



Overweight and obesity in the United States: prevalence and trends, 1960–1994

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OBJECTIVE: To describe the prevalence of, and trends in, overweight and obesity in the US population using standardized international definitions.

DESIGN: Successive cross-sectional nationally representative surveys, including the National Health Examination Survey (NHES I; 1960–62) and the National Health and Nutrition Examination Surveys (NHANES I: 1971–1974; NHANES II: 1976–1980; NHANES III: 1988–94). Body mass index (BMI: kg/m²) was calculated from measured weight and height. Overweight and obesity were defined as follows: Overweight (BMI \geq 25.0); pre-obese (BMI 25.0–29.9), class I obesity (BMI 30.0–34.9), class II obesity (BMI 35.0–39.9), and class III obesity (BMI \geq 40.0).

RESULTS: For men and women aged 20–74 y, the age-adjusted prevalence of BMI 25.0–29.9 showed little or no increase over time (NHES I: 30.5%, NHANES I: 32.0%, NHANES II: 31.5% and NHANES III: 32.0%) but the prevalence of obesity (BMI \geq 30.0) showed a large increase between NHANES II and NHANES III (NHES I: 12.8%; NHANES I, 14.1%; NHANES II, 14.5% and NHANES III, 22.5%). Trends were generally similar for all age, gender and race-ethnic groups. The crude prevalence of overweight and obesity (BMI \geq 25.0) for age \geq 20 y was 59.4% for men, 50.7% for women and 54.9% overall. The prevalence of class III obesity (BMI \geq 40.0) exceeded 10% for non-Hispanic black women aged 40–59 y.

CONCLUSIONS: Between 1976–80 and 1988–94, the prevalence of obesity (BMI \geq 30.0) increased markedly in the US. These findings are in agreement with trends seen elsewhere in the world. Use of standardized definitions facilitates international comparisons.

Keywords: body weight; body mass index; obesity; health surveys; nutrition surveys; United States; whites; blacks; Mexican Americans

Introduction

Overweight and obesity are linked to a host of chronic disorders, including hypertension, hyperlipidemia, diabetes mellitus and osteoarthritis. The prevalence of overweight has been reported to be increasing in varying degrees, not only in the United States, but also in Britain and elsewhere in Europe, as well as in countries as diverse as Australia, Brazil, China, Mauritius and Western Samoa.^{1–11}

The use of differing definitions of overweight has made it difficult to compare data from different studies and from different countries.¹² In the United States, and to some extent in other countries,¹³ many studies have used the 1959¹⁴ or the 1983¹⁵ Metropolitan Life Insurance tables of desirable or reference weights-for-height, and defined overweight as a weight exceeding the midpoint of these standards by a certain percentage. Studies in the past in European countries have often used definitions based on the Broca normal weight.¹⁶ In 1985, an NIH Consensus

Conference endorsed the use of body mass index (BMI; weight (kg)/height (m) squared) and observed that the 85th percentile of BMI from the second National Health and Nutrition Examination Survey (NHANES II) for men and women aged 20–29 y corresponded fairly well to approximately 20% overweight, according to the Metropolitan Life tables.¹⁷ Using these 85th percentile values as the standard, overweight has been defined as a BMI \geq 27.8 for men and \geq 27.3 for women,¹⁸ which corresponds closely to 124% of ideal weight for men of average height and 120% of ideal weight for women of average height based on the 1983 Metropolitan Life tables. These 85th percentile definitions have been widely used in the United States but not elsewhere. In 1985, a FAO/WHO/UNO expert committee also included BMI in a table and provided a definition of obesity as a BMI \geq 30 for men and \geq 28.6 for women.¹⁹ A wide variety of other definitions of overweight and obesity have been used.¹²

In 1995, an expert committee convened by the World Health Organization (WHO) recommended a classification for grade 1, grade 2 and grade 3 overweight using BMI cutpoints of 25, 30 and 40.²⁰ This classification recommended by the WHO expert committee corresponds closely to the classification proposed by Garrow²¹ and to that described by Bray²² as corresponding to low risk, moderate risk and high risk

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categories of overweight. A similar classification using slightly different terminology and an additional cutpoint of a BMI of 35 has been suggested by the International Obesity Task Force (IOTF).²³

In this paper, we report the prevalence of overweight and obesity (class I, II and III), using a classification similar to that recommended by the IOTF, for the most recent US national data from the third National Health and Nutrition Examination Survey (NHANES III), covering the period 1988–1994. We also report these estimates by age, gender and race-ethnic group and compare these results with data from prior surveys to describe trends over time in the US population. The prevalence of overweight in the US population based on the 85th percentile definition for the first phase of NHANES III (1988–1991) was previously reported.¹ Here we present data from the full six years (1988–1994) of NHANES III, using more standard international definitions of overweight and obesity to facilitate comparisons between US data and data from other countries.

The 85th percentile definitions continue to be used in the United States for such purposes as monitoring progress toward the Healthy People 2000 objectives, for example.²⁴ However, the 1995 Dietary Guidelines for Americans include ranges of healthy weights for adults, the upper limit of which corresponds to a BMI of 25.²⁵ Thus, the classification of overweight and obesity recommended by the WHO expert committee and the IOTF also corresponds closely to levels above the recommendations of the 1995 US Dietary Guidelines for healthy weight ranges.

Methods

NHANES III and previous health examination surveys

NHANES III was conducted from 1988 to 1994 by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention.^{26,27} A nationally representative sample of the US civilian, non-institutionalized population, was selected using a complex, stratified, multistage probability cluster sampling design. Informed consent was obtained from all respondents and the protocol was reviewed and approved by the NCHS NHANES institutional review board. A home interview was followed by a physical examination in a mobile examination center.

NHANES III is the most recent in a series of health examination surveys carried out by NCHS. Previous national surveys include the first National Health Examination Survey (NHES I, 1960–1962) and the first and second National Health and Nutrition Examination Surveys (NHANES I, 1971–1974 and NHANES II, 1976–1980). In addition, data on a representative sample of Mexican-Americans in the Southwestern US were collected as part of the Hispanic Health and Nutrition Examination Survey

(HHANES, 1982–1984). Descriptions of the plan and operation of these surveys have been published.^{28–31}

Anthropometric methods and definitions of overweight and obesity

Weight and height in all surveys were measured using standardized techniques and equipment.¹ For the present analyses, 0.9 kg was subtracted from the measured body weights in NHES I, because in NHES I, subjects wore heavier clothing than in subsequent surveys. No adjustments were made to measurements from the other surveys.

BMI was calculated to one decimal place as weight (kg) divided by height (m) squared. Overweight and obesity were defined as follows: Overweight (BMI \geq 25.0); pre-obesity (BMI 25.0–29.9); class I obesity (BMI 30.0–34.9); class II obesity (BMI 34.9–39.9); class III obesity (BMI \geq 40.0). These definitions are similar to those used in the IOTF report.²³

Data analysis and statistical methods

In NHANES III, race-ethnic group based on self-report was categorized as non-Hispanic white, non-Hispanic black, Mexican-American or other. In previous national surveys, race was based on observation and categorized as white, black or other. In NHANES II, but not in previous surveys, information on Hispanic origin was also collected. For these analyses, subjects in NHANES II were also categorized as non-Hispanic white, non-Hispanic black or other for purposes of comparison with NHANES III. Because NHANES II did not have an adequate sample size to permit separate estimates for Mexican Americans, HHANES data on Mexican Americans were used for comparisons with Mexican Americans in NHANES III.

For all previous surveys except NHES I, age (y) was defined at the time of the household interview, which generally preceded the examination by 2–3 weeks. For NHES I, age at interview was not available and the age at examination was used. NHANES III had no upper age limit and age was categorized as 20–29 y, 30–39 y, 40–49 y, 50–59 y, 60–69 y, 70–79 y, or \geq 80 y. The upper age limit was 79 y for NHES I, and for NHANES I and NHANES II, 74 y. For comparisons across surveys, data for subjects ages 20–74 y were age-adjusted by the direct method, to the total US population for 1980, using the age groups 20–29 y, 30–39 y, 40–49 y, 50–59 y, 60–69 y, and 70–74 y.³² For each survey, women who were pregnant at the time of the examination were excluded from these analyses.

Statistical analyses were carried out using SAS³³ and SUDAAN.³⁴ For each survey, sampling weights were calculated that took into account the unequal probabilities of selection resulting from the sample design and from planned oversampling of certain subgroups. All analyses incorporated these sampling weights and the complex sample design for tests of

statistical significance. These surveys were not designed to yield precise and reliable estimates for prevalences less than 10%. Some prevalence estimates in this paper do not meet the usual NCHS guidelines for reliability and accuracy of data, but are being presented here because of their public health significance. Statistical tests are not reported for these low prevalence estimates.

Results

Trends over time in the prevalence of overweight and obesity

The prevalence of pre-obesity (BMI 25.0–29.9) by age group, gender and survey is presented in Table 1. In each survey, a considerable proportion of the population fell into this category. Trends by gender and age were fairly similar across all surveys. The prevalence of BMI 25.0–29.9 was higher for men than for women. For men, the prevalence of BMI 25.0–29.9 was lowest in the age group 20–29 y and higher by about 10 percentage points in the age group 30–39 y, with only slight additional increases in older age groups. For women, in contrast, the prevalence of BMI 25.0–29.9 increased fairly steadily with each increasing age group. Within most gender-age groups, there was little or no increase in the prevalence of BMI 25.0–29.9 over time and differences between surveys were not statistically significant. The main exception was for women aged 20–29 y, for whom the prevalence of BMI 25.0–29.9 increased gradually by almost 8 percentage points over the time period covered by these surveys ($P < 0.05$).

The prevalence of class I obesity (BMI 30.0–34.9) by age group, gender and survey is presented in Table 2. Over the period from NHES I (1960–62) to

NHANES II (1976–80), the prevalence of BMI 30.0–34.9 showed no consistent pattern. However, in NHANES III, the prevalence of BMI 30.0–34.9 was significantly higher than in previous surveys. The largest increases were seen in the middle-aged groups, particularly for men. Trends with age were fairly similar across all surveys and for both men and women. The prevalence of BMI 30.0–34.9 increased with age group to a maximum in middle age, then was lower in older age groups. The prevalence of BMI 30.0–34.9 was generally similar for men and women.

Prevalence estimates for class II (BMI 35.0–39.9) and class III (BMI ≥ 40.0) obesity by age group, gender and survey are presented in Table 3 and Table 4. For both categories, the estimated prevalence was quite low in the earlier surveys, both for class II (<3% for men and <6% for women) and for class III (<1% for men and <3% for women) and was higher for women than for men almost everywhere. It should be noted that such low percentages cannot be estimated very precisely from these surveys and should be interpreted with caution. These low prevalences do not meet the usual NCHS guidelines for reliability and accuracy of data, but are being presented here because of the public health significance of these levels of obesity. For both men and women, the estimated prevalence of both class II and class III obesity increased over time, with the largest increases occurring between NHANES II and NHANES III.

Trends in the prevalence of overweight and obesity by gender and race-ethnic group

Both because the main increase in overweight occurred between NHANES II and NHANES III and because data on race-ethnic group were not available for surveys prior to NHANES II, trends in overweight and obesity by race-ethnic groups were only examined

Table 1 Prevalence of pre-obesity ($25.0 \leq \text{BMI} \leq 29.9$) by age group, gender and survey: United States 1960–1994

	Age group (y)							Total	
	20–29	30–39	40–49	50–59	60–69	70–79 ^a	$\geq 80^b$	Crude ^c (≥ 20 y)	Age-adjusted (20–74 y)
<i>Men:</i>									
NHES I	30.8	39.1	41.6	40.7	45.1	27.4	–	38.3	37.8
NHANES I	30.6	44.7	49.4	43.2	45.3	41.6	–	41.5	41.1
NHANES II	28.8	40.5	43.9	46.6	43.9	39.7	–	39.2	39.1
NHANES III	30.6	40.9	42.4	44.1	45.4	43.1	42.7	39.9	39.4
<i>Women:</i>									
NHES I	10.9	20.7	25.2	34.7	36.0	35.5	–	25.3	23.6
NHANES I	15.0	19.8	27.1	30.2	32.7	34.0	–	24.3	23.6
NHANES II	16.0	20.1	26.3	30.2	34.5	38.8	–	24.8	24.3
NHANES III	18.5	21.2	25.9	28.8	34.2	32.8	35.0	25.7	24.7
<i>Both genders:</i>									
NHES I	20.4	29.8	33.3	37.6	40.3	31.7	–	31.6	30.5
NHANES I	22.8	31.7	37.9	36.5	38.0	37.2	–	32.5	32.0
NHANES II	22.4	30.1	34.8	37.8	38.9	39.2	–	31.7	31.5
NHANES III	24.8	31.1	34.0	36.2	39.3	37.2	37.7	32.6	32.0

^a For NHANES I and NHANES II, the estimates in this category are for persons aged 70–74 y only.

^b Data for this age group only available from NHANES III.

^c Crude (non-age-adjusted) total includes ages 20–79 y for NHES I, ages 20–74 y for NHANES I and NHANES II, and ages ≥ 20 y (no upper age limit) for NHANES III.

Table 2 Prevalence of class I obesity ($30.0 \leq \text{BMI} \leq 34.9$) by age group, gender and survey: United States, 1960–1994

	Age group (y)						Total		
	20–29	30–39	40–49	50–59	60–69	70–79 ^a	$\geq 80^b$	Crude ^c (≥ 20 y)	Age-adjusted (20–74 y)
<i>Men:</i>									
NHES I	6.6	9.1	10.7	12.1	7.0	7.0	–	9.1	8.8
NHANES I	5.9	10.6	12.5	12.0	8.6	10.4	–	9.7	9.5
NHANES II	6.0	9.6	13.7	11.2	12.2	11.9	–	10.0	10.0
NHANES III	8.4	11.6	16.5	22.5	20.4	15.2	6.6	14.3	14.6
<i>Women:</i>									
NHES I	4.4	8.1	11.6	14.0	18.8	16.1	–	11.2	10.4
NHANES I	4.9	8.9	10.8	13.9	18.4	15.9	–	10.9	10.5
NHANES II	6.0	9.5	10.3	14.0	14.2	14.0	–	10.4	10.2
NHANES III	8.6	14.1	15.5	20.2	17.4	15.9	11.2	14.5	14.2
<i>Both genders:</i>									
NHES I	5.5	8.6	11.1	13.1	13.2	11.8	–	10.2	9.6
NHANES I	5.4	9.7	11.6	12.9	14.1	13.6	–	10.3	10.1
NHANES II	6.0	9.6	11.9	12.7	13.3	13.1	–	10.2	10.1
NHANES III	8.5	12.9	16.0	21.4	18.8	15.6	9.6	14.4	14.4

^a For NHANES I and NHANES II, the estimates in this category are for persons aged 70–74 y only.

^b Data for this age group only available from NHANES III.

^c Crude (non-age-adjusted) total includes ages 20–79 y for NHES I, ages 20–74 y for NHANES I and NHANES II, and ages ≥ 20 y (no upper age limit) for NHANES III.

Table 3 Prevalence of class II obesity ($35.0 \leq \text{BMI} \leq 39.9$) by age group, gender and survey: United States, 1960–1994

	Age group (y)						Total		
	20–29	30–39	40–49	50–59	60–69	70–79 ^a	$\geq 80^b$	Crude ^c (≥ 20 y)	Age-adjusted (20–74 y)
<i>Men:</i>									
NHES I	2.4	0.7	1.1	0.6	0.8	1.6	–	1.2	1.3
NHANES I	1.7	1.8	1.0	2.4	1.6	0.6	–	1.7	1.7
NHANES II	1.8	2.1	1.9	2.6	1.1	1.5	–	1.9	1.9
NHANES III	2.9	2.8	4.4	4.5	3.5	4.6	0.9	3.5	3.6
<i>Women:</i>									
NHES I	1.0	2.8	3.7	4.4	6.3	5.8	–	3.6	3.3
NHANES I	2.2	3.7	4.1	5.7	4.1	4.8	–	3.9	3.8
NHANES II	1.9	5.3	4.7	5.8	5.6	3.1	–	4.3	4.2
NHANES III	4.3	7.3	6.5	9.6	8.7	5.2	3.7	6.6	6.8
<i>Both genders:</i>									
NHES I	1.7	1.8	2.4	2.6	3.7	3.9	–	2.4	2.4
NHANES I	1.9	2.8	2.6	4.1	3.0	3.0	–	2.8	2.8
NHANES II	1.8	3.7	3.4	4.3	3.5	2.4	–	3.2	3.1
NHANES III	3.6	5.0	5.5	7.1	6.3	4.9	2.7	5.1	5.2

^a For NHANES I and NHANES II, the estimates in this category are for persons aged 70–74 y only.

^b Data for this age group only available from NHANES III.

^c Crude (non-age-adjusted) total includes ages 20–79 y for NHES I, ages 20–74 y for NHANES I and NHANES II, and ages ≥ 20 y (no upper age limit) for NHANES III.

between NHANES II or HHANES and NHANES III. The age-adjusted prevalences of overweight and obesity by gender and race-ethnic group for NHANES II and NHANES III are presented in Table 5 for non-Hispanic whites and non-Hispanic blacks and for all race-ethnic groups combined. Similar comparisons between HHANES and NHANES III for Mexican-Americans are also presented in Table 5.

For all groups, the age-adjusted prevalence of pre-obesity (BMI 25.0–29.9) showed little change between NHANES II or HHANES and NHANES III. The age-adjusted prevalence of class I obesity (BMI 30.0–34.9) showed a substantial increase in almost all groups, ranging from an increase of 1.1 percentage points between NHANES II and NHANES III for non-Hispanic black women to an increase of

5.8 percentage points between HHANES and NHANES III for Mexican-American men. There were only slight differences across groups in the magnitude of the increases. However, for both men and women the estimated increases for class I obesity (BMI 34.0–39.9) were smallest for non-Hispanic blacks, intermediate for non-Hispanic whites, and largest for Mexican-Americans.

The age-adjusted prevalence of class II and class III obesity (BMI ≥ 35.0) also increased in all groups, ranging from an increase of 1.8 percentage points for Mexican-American men to an increase of 6.2 percentage points for non-Hispanic black women. For both men and women, non-Hispanic blacks showed the largest increase in the age-adjusted prevalence of BMI ≥ 35.0 and within each race-ethnic

Table 4 Prevalence of class III obesity (BMI \geq 40.00) by age group, gender and survey: United States, 1960–1994

	Age group (y)							Total	
	20–29	30–39	40–49	50–59	60–69	70–79 ^a	\geq 80+ ^b	Crude ^c (\geq 20 y)	Age-adjusted (20–74 y)
<i>Men:</i>									
NHES I	0.0	0.6	0.2	0.6	0.0	0.0	–	0.3	0.3
NHANES I	0.5	0.9	0.7	0.9	0.1	0.1	–	0.6	0.6
NHANES II	0.3	0.3	0.8	0.5	0.2	0.2	–	0.4	0.4
NHANES III	1.2	2.9	2.2	1.9	1.0	0.2	0.5	1.8	1.8
<i>Women:</i>									
NHES I	0.7	1.2	1.7	2.0	2.1	0.0	–	1.4	1.3
NHANES I	1.1	2.5	2.7	2.4	1.4	1.2	–	1.9	1.9
NHANES II	1.1	2.0	3.1	2.8	2.3	2.3	–	2.1	2.1
NHANES III	1.8	4.4	5.0	5.7	3.7	3.9	0.2	3.8	3.9
<i>Both genders:</i>									
NHES I	0.4	0.9	1.0	1.3	1.1	0.0	–	0.8	0.8
NHANES I	0.8	1.7	1.7	1.7	0.8	0.7	–	1.3	1.3
NHANES II	0.7	1.1	2.0	1.7	1.3	1.4	–	1.3	1.3
NHANES III	1.5	3.6	3.6	3.9	2.5	2.4	0.3	2.8	2.9

^a For NHANES I and NHANES II, the estimates in this category are for persons aged 70–74 y only.

^b Data for this age group only available from NHANES III.

^c Crude (non-age-adjusted) total includes ages 20–79 y for NHES I, ages 20–74 y for NHANES I and NHANES II, and ages \geq 20 y (no upper age limit) for NHANES III.

Table 5 Changes in age-adjusted prevalence of overweight and obesity in the US between NHANES II (1976–80) or HHANES (1982–84) and NHANES III (1988–94), overall and by race-ethnic group for men and women aged 20–74 y.

	Men		Women		Both genders	
	NHANES II ^a	NHANES III	NHANES II ^a	NHANES III	NHANES II ^a	NHANES III
<i>Non-Hispanic white</i>						
Pre-obese: BMI 25.0–29.9	40.0	39.6	22.9	23.0	31.3	31.3
Class I obesity: BMI 30.0–34.9	9.7	14.7	9.1	12.7	9.4	13.6
Class II and III obesity: BMI \geq 35.0	2.3	5.4	5.6	9.8	4.0	7.6
Overweight: BMI \geq 25.0	51.5	59.6	37.4	45.5	44.3	52.6
Obesity: BMI \geq 30.0	12.0	20.0	14.8	22.4	13.4	21.2
<i>Non-Hispanic black</i>						
Pre-obese: BMI 25.0–29.9	33.9	36.2	30.5	29.2	32.0	32.3
Class I obesity: BMI 30.0–34.9	12.0	14.5	18.1	19.2	15.3	17.2
Class II and III obesity: BMI \geq 35.0	3.0	6.8	11.9	18.1	7.9	13.0
Overweight: BMI \geq 25.0	48.9	57.5	60.2	66.5	55.1	62.5
Obesity: BMI \geq 30.0	15.0	21.3	30.0	37.4	23.2	30.2
<i>Mexican-American^a</i>						
Pre-obese: BMI 25.0–29.9	44.3	44.0	34.7	33.4	39.5	39.0
Class I obesity: BMI 30.0–34.9	12.4	18.2	15.5	21.3	14.0	19.6
Class II and III obesity: BMI \geq 35.0	3.1	4.9	9.9	12.9	6.6	8.8
Overweight: BMI \geq 25.0	59.7	67.1	60.1	67.6	60.1	67.4
Obesity: BMI \geq 30.0	15.4	23.1	25.4	34.2	20.6	28.4
<i>All race-ethnic groups^b</i>						
Pre-obese: BMI 25.0–29.9	39.1	39.4	24.3	24.7	31.5	32.0
Class I obesity: BMI 30.0–34.9	10.0	14.6	10.2	14.2	10.1	14.4
Class II and III obesity: BMI \geq 35.0	2.3	5.3	6.3	10.7	4.4	8.1
Overweight: BMI \geq 25.0	51.4	59.3	40.8	49.6	46.0	54.4
Obesity: BMI \geq 30.0	12.3	19.9	16.5	24.9	14.5	22.5

^a Comparative data for Mexican-Americans shown separately are from HHANES, not from NHANES II. For all race-ethnic groups combined, data are from NHANES II only.

^b Includes race-ethnic groups not shown separately.

group, the increases were larger for women than for men. These surveys were not designed to yield precise and reliable estimates for prevalences \leq 10% so these estimates for BMI \geq 35.0 should be interpreted with caution.

For men and women aged 20–74 y of all race-ethnic groups, the total age-adjusted prevalence of obesity (BMI \geq 30.0) increased by 8.0 percentage points. The

increases were similar for both men and women considered separately, although the increase for men (7.6 percentage points) was slightly less than the increase for women (8.4 percentage points). Approximately half of the total increase was due to an increase in the prevalence of class I obesity, with the remainder due to an increase in class II or class III obesity.

Table 6 Age-specific prevalence of overweight and obesity from NHANES III by gender and race-ethnic group: United States, 1988–1994

	Age group (y)							Total	
	20–29	30–39	40–49	50–59	60–69	70–79	≥ 80	Crude	Age-adjusted
<i>Pre-obese: BMI 25.0–29.9</i>									
<i>Men</i>									
Non-Hispanic white	29.7	41.7	44.4	42.4	46.9	44.4	44.2	40.7	39.9
Non-Hispanic black	31.0	33.7	41.6	43.9	36.6	34.2	37.4	35.9	36.2
Mexican-American	36.6	50.4	45.6	43.5	45.1	46.8	56.1	43.3	44.3
<i>Women</i>									
Non-Hispanic white	14.6	18.8	25.7	29.3	33.6	32.1	35.3	24.8	23.7
Non-Hispanic black	26.6	27.5	30.4	28.0	34.0	38.1	33.7	29.4	29.6
Mexican-American	30.3	32.0	32.8	33.8	39.5	36.8	31.8	32.6	33.2
<i>Class I obesity: BMI 30.0–34.9</i>									
<i>Men</i>									
Non-Hispanic white	7.9	11.8	15.8	23.6	21.1	15.3	6.7	14.6	14.4
Non-Hispanic black	12.1	12.6	16.1	14.3	20.0	15.4	4.2	14.0	14.1
Mexican-American	10.5	12.1	25.2	29.9	23.9	17.0	2.4	15.8	17.8
<i>Women</i>									
Non-Hispanic white	7.6	12.3	12.8	18.4	16.4	16.0	10.5	13.1	12.8
Non-Hispanic black	12.6	16.5	21.0	27.3	25.9	19.4	16.1	18.7	19.1
Mexican-American	14.8	19.2	28.1	31.1	21.8	14.1	18.1	20.7	21.1
<i>Class II obesity: BMI 35.0–39.9</i>									
<i>Men</i>									
Non-Hispanic white	3.0	1.9	4.6	5.1	3.2	5.1	0.6	3.4	3.4
Non-Hispanic black	4.1	4.6	4.6	3.4	4.8	1.8	4.9	4.2	4.1
Mexican-American	2.1	4.8	6.0	4.9	2.4	1.2	2.0	3.7	3.6
<i>Women</i>									
Non-Hispanic white	4.1	6.4	5.3	9.7	8.6	4.6	3.6	6.2	6.2
Non-Hispanic black	7.2	11.0	12.5	12.5	12.0	10.6	3.1	10.4	10.3
Mexican-American	4.6	9.1	10.5	9.1	11.5	5.6	0.9	7.9	7.9
<i>Class III obesity: BMI ≥ 40</i>									
<i>Men</i>									
Non-Hispanic white	1.1	3.3	2.3	1.8	1.1	0.0	0.4	1.9	1.7
Non-Hispanic black	2.9	3.0	1.5	3.8	0.8	2.3	2.0	2.6	2.5
Mexican-American	0.7	1.0	1.8	2.3	0.4	0.3	0.0	1.1	1.1
<i>Women</i>									
Non-Hispanic white	1.3	3.6	4.5	5.4	3.4	3.1	0.1	3.3	3.2
Non-Hispanic black	3.5	8.1	11.1	10.4	7.5	8.3	1.2	7.6	7.4
Mexican-American	3.0	6.4	6.1	2.8	5.8	4.5	0.0	4.7	4.5

Prevalence of overweight and obesity by age, gender and race-ethnic group

The age-specific prevalences of overweight and obesity by gender and race-ethnic group from NHANES III are presented in Table 6. For men in all race-ethnic groups, the prevalence of pre-obesity (BMI 25.0–29.9) increased considerably between the group aged 20–29 y and the older age groups, but then leveled off with little variability by age thereafter. For men, non-Hispanic black men tended to have the lowest prevalence of BMI 25.0–29.9, although the differences were statistically significant only for the ages of 30–39 y and 60–69 y. For women, the prevalence of BMI 25.0–29.9 was also lowest in the age group 20–29 y but then tended to increase steadily thereafter. For women ages 20–39 y, non-Hispanic white women had a significantly lower prevalence of BMI 25.0–29.9 than other race-ethnic groups, but the differences across race-ethnic groups in the prevalence of BMI 25.0–29.9 were smaller, and not statistically significant, for women in the older age groups.

For men in each race-ethnic group, the prevalence of class I obesity (BMI 30.0–34.9) first increased steadily by age group, reaching a maximum in middle age, and then declined steadily thereafter. The pattern for women was generally similar, but with less of a decline with age. For non-Hispanic whites, the prevalence of BMI 30.0–34.9 for women was similar to, or lower than, that for men. For non-Hispanic blacks and Mexican Americans, however, the prevalence of BMI 30.0–34.9 tended to be higher for women than for men. Differences among race-ethnic groups in the prevalence of BMI 30.0–34.9 were much more pronounced for women than for men. The prevalence of BMI 30.0–34.9 was significantly higher for non-Hispanic black and Mexican-American women than for non-Hispanic white women. This pattern was similar for all age groups.

The prevalences of class II obesity (BMI 35.0–39.9) and class III obesity (BMI ≥ 40.0) showed no strong age trends, although both tended to increase by age group up to middle age, and then to decline. With few exceptions, within each race-ethnic group,

the prevalence of both BMI 35.0–39.9 and BMI \geq 40.0 was higher for women than for men. Within each age group, non-Hispanic black women had the highest prevalence of both BMI 35.0–39.9 and BMI \geq 40.0. For non-Hispanic black women aged 40–49 y, the estimated prevalence of BMI 35.0–39.9 was 12.5% and of BMI \geq 40.0 was 11.1%, the highest values for any age-gender-race-ethnic group.

Discussion

These results are consistent with our previous report on the prevalence of overweight in the US¹ and show a marked increase in the prevalence of overweight and obesity (BMI \geq 25.0) in the US population that occurred primarily between NHANES II (1976–1980) and NHANES III (1988–1994). The increase in prevalence was almost entirely due to increases in the prevalence of obesity (BMI \geq 30.0). The prevalence of pre-obesity (BMI 25.0–29.9) showed little or no change.

On an absolute basis, the increase was the greatest in the category of class I obesity (BMI 30.0–34.9). However, the increases in class II obesity (BMI 35.0–39.9) and class III obesity (BMI \geq 40.0) are also cause for concern.

The upper limit of the 'healthy weight' ranges for adult men and women in the 1995 US Dietary Guidelines²⁵ corresponds to a BMI of 25. Thus for practical purposes, body weights corresponding to the definitions of overweight and obesity used here are above the healthy weight range in the 1995 Dietary Guidelines. The proportion of the US population aged \gg 20 y exceeding the healthy weight ranges (that is, the prevalence of BMI \gg 25.0) was quite high, including 59.4% of men, 50.7% of women and 54.9% of the total population (non age-adjusted totals). Within certain age, gender and race-ethnic groups, the prevalences were even higher. For example, in the 50–59 y age group, the prevalence of overweight and obesity (BMI \geq 25.0) was 72.9% for non-Hispanic white men and 78.1% for non-Hispanic black women and the prevalence of overweight and obesity ranged from 62.8% for non-Hispanic white women to 80.6% for Mexican-American men.

Although the prevalence of BMI \geq 25.0 was fairly similar across gender and race-ethnic groups, there were clear differences between gender and race-ethnic groups in the prevalence of the different categories of overweight and obesity. In general, the prevalence of BMI 25.0–29.9 was higher for men than for women; the prevalence of BMI 30.0–34.9 was similar for men and women, and the prevalence of BMI \geq 35 was lower for men than for women. For men, the age-adjusted prevalences of overweight and obesity tended to be similar across race-ethnic groups. For women, the age-adjusted and age specific prevalence

of each level of overweight and obesity was higher for non-Hispanic black women and for Mexican-American women than for non-Hispanic white women. Of particular note is the high prevalence, over 10%, of class III obesity (BMI \geq 40.0) among non-Hispanic black women in the middle age groups. These values were considerably higher than the corresponding estimates for other groups. Trends with age were similar to those seen in other studies, generally showing a higher prevalence up to the age of 50–59 y and then a decline thereafter. The lower prevalences in older age groups are likely to be due largely to weight loss occurring in older age,^{35,36} although differential mortality by weight might also play a role.

We do not know the causes of these increases in overweight and obesity. Smoking cessation has been suggested as a contributing factor.³⁷ Our previous analyses suggest that although smoking cessation could account for some of the increase in overweight, it does not explain the majority of the increase and cannot be the sole contributing factor.³⁸ Similar findings on the effect of smoking on the prevalence of overweight have been reported from Minnesota, Sweden, Australia and New Zealand.^{2,39–41} Other developing countries are experiencing similar trends in overweight, although at a lower level. Reductions in physical activity, often of a type that are difficult to measure, may account for some of these trends.^{3, 42}

Implications of these results

The recommendation in the 1995 US Dietary Guidelines is that persons who have problems linked to overweight, including high blood pressure, heart disease, stroke, diabetes, certain types of cancer, arthritis, breathing problems and other illness, should try to lose weight and persons whose weight is not in the healthiest range should try to reduce health risks through better eating and exercise habits.²⁵ However, partly because the Dietary Guidelines Advisory Committee recognized the difficulties in accomplishing sustained weight loss to within the healthy weight range for the large number of overweight persons in the US, the recommendation focuses on maintaining weight and improving weight, if possible. According to the Committee, '[m]aintenance of a healthy weight is still a major goal but is now secondary to weight maintenance at any level.'²⁵

The WHO expert committee's recommendations for BMI 25.0–29.9 are generally similar to the 1995 US Dietary Guidelines.²⁰ First, individuals in this category are advised to avoid additional weight gain. If additional risk factors are present, such as a high waist-hip ratio, hypertension, hyperlipidemia, glucose intolerance, type 2 diabetes, a family history of diabetes or coronary heart disease, the recommendations are for a healthy lifestyle, including smoking cessation, increased physical activity and reduced saturated fat intake. According to the WHO expert committee, 'Moderate weight loss is recommended but weight loss *per se* should not be the primary target

of intervention.' Although the level of concern for class I and class II obesity (BMI 30.0–39.9) is higher and the likelihood of weight-related chronic conditions is higher, the recommendations are similar, including the emphasis on risk factor reduction rather than on weight loss *per se*. However, for class III obesity (BMI \geq 40.0), the WHO expert committee recommends intensive action to reduce weight, including considering options such as surgical treatment for obesity. In the total US population, the overall prevalence of class III obesity is low, but for some groups, particularly middle-aged non-Hispanic black women, the prevalence of class III obesity approaches or exceeds 10%.

The issues of what weight is associated with lowest mortality and morbidity at different ages and of the effects of weight loss and weight cycling on mortality and morbidity remain controversial.^{43–45} The use of a BMI of 25 as the upper limit for healthy weights defines a considerable majority of the US population, particularly in older age ranges and for women in minority groups, as being overweight. The increasing prevalence of overweight and obesity raises the possibility of widespread use of pharmacological treatment for obesity in the US.

The increasing prevalence of overweight is not limited to just one country. Data from a similar design of successive cross-sectional surveys have been reported from a number of other countries and regions of the world. In Britain, the prevalence of BMI \gg 30 doubled over the time period 1980–1991, although the prevalence in Britain remained considerably below the prevalence in the US. From the point of view of energy balance, the increase in overweight is due to energy intake that exceeds energy expenditure. However, this formulation provides little insight into the social and environmental causes of the imbalance and the possible role of differences in genetic susceptibility to an environment that facilitates both higher energy consumption, partly through increased availability of energy-dense high-fat foods, and lower levels of physical activity both at work and elsewhere.^{3,46} Increased modernization and a Westernized diet and lifestyle are associated with an increased prevalence of overweight in many developing countries. This has been conceived of as part of a transition to modernity, sometimes referred to as the nutrition transition.⁴⁷ However, to date there is little evidence of a point at which this process ceases. As Prentice and Jebb³ put it succinctly 'The American experience provides no grounds for optimism regarding the developing epidemic in Britain' nor indeed in the rest of the world. Presentation of data from the US in a form that facilitates international comparisons, may aid in epidemiological investigations around the world to elucidate the challenging problem of the increases in overweight and obesity occurring in many countries.

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