Chapter One
Introduction

This report describes the nutrition and health characteristics of the Nation's school-age children—boys and girls 5 to 18 years of age—using data from the Third National Health and Nutrition Examination Survey (NHANES-III). The NHANES survey is the primary source of information used in monitoring the Nation's nutrition and health status. NHANES-III was completed between 1988 and 1994 and provides data for a large nationally representative sample of individuals.[1]

The report compares and contrasts children in three different income groups: income at or below 130 percent of poverty (lowest income), income between 131 and 185 percent of poverty (low income), and income greater than 185 percent of poverty (higher income). The lowest-income group corresponds to the income-eligibility criterion used to define eligibility for free meals in the National School Lunch Program (NSLP) and the School Breakfast Program (SBP). The low-income group corresponds to eligibility for reduced-price meals in these programs.

Two previous volumes in this series compare participants and nonparticipants in major Federal food and nutrition assistance programs (volume I: the Food Stamp Program (Fox and Cole, 2004) and volume II: the WIC Program (Cole and Fox, 2004a)).[2] It was not possible to effectively compare participants and nonparticipants in the NSLP and SBP because NHANES-III data are not detailed enough to identify children who actually consumed NSLP/SBP meals on the day dietary intake data were collected. This limitation makes it impossible to make valid comparisons between NSLP/SBP participants and nonparticipants for any of the dietary intake variables examined in this report. This includes all of the data reported in Chapter Three and most of the data reported in Chapter Two.

This research was designed to establish a baseline from which to monitor the nutrition and health characteristics of school-age children over time, particularly those in the lowest- and low-income groups, and to generate questions and hypotheses for future research. The data presented in this report provide useful background information for researchers interested in studying the nutrition and health characteristics of school-age children and/or the impact of participation in food and nutrition assistance programs, or other variables, on nutrition and health characteristics. The data also provide important insights for individuals who plan and implement nutrition or health programs for school-age children.

A broad array of measures is used to describe the nutrition and health characteristics of school-age children. Nutritional status is examined through measures of dietary intake, body weight, and selected nutritional biochemistries. Important health-related behaviors are also examined, including physical activity, television viewing, and alcohol and tobacco use. General health status is assessed on the basis of both caregiver and physician assessments. In addition, dental health and other measures of child health are examined. Finally, data on health insurance coverage

[1]Beginning in 1999, NHANES became a continuing survey, without breaks between data collection cycles. Similar sampling and data collection procedures are used, although at least two years of data are necessary to have adequate sample sizes for subgroup analyses (Flegal et al., 2002). Data for the first two continuous years of the ongoing NHANES (1999-2000) have been released since the time the tabulations presented in this report were prepared. Data for subsequent years are expected in mid-2005.

[2]The series also includes a fourth volume, which focuses on older adults (Cole and Fox, 2004b).

and use of regular health care providers are used to assess access to health care services.

This introductory chapter provides a brief description of the NHANES-III data and the general analytic approach. The six chapters that follow present data on the nutrition and health characteristics mentioned above. Details on data and methodology may be found in appendices referenced throughout the report.

The Third National Health and Nutrition Examination Survey

NHANES-III was conducted by the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC) between 1988 and 1994. The survey included interviews and physical examinations, and was designed to provide national estimates of the health and nutrition status of the civilian, noninstitutionalized population in the 50 United States.

NHANES-III was based on a complex multi-stage probability sample design (NCHS, 1994). Persons were selected on the basis of sex, age, and race or ethnicity. Children under 6 years of age, adults over 60 years of age, and black and Mexican American persons were oversampled. NHANES-III collected data from 33,994 persons 2 months of age and older. Response rates were 85.6 percent for the household interviews and 78.8 percent for the physical examinations (NCHS, 1996). The total sample of school-age children is 6,824.

Interviews were conducted in respondents' homes and physical examinations and measurements were completed in a Mobile Exam Center (MEC). Interview procedures varied for children of different ages. For children under the age of 17, the Household Youth Interview was administered to a parent or other primary caregiver. The MEC-Youth Interview, which included questions about tobacco, alcohol, drugs, reproductive health, physical activity, and selected questions about diet, was completed by children 8 years and older, when they visited the MEC. Children generally completed the MEC-Youth Interview on their own—that is, without a parent or other caregiver present. Children 17 years and older were considered adults and completed the Adult Household Interview and MEC-Adult Interview. These interviews included many, but not all, of the questions covered in the two youth interviews. All school-age children completed the MEC examination, which included a physical exam, dietary interview, health interview, blood tests, body measurements, and a dental exam.

The dietary interview included a single 24-hour dietary recall.[3] The recall collected quantitative data on foods and beverages consumed during the preceding 24 hours. Primary caregivers provided data for children less than 6 years of age. Children 6 to 11 years of age were interviewed with their caregiver. Children 12 and older were interviewed alone. NCHS staff calculated 24-hour nutrient intakes, using food composition data from the Survey Nutrient Database maintained by the U.S. Department of Agriculture's (USDA) Agricultural Research Service (ARS).

Analytic Approach

School-age children in the NHANES-III sample were divided into three groups on the basis of household income: income at or below 130 percent of poverty (lowest income), income between 131 and 185 percent of poverty (low income), and income greater than 185 percent of poverty (higher income). As noted previously, these criterion incorporate the cutoffs used to define income eligibility for free (lowest-income

[3]For respondents 17 years and older, NHANES-III also included a food frequency questionnaire, which was administered as part of the household interview. The food frequency had a 1-month reference period and was designed to collect qualitative information about dietary patterns. Data from the food frequency were not analyzed for this series of reports.

Table 1—Number of NHANES-III respondents: School-age children

	All children		Lowest income: ≤ 130% poverty		Low-income: 131-185% poverty		Higher-income: > 185% poverty	
	Household Interview	MEC Examined	Household Interview	MEC Examined	Household Interview	MEC Examined	Household Interview	MEC Examined
Both sexes								
5-10 years	3,671	3,476	1,817	1,763	436	418	1,194	1,103
11-13 years	1,503	1,423	724	699	172	165	510	473
14-18 years	1,650	1,553	750	729	198	191	579	526
Total	6,824	6,452	3,291	3,191	806	774	2,283	2,102
Male								
5-10 years	1,868	1,753	896	868	213	203	637	581
11-13 years	718	681	344	334	89	84	241	227
14-18 years	784	741	356	346	94	91	265	242
Total	3,370	3,175	1,596	1,548	396	378	1,143	1,050
Female								
5-10 years	1,803	1,723	921	895	223	215	557	522
11-13 years	785	742	380	365	83	81	269	246
14-18 years	866	812	394	383	104	100	314	284
Total	3,454	3,277	1,695	1,643	410	396	1,140	1,052

Source: NHANES-III, 1988-94.

group) and reduced-price (low-income group) meals in the school meal programs. Children who resided in households participating in the Food Stamp Program (FSP) were considered members of the lowest-income group (income at or below 130 percent of poverty), regardless of reported income. This approach is consistent with the classification scheme used in the companion reports in this series (Fox and Cole, 2004, Cole and Fox, 2004a, and Cole and Fox, 2004b), and gives precedence to reported program participation.[4]

The three income strata were further divided on the basis of gender and age into 18 subgroups. The age groups used (5-10 years, 11-13 years, and 14-18 years) approximate the ages of children attending elementary, middle, and high schools. For analyses involving dietary outcomes (Chapters Two and Three), a slightly different set of age groups (5-8-years, 9-13 years, and 14-18 years) was used. The reason for this variation is discussed in Chapter Two.

For each variable examined, detailed tables were produced showing estimates for each of the 18 subgroups. Separate estimates were also produced for the total population, for each age group (both genders combined), and for each gender (all ages combined). Readers interested in comparing data for school-age children to the population as a whole or to other subgroups of the population are referred to volume I in this series (Fox and Cole, 2004). The detailed tables that accompany that volume include data for the entire population as well as for 72 gender-and-age-specific subgroups.

Table 1 illustrates the format used in the detailed tabulations. Columns show data for all children as well as for children in each of the three income groups. Rows show data for the age-specific subgroups, overall and by gender. Table 1 also shows the maximum sample size for each table cell. The two columns included under each of the income groups (Household Interview and MEC Examined) show cell sizes for the two NHANES-III samples used in this report. The Household Interview sample contains all respondents and the MEC Examined sample contains the subsample of all respondents who completed physical examinations in the MEC.[5]

Tables include footnotes that clearly identify data source(s). Brief descriptions of the various NHANES-III data files used in the analysis are provided in appendix A. Tables also include footnotes, as appropriate, that identify reference standards used in interpreting NHANES-III data. Reference standards are described in appendix B. To the extent possible, standards are based on those used in the *Healthy People 2010* objectives (U.S. Department of Health and Human Services (U.S. DHHS), 2000a).

Age Adjustment

Data shown in the "total" rows of all detailed tables are age-adjusted, or standardized according to the age distribution of the U.S. population in the year 2000. Age-adjustment is important for comparisons between subgroups and for trend analyses between NHANES surveys. When comparing subgroups such as school-age children in the lowest-income and low-income groups at a point in time, age-adjustment elimi-

[4]NHANES-III data include individuals who reported participation in the FSP and reported household incomes above the 130 percent of poverty cutoff used to define income eligibility for the FSP. This was true for 12.6 percent of those reporting FSP participation. Several factors may contribute to conflicting data on income and program participation. For example, NHANES-III measures income as a range rather than as an exact value and uses the midpoint of the range to compare household income to the poverty line; FSP eligibility is based on contemporaneous measures of household income, while NHANES-III measured income retrospectively (over the past 12 months); and NHANES-III interviewers and FSP eligibility workers may have used different probes or techniques to ascertain household income.

[5] A third NHANES-III sample (the MEC+Home-examined sample) is included in other volumes in this series. This sample contains some infants, elderly, and wheelchair-bound individuals, but does not include any school-age children.

Table 2—Age distribution of school-age children in NHANES-III sample frame and year 2000 population

	Year 2000 population distribution		NHANES-III sample frame							
	Total children		Total children[1]		Lowest income: ≤ 130% poverty		Low-income: 131-185% poverty		Higher-income: > 185% poverty	
	Population (thousands)	Percent	Population (thousands)	Percent	Population (thousands)	Percent	Population (thousands)	Percent	Population (thousands)	Percent
Both sexes										
5-10 years	23,984	43.3	20,298	46.8	6,958	49.5	2,569	46.8	10,772	45.2
11-13 years	11,728	21.2	10,352	23.9	3,220	22.9	1,217	22.2	5,915	24.8
14-18 years	19,633	35.5	12,713	29.3	3,867	27.5	1,698	31.0	7,147	30.0
Total	55,345	100.0	43,363	100.0	14,046	100.0	5,483	100.0	23,834	100.0
Male										
5-10 years	–	43.3	10,615	48.1	3,358	49.9	1,215	44.4	6,043	47.9
11-13 years	–	21.2	5,267	23.8	1,560	23.2	666	24.3	3,041	24.1
14-18 years	–	35.5	6,205	28.1	1,811	26.9	857	31.3	3,537	28.0
Total	–	100.0	22,087	100.0	6,729	100.0	2,737	100.0	12,621	100.0
Female										
5-10 years	–	43.3	9,683	45.5	3,600	49.2	1,354	49.3	4,728	42.2
11-13 years	–	21.2	5,085	23.9	1,660	22.7	550	20.0	2,874	25.6
14-18 years	–	35.5	6,508	30.6	2,056	28.1	842	30.7	3,611	32.2
Total	–	100.0	21,276	100.0	7,317	100.0	2,746	100.0	11,213	100.0

[1] Total includes children with missing income.
– Population by gender not available. Overall age distribution was used to adjust both male and female totals.
Source: NHANES-III, 1988-94. Year 2000 population from U.S. Census Bureau, *Monthly Estimates of the United States Population*, April 2000.

nates between-group differences that are due solely to differences in the age distributions of the groups (U.S. DHHS, 2000b).

It is important to understand that age-adjusted estimates do not represent the *true* or raw estimates for a given population or subgroup. Rather, the age-adjusted estimates should be viewed as constructs or indices that provide information on the relative comparability of two or more populations (in this case, school-age children in different income groups) on a particular measure (U.S. DHHS, 2000b).[6]

The choice of a standard population for age-adjusted estimates is somewhat arbitrary. For this report, adjustments are based on year 2000 Census estimates. Use of year 2000 population estimates facilitates comparison of NHANES-III estimates with estimates from NHANES 1999-2000. Population estimates are shown in table 2. The year 2000 age distribution shown in column 1 of table 2 was applied to each group of school-age children.

Statistical Tests

The statistical significance of differences between the lowest-income group and the two other income groups was tested using t-tests. When multiple outcome categories were examined simultaneously, the Bonferroni adjustment was used to adjust for multiplicity (Lohr, 1999). Nonetheless, because of the large number of t-tests conducted, caution must be exercised in interpreting results. In general, findings discussed in the text are limited to those with strong statistical significance (1 percent level or better) or those that are part of an obvious trend or pattern in the data.

Text discussions generally focus on differences between the lowest-income group and one or both of the other income groups. Reference may be made to other between-group differences—most often males vs. females—when the differences are noteworthy. The statistical significance of these secondary comparisons has not been tested, however, and this fact is noted in the text. Statistical tests were not performed on these second-level differences because of the expansive number of statistical tests performed in the main analysis and because these comparisons are not the focus of the report.

Additional information about the analytic approach, including use of NHANES-III sampling weights, calculation of standard errors, age standardization, and guidelines used to flag point estimates deemed to be statistically unreliable, is provided in appendix C. Individual point estimates may be deemed statistically unreliable because of small sample size or a large coefficient of variation. In keeping with NHANES-III reporting guidelines, such estimates are reported in detailed tables and are clearly flagged.

The chapters that follow summarize key findings. Graphics are used to illustrate observed differences between school-age children in different income groups. Differences that are statistically significant at the 5 percent level or better are highlighted. Detailed tables provided in appendix D differentiate three levels of statistical significance ($p < .001$, .01, and .05). It is important to note that differences between income groups may be statistically significant even if point estimates are unreliable. When this occurs, the text describes the existence and direction of the significant difference and identifies the group(s) for which point estimates are unreliable.

[6]Estimates for gender-and-age-specific subgroups are not adjusted and do represent *true* or raw estimates for the specific subgroup.