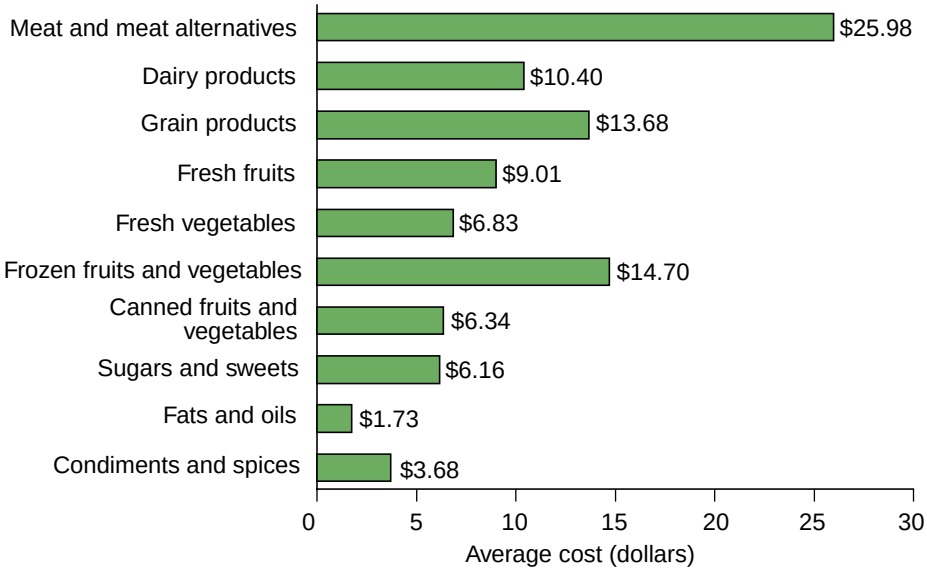
children age 6-11) at the 34 food retailers was $98.51 per week (table 1). The August 2000 cost for a family of four nationwide averaged $101.70 per week. The lower cost of the TFP shopping list in Washington, DC, may seem surprising because food prices are generally higher in large urban areas. The difference can be explained in part by the methods used to calculate the nationwide TFP cost and the TFP shopping list cost. The nationwide average cost of the TFP is based on average prices for the entire country for a wide array of food products in each food category whereas the ERS survey priced 68 specific items plus condiments at the lowest per unit cost available in the store. For example, the cost of spaghetti sauce in the nationwide TFP is based on a weighted average of brand name, store brand, and generic products of different container sizes. The Washington, DC, cost for spaghetti sauce is based on the lowest cost for a 26-ounce jar of spaghetti sauce at surveyed stores.

Figure 4
Ground Pork Tops List of TFP Items Missing at Stores Surveyed



Source: USDA's Economic Research Service, Food Store Survey, August 2000.

Figure 5
Meats Take the Largest Bite out of Average TFP Costs



Source: USDA's Economic Research Service, Food Store Survey, August 2000.

The shopping list food category with the highest average cost was meat and meat alternatives, which accounted for $25.98, or 26.4 percent of the total cost of the TFP shopping list (fig. 5). The fresh, frozen, and canned fruits and vegetables categories were also significant cost components, together totaling $36.88, or 37.4 percent of the total TFP shopping list cost. Fats and oils, which made up $1.73, or 1.8 percent of the TFP shopping list, was the food category with the lowest average cost. The low cost is not surprising because fats and oils are used sparingly as a part of a low-fat diet and are generally inexpensive.

As expected, the overall cost of the TFP varied substantially by type of store (table 1). In the 21 chain supermarkets, the cost of the TFP shopping list averaged $100.54; the average cost in the 7 independent supermarkets was $103.30. Costs were substantially lower in the six discount food stores, where the TFP shopping list, on average, cost $85.86, about 16 percent lower than the average cost in supermarkets.

While these results suggest that the discount food stores are successful in supplying affordable food to food stamp participants, it should be noted that food availability was more of a problem in those stores. The average discount food store was missing slightly more than 18 items,

about 27 percent of the total number of items in the TFP market basket. In contrast, chain supermarkets averaged 1 missing item, and independent supermarkets averaged 7.7 missing items.

…And Not Very Different in Lower and Higher Poverty Areas

To determine whether the TFP shopping list costs more in high-poverty areas, the 19 Zip Code areas of Washington, DC, were classified by the percentage of the population in poverty. The average cost of the TFP shopping list at the 21 food retailers located in Zip Codes with more than 15 percent of the population in poverty was $98.26, slightly less than the $98.92 average cost at the 13 food retailers in less poor areas.

Again, this result needs to be interpreted cautiously. The lower cost of the TFP shopping list in the higher poverty Zip Codes is largely a result of the greater preponderance of discount food stores in those areas. Five of the six discount food stores were located in Zip Codes where more than 15 percent of the population lives below the poverty

ERS found that food availability was greatest in chain supermarkets, which on average carried all but 1 of the 68 food items on the TFP shopping list.

Table 1
Supermarkets Best for Availability of Items, Discount Food Stores Best for Cost

Food stores in ERS survey	Stores	Missing items	Weekly cost of TFP[1]
	Number		*Dollars*
Chain supermarkets[2] (total)	21	1.0	100.54
Located in Zip Code areas with:			
Less than 15 percent of residents in poverty	10	.8	99.57
15 percent or more of residents in poverty	11	1.2	101.41
Independent supermarkets[3] (total)	7	7.7	103.30
Located in Zip Code areas with:			
Less than 15 percent of residents in poverty	2	-	-
15 percent or more of residents in poverty	5	6.8	104.48
Discount food stores (total)	6	18.3	85.86
Located in Zip Code areas with:			
Less than 15 percent of residents in poverty	1	-	-
15 percent or more of residents in poverty	5	15.2	85.10
Total sample	34	5.4	98.51
Located in Zip Code areas with:			
Less than 15 percent of residents in poverty	13	4.3	98.92
15 percent or more of residents in poverty	21	5.9	98.26

- = Estimates suppressed due to small sample size.
[1]Based on cost for a family of four.
[2] A supermarket associated with a firm that operates 10 or more stores.
[3]A supermarket not belonging to a chain, but not always a single-store chain.
Source: USDA's Economic Research Service.

line. As previously noted, these stores have lower prices but less variety in the number of food items available than the chain and independent supermarkets. Furthermore, within the two supermarket categories, the cost of the TFP shopping list is higher in the higher poverty Zip Codes (though the sample size in this study is too small to determine whether the differences are statistically significant). This finding is consistent with prior research that suggests that supermarkets in low-income neighborhoods may have higher prices than supermarkets in nearby higher income areas.

This study illustrates the usefulness of the TFP shopping lists for assessing the availability and affordability of food in a large metropolitan area. Even though the list of foods surveyed does not fully represent the range of the foods consumed in the Washington, DC, area, the ERS survey did generate useful data and store comparisons.

Overall, the findings show that a careful shopper in Washington, DC, can find the foods on the TFP shopping list (foods that conform to nutritional and dietary standards) at a relatively low cost. By that standard, food in the city is affordable and available. However, food affordability and availability also need to be assessed within the geographic and socioeconomic resources of target populations. The ERS study did not assess any time, transportation, or travel-cost issues that might prevent low-income food stamp participants from accessing affordable food. These factors could be more of an issue in higher poverty areas of the city where supermarkets are less accessible and where other food stores, such as the discount food stores surveyed in this study, carry a more restricted range of products.

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U.S. Consumption Patterns of Tree Nuts

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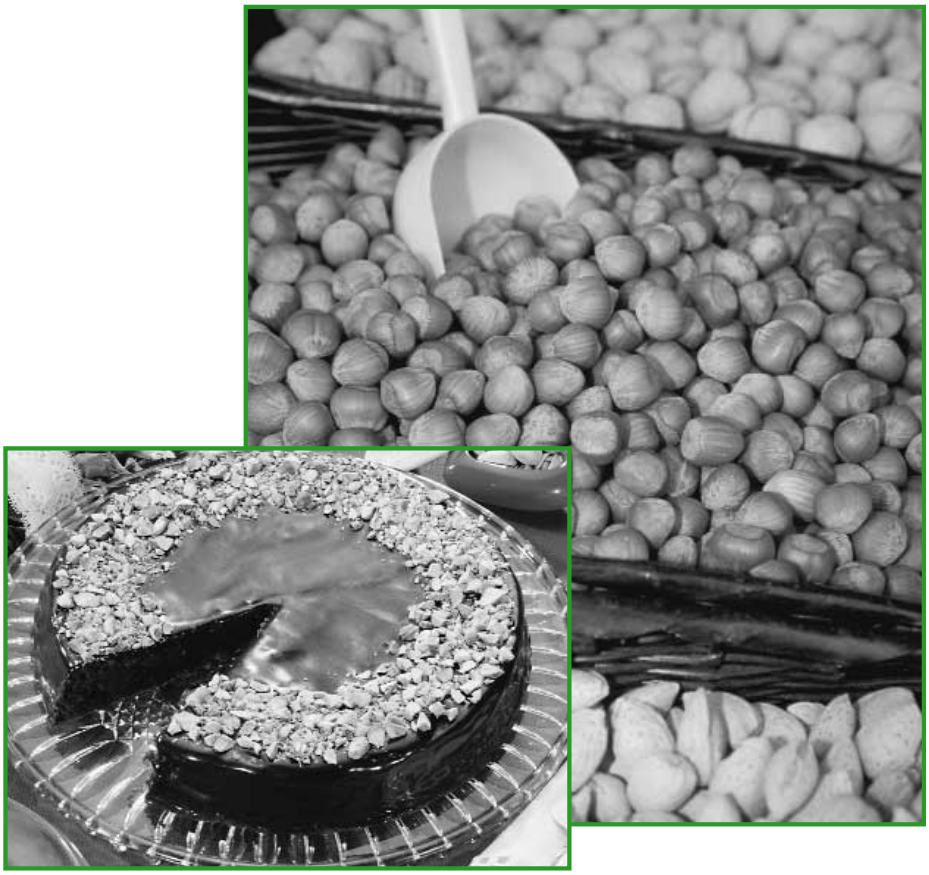
Americans are more than a little nutty when it comes to their diets. Recent USDA food consumption data show that about 1 in every 10 consumers eats tree nuts (almonds, walnuts, pecans, pistachios, cashews, and others) on any given day, and the amount eaten is fairly small. On average, slightly more than 1 gram of tree nuts are eaten per person per day. Tree nut consumption is higher among wealthier consumers and Whites in the United States. More adults age 40 and above eat tree nuts than younger consumers. A smaller proportion of consumers living in the South and in rural areas consume tree nuts than other consumers.

These findings are from a new analysis by USDA's Economic Research Service (ERS) of USDA's most recent food consumption survey, the 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII). Each year of the survey's 3-year data set comprises a nationally representative sample of noninstitutionalized persons residing in all 50 States and Washington, DC. The 1994-96 CSFII collected 2 nonconsecutive days of dietary data for individuals of all ages through in-person interviews. Survey respondents were asked to recall all the food and beverages they had consumed in the last 24 hours. The respondents provided a list of foods consumed as well as information on where, when, and how much of each food was eaten. An array of social, demographic, and economic data were collected for each respondent. The ERS study analyzed the responses of



About 60 percent of all tree nuts consumed in the United States are consumed in nut-containing foods, such as breakfast cereals, candies, pastries, and cakes.

Credits: Ken Hammond, USDA (nuts). PhotoDisc (cake).

The authors are agricultural economists with the Food and Rural Economics Division, Economic Research Service, USDA.

the 14,262 individuals age 2 and above who completed the 2-day dietary recalls.

Our analysis was supported by two technical databases developed by USDA's Agricultural Research Service (ARS): Pyramid Servings Data and Recipe Files. ARS's Pyramid Servings Data provide servings of 30 different food groups contained in each of the 7,300 foods that were reported eaten by consumers in the United States. For example, a 100-gram Danish pastry with nuts provides about 5 teaspoons of added sugar, 25 grams of total fat, 2 servings of nonwhole grains, and 0.3 ounces of nuts and seeds (in lean-meat equivalents). The "nuts and seeds" group includes tree nuts, peanuts, and seeds (such as sunflower seeds). ARS's Recipe Files helped us identify the types of tree nuts in nut-containing foods (such as almonds in breakfast cereal and walnuts in brownies). We also used the Recipe Files to calculate quantities of tree nuts by subtracting the peanuts and seeds from the total servings of nuts and seeds. The servings data for nuts are expressed in terms of cooked lean-meat equivalent: 1 cup of tree nuts equals 3 ounces of lean meat. We used 142 grams per cup to express nut consumption in grams.

Consumption Highest Among 40- to 59-Year-Olds

On any given day in 1994-96, 12 percent of males and 14 percent of females ate tree nuts. On any given day, 15 percent of adults age 40 and older consumed tree nuts, compared with 11 percent for younger adults and children (table 1). Older adults consumed more tree nuts than younger adults. Among the 13 percent of the population that ate tree nuts, children age 2-5 consumed 3.2 grams per person per day, children 6-19 consumed 3.6 grams, adults 20-

Table 1
Americans Are More Than a Little Nutty When It Comes to Their Diets

Individuals	Population eating nuts	Per capita consumption: All individuals	Per capita consumption: Individuals consuming
	Percent	*Grams*	
U.S. consumers, age 2 and over	13	1.1	6.2
Age 2-5	11	.5	3.2
Age 6-19	12	.6	3.6
Age 20-39	11	1.0	6.4
Age 40-59	15	1.6	8.1
Age 60 and over	15	1.2	6.4
Male, all	12	1.1	6.9
Age 2-5	10	.5	3.0
Age 6-19	12	.7	4.1
Age 20-39	10	1.0	7.9
Age 40-59	14	1.7	9.2
Age 60 and over	16	1.4	7.1
Female, all	14	1.1	5.6
Age 2-5	11	.6	3.4
Age 6-19	13	.5	2.6
Age 20-39	12	1.0	5.5
Age 40-59	16	1.5	7.2
Age 60 and over	15	1.1	5.8
Race/Ethnic origin:			
White, non-Hispanic	15	1.3	6.3
Black, non-Hispanic	5	.4	4.5
Hispanic	7	.9	7.1
Others	10	.5	4.0
Household income as a percentage of poverty:			
0-130 percent	7	.5	5.2
131-350 percent	11	.9	5.5
351 percent and above	18	1.6	7.0
Census region:			
Northeast[1]	12	1.1	6.5
Midwest[2]	16	1.0	5.0
South[3]	10	.9	6.7
West[4]	16	1.4	6.8
Metropolitan Statistical Area status:			
Metropolitan	13	1.0	5.9
Suburban	14	1.2	6.4
Rural	11	1.0	6.3

[1]Northeastern States are Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.
[2]Midwestern States are Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.
[3]Southern States are Alabama, Arkansas, Delaware, Washington, DC, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.
[4]Western States are Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, New Mexico, Oregon, Utah, Washington, and Wyoming.
Source: 1994-96 CSFII, 2-day.

39 consumed 6.4 grams, adults 40-59 consumed 8.1 grams, and adults 60 and above consumed 6.4 grams. On a per capita basis for all individuals, children age 2-5 consumed 0.5 grams per day, children 6-19 consumed 0.6 grams, adults 20-39 consumed 1.0 grams, adults 40-59 consumed 1.6 grams, and adults 60 and above consumed 1.2 grams

Popularity of Tree Nuts Rises With Income, Varies by Race

According to the CSFII data, tree nut consumption rises with income; that is, people with higher incomes eat more tree nuts and eat them more frequently than people with lower incomes. We classified households into three income groups. About 40 percent of U.S. households had high incomes—incomes exceeding 350 percent of the poverty level. (The Federal poverty level was $15,141 for a family of four in 1995.) Forty-two percent of households were classified as middle income, with incomes falling between 131 and 350 percent of the poverty level. Nineteen percent of households fell into the low-income group, with incomes below 131 percent of the poverty level.

Eighteen percent of people in the high-income group consumed tree nuts on any given day, compared with 7 percent for the low-income group and 11 percent for the middle-income group. On a per capita basis for all individuals, the high-income group consumed 1.6 grams of tree nuts per day, compared with 0.5 gram for the low-income group and 0.9 grams for the middle-income group. Among those who consumed tree nuts, individuals in the high-income group consumed 7.0 grams per person per day, more than one-third higher than individuals in the low-income group and more than one-quarter higher than individuals in the middle-income group.

Tree nuts are more popular among non-Hispanic Whites (73 percent of the U.S. population) than other racial/ethnic groups. Fifteen percent of non-Hispanic Whites consumed tree nuts on any given day, compared with 5 percent of non-Hispanic Blacks (13 percent of the U.S. population) and 7 percent of Hispanics (11 percent of the U.S. population). Whites consumed 1.3 grams of tree nuts per person each day, while Blacks consumed 0.4 grams and Hispanics consumed 0.9 grams. Among those who reported eating tree nuts, Hispanics ate 7.1 grams per person per day, Blacks consumed 4.5 grams, and Whites consumed 6.3 grams.

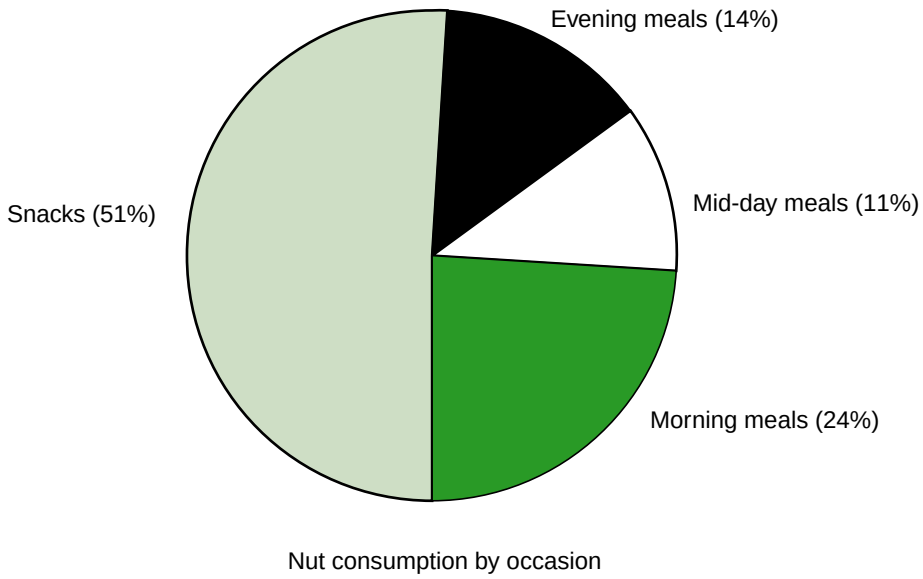
Tree nut consumption also varies among regions. Sixteen percent of the people in the Western States and the Midwestern States consumed tree nuts on any given day, compared with 12 percent in Northeastern States and 10 percent in Southern States. Of the four regions, per capita consumption among those eating tree nuts was highest (6.8 grams per day) for consumers in the West.

Tree Nuts Mostly Consumed as Snacks

Over half (51 percent) of tree nuts eaten in the United States were consumed as snacks, followed by 24 percent consumed during morning meals, including breakfast and brunch before 10 a.m. (fig. 1). Fourteen percent of tree nuts were consumed during evening meals (dinner, supper, or brunch after 3 p.m.) and 11 percent of tree nuts were consumed during mid-day meals, including lunch and brunch between 10 a.m. and 3 p.m.

The distribution of tree nut consumption by snacks and meals is related to the different types of foods that contain tree nuts. We separated nut-containing foods into five groups: nuts, breakfast cereals, desserts and baked foods, candies, and others. Thirty-nine percent of tree nuts were consumed as nuts

Figure 1
Over Half of Tree Nuts Are Consumed as Snacks

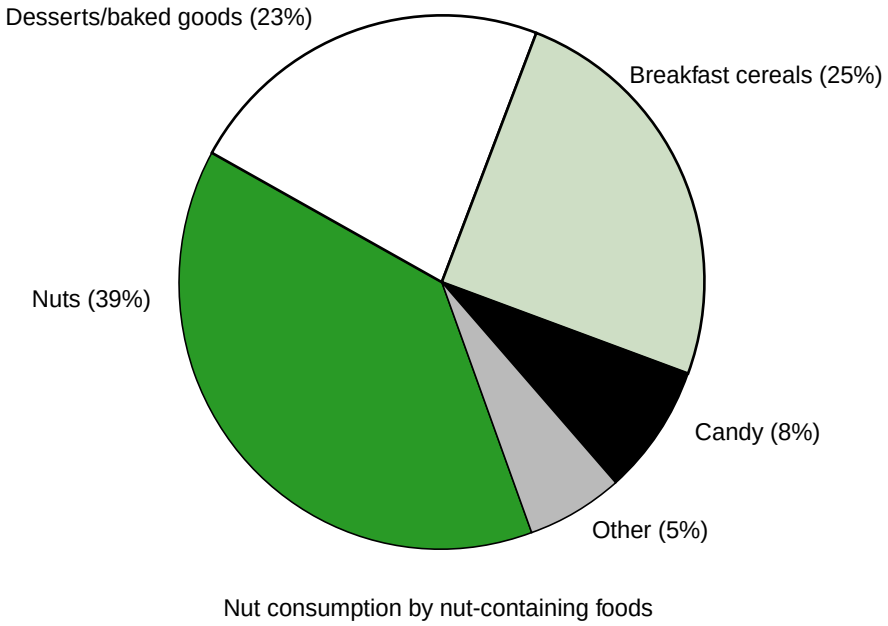


Source: 1994-96 CSFII, 2-day.

(fig. 2), consistent with the dominant consumption of tree nuts as snacks. As 24 percent of tree nuts were consumed during morning meals, it is no coincidence that 25 percent of tree nuts consumed came from breakfast cereals. A substantial amount of tree nuts were consumed as desserts and baked goods (23 percent), and 8 percent of tree nuts were consumed in candies.

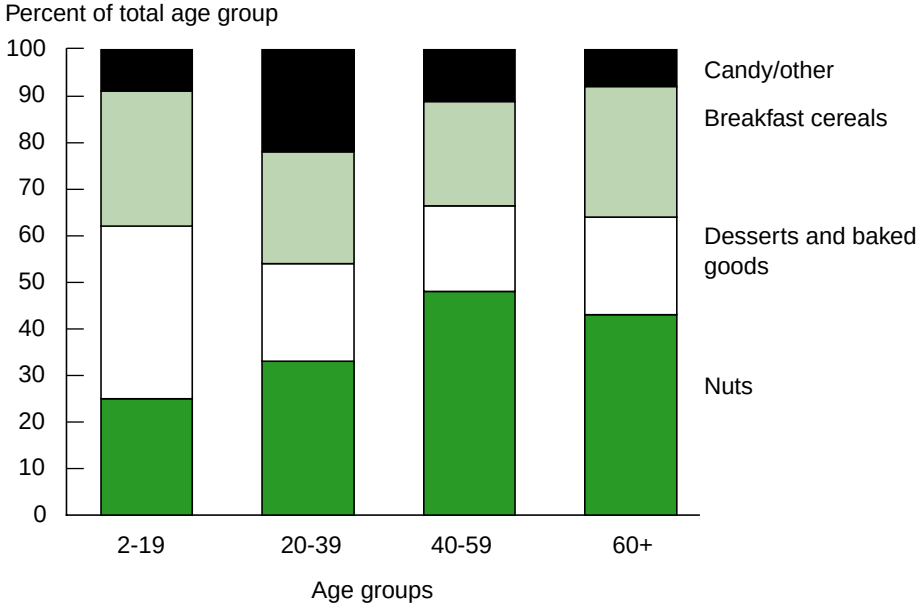
Americans' favorite ways to eat tree nuts vary by age (fig. 3). Nut-containing desserts and baked goods account for 37 percent of total tree nut consumption by children age 2-19, whereas about 45 percent of tree nuts consumed by adults age 40 and older are eaten as nuts. Nuts eaten as nuts account for only 25 percent and 33 percent of tree-nut consumption among children age 2-19 and young adults age 20-39, respectively. Breakfast cereals contribute to similar shares of tree nut consumption across all age groups, with slightly higher shares among children (29 percent) and seniors (28 percent). Breakfast cereals accounted for 24 percent of tree nut consumption among adults age 20-39 and 22 percent among adults age 40-59.

Figure 2
Americans Favor Eating Tree Nuts as Nuts



Source: 1994-96 CSFII, 2-day.

Figure 3
Adults Favor Eating Tree Nuts as Nuts, Children Like Desserts and Baked Goods Containing Nuts



Source: 1994-96 CSFII, 2-day.

Tree Nuts—Good Sources of Monounsaturated Fats

Tree nuts are high in fat and dense in energy. Each 100-gram quantity of tree nuts contains 52 grams of fat. About 14 percent of this total fat is saturated fat; unsaturated fats (mono- and polyunsaturated fat) account for 82 percent of total fat in tree nuts. Tree nuts are also good sources of other nutrients. For example, 100 grams of tree nuts contain 7.6 grams of fiber, 200 milligrams of magnesium, and 6 milligrams of vitamin E. The daily Recommended Dietary Allowances for females age 31-50 are 5.2 grams of fiber, 320 milligrams of magnesium, and 8 milligrams of vitamin E.

Because tree nuts are excellent sources of monounsaturated fats, they have received attention as foods having a protective effect against coronary heart disease. Several controlled diet studies indicate that low-fat diets supplemented with tree nuts can lower total cho-

lesterol and low-density lipoprotein cholesterol. However, over half of all tree nuts consumed in the United States are consumed as ingredients in nut-containing foods. Thus, we need to look at the nutrient profile of the nuts themselves, as well as that of the different nut-containing foods, to determine the nutrients Americans would add to their diets if they decided to increase their nut consumption through a variety of nut-containing foods.

We used ARS's nutrient-composition database, which lists the quantities of about 20 nutrients contained in each food reported in CSFII, to compare the nutrient profiles of the five nut-containing foods. Tree nuts consumed as nuts have the highest energy density of the five types of nut-containing foods, providing 595 calories per 100 grams of tree nuts. Candy provides 510 calories, breakfast cereals provide 396 calories, and desserts and baked goods provide 370 calories. The nutritional profile of the catchall category "other" is not reported here.

The nutrient-to-calorie (or nutrient) density, which measures the amount of a nutrient for each 1,000 calories of a food, can be used to compare nutritional values of different nut-containing foods. The amount of tree nuts that generates 1,000 calories also provides 88 grams of total fat (12 grams are saturated fats and 76 grams are unsaturated fat). Nut-containing breakfast cereals are much lower in fats (23 grams of total fat, of which 16 grams are unsaturated fat, per 1,000 calories). Cereals are fortified with additional nutrients, such as iron and folate. Candies that contain tree nuts provide considerably higher amounts of saturated fat (27 grams of saturated fat per 1,000 calories) and lower amounts of fiber and magnesium than cereals or nuts alone.

While studies have found that total cholesterol and low-density lipoprotein cholesterol can be lowered in low-fat diets that are supplemented with tree nuts, not all Americans adhere to dietary recommendations regarding fat intake. The 2000 *Dietary Guidelines for Americans* recommend that total fat should account for no more than 30 percent of total calories and less than 10 percent of total calories from saturated fat. In 1994-96, only 37 percent of U.S. consumers age 2 and above met the recommended intake for fat and only 40 percent met the recommended intake for saturated fat.

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