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Obesity-related deaths and hospitalizations among adult Californians are examined in this report.

Highlights

- Obesity prevalence among Californians is significantly higher than the Healthy People 2010 objective of 15 percent.
Obesity was a principal diagnosis in an annual average of over 8,700 hospital discharges, and an other diagnosis in an additional 86,500 hospital discharges.
An annual average of 334 deaths were directly attributed to obesity, and obesity was a contributing cause in another 1,680 deaths.
Disparities in obesity-related morbidity and mortality by race and ethnicity and by gender were found.

Obesity-Related Morbidity and Mortality California, 2000-2002

By Jim Sutocky

Background

Obesity has received considerable attention recently through a series of scientific journal articles, public health reports, and media coverages. Obesity has been defined by the United States (U.S.) Centers for Disease Control and Prevention (CDC) as a Body Mass Index (BMI) of 30 or greater, and is a major risk factor for illnesses and premature deaths as well as direct and indirect costs associated with medical care, insurance claims, and lost productivity attributed to job absenteeism.

BMI = ((Weight in Pounds / ((Height in inches) x (Height in inches)))) x 703

During the past 20 years, obesity among adults has risen significantly in the U.S. The latest data from the CDC's National Center for Health Statistics (NCHS) show that 30 percent of U.S. adults 20 years of age and older (over 60 million people) are obese. Although one of the national health objectives for the year 2010 is to reduce the prevalence of obesity among adults to less than 15 percent, currently available data indicate that adult obesity in California has not been improving.

Increasing prevalence rates for obesity have significant implications for public health. Being obese increases the risk of many diseases and health conditions, including hypertension, dyslipidemia (e.g., high total cholesterol or high levels of triglycerides), Type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, and some cancers (e.g., endometrial, breast, and colon). As an underlying (i.e., direct) or contributing cause of death, obesity was responsible for a significantly increasing mortality rate between 1990 and 1998. An economic analysis commissioned by the California Department of Health Services (CDHS) has estimated annual direct costs of obesity among Californians in 2000 to be \$4.11 billion, with indirect costs exceeding \$2.26 billion.

Methods

This study examines obesity from a number of available data sources for the time period 2000-2002. Prevalence estimates for obesity among the California adult population aged 20 years and over were obtained from the 2001 California Health Interview Survey (CHIS).²³ This age grouping is consistent with Healthy People 2010 (HP2010) objective 19.2, which targets a reduction in adult obesity to a level of no more than 15 percent of persons aged 20 years and older.

Morbidity data for adults aged 20 years and over were extracted from the Patient Discharge Data files supplied by the California Office of Statewide Health Planning and Development (OSHPD).²⁴ The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes used to define obesity-related hospitalizations are shown in Table A.²⁵ A “Principal Diagnosis” is defined by OSHPD as the condition established to be the chief cause of the admission of the patient for care. “Other Diagnoses” are defined as conditions that coexist at the time of admission, affect the treatment received, or affect the length of stay. Up to ten other diagnoses were examined in this study.

Table A. ICD-9-CM code set used to define obesity-related morbidity

<u>Description</u>	<u>ICD-9-CM codes</u>
Obesity, unspecified	278.00
Morbid obesity	278.01

Mortality data for adults aged 20 years and over were extracted from the Multiple Cause of Death (MCO) files maintained by the CDHS Center for Health Statistics (CHS).²⁶ The International Classification of Diseases, Tenth Revision (ICD-10) codes used to define obesity-related deaths are shown in Table B. An “Underlying Cause” of death is defined by the World Health Organization (WHO) as the disease or injury that initiated the train of events leading directly to death.²⁷ “Contributing Causes” (i.e., nonunderlying or multiple causes) of death are defined as the conditions specified on the death certificate that were not selected as the underlying cause of death. Up to ten contributing causes of death were examined in this study.

Table B. ICD-10 code set used to define obesity-related mortality

<u>Description</u>	<u>ICD-10 codes</u>
Obesity due to excess calories	E66.0
Drug-induced obesity	E66.1
Extreme obesity w/ alveolar hypoventilation	E66.2
Other obesity	E66.8
Obesity, unspecified	E66.9

Single year (2001) prevalence rates (percentages), and three-year average (2000-2002) morbidity and mortality rates (per 100,000 population) were age-adjusted by the direct method using population denominator data supplied by the California Department of Finance, and the 2000 U.S. Standard Population adjustment weights for persons aged 20 years and over obtained from the NCHS.²⁸⁻²⁹

Ninety-five percent confidence intervals (i.e., upper and lower 95 percent confidence bounds) and relative standard errors (RSE) were also calculated to provide measures of variability and of reliability of the data, and as a means for testing the statistical significance of differences in rates between race-ethnic and gender groups.³⁰

Results

Prevalence (Table 1, Figure 1)

According to the age-adjusted estimates derived from the 2001 CHIS, 18.6 percent of adult Californians aged 20 years and older (over 4.5 million people) were classified as obese based on their height and weight information. This overall rate is significantly higher than the HP2010 target of 15 percent.

No significant differences in age-adjusted obesity prevalence rates were found between females and males (18.3 percent and 19.0 percent, respectively), and the HP2010 objective is not being met for either gender.

Significant differences between racial and ethnic populations were found, with American Indians/Alaska Natives having the highest age-adjusted adult obesity prevalence rate (29.4 percent), followed by African Americans/Blacks (28.9 percent), and by Hispanics/Latinos (25.0 percent). Whites experienced one of the lowest obesity prevalence rates (16.7 percent). The HP2010 objective is not being achieved for any race/ethnic population in California except Asian/Pacific Islander adults (5.0 percent).

Morbidity (Table 2, Figure 2)

An annual average of 95,360 adult Californians were discharged from hospitals with a Principal Diagnosis or Other Diagnoses of obesity during 2000-2002, at an age-adjusted rate of 408.5 per 100,000 population aged 20 years and over.

Three-year average age-adjusted obesity-related discharge rates among adult females (520.8 per 100,000 population) were significantly higher than those for adult males (290.8 per 100,000)

African American/Black adults had significantly higher average age-adjusted obesity-related hospital discharge rates (744.1 per 100,000) than all other racial and ethnic populations, followed by White adults (466.6 per 100,000). The lowest three-year average adult obesity-related discharge rates were observed for Asians/Pacific Islanders (73.6 per 100,000 population).

Obesity as a Principal Diagnosis (n=8,780) accounted for less than ten percent of the total unduplicated obesity-related discharges, at an age-adjusted rate of 31.6 per 100,000 population aged 20 and over. As Other Diagnoses, adult obesity accounted for 86,581 of the total discharges, at an age-adjusted rate of 373.1 per 100,000.

White adults experienced the highest age-adjusted hospital discharge rates for obesity as a Principal Diagnosis (54.4 per 100,000), followed by African American/Black adults (41.1 per 100,000). However, African Americans/Blacks had the highest rates for adult obesity as Other Diagnoses (703.0 per 100,000), followed by Whites (412.2 per 100,000). Asian/Pacific Islander adults had the lowest rates (1.6 per 100,000 as a Principal Diagnosis, and 72.1 per 100,000 as Other Diagnoses).

Mortality (Table 3, Figure 3)

Over 2,000 adult Californians died annually from obesity-related causes between 2000-2002, at a rate of 8.8 per 100,000 population aged 20 years and over. As an underlying cause of death, obesity claimed an average of 334 lives per year at an age-adjusted rate of 1.4 per 100,000 population. As a contributing cause of death, obesity was involved in an average of 1,680 deaths annually at an age-adjusted rate of 7.4 per 100,000.

Although females experienced numerically more obesity-related deaths than males, there were no statistically significant differences in age-adjusted death rates between females and males (8.8 per 100,000 and 8.7 per 100,000, respectively). This pattern held true for both underlying and contributing causes of death.

Data by race/ethnicity indicate that African American/Black adults had a significantly higher age-adjusted obesity-related death rate (19.9 per 100,000 population) than all other racial and ethnic populations. The second highest adult obesity-related death rate was found for Whites (10.5 per 100,000). This pattern held true for both underlying and contributing causes of death. The lowest reliable age-adjusted death rate was found for Asians/Pacific Islanders (1.2 per 100,000 population). Reliable age-adjusted death rates could not be calculated for American Indians/Alaska Natives due to small numbers of events.

Discussion

The prevalence of adult obesity among Californians is significantly higher than the HP2010 objective of 15 percent, and has been identified by the California Obesity Prevention Initiative (COPI) as an unparalleled public health challenge for the 21st Century.¹⁶ The CDC's Behavioral Risk Factor Surveillance System (BRFSS) tracks obesity prevalence for all states, but its public use interactive data system (<http://apps.nccd.cdc.gov/brfss/>) does not allow for extraction of data using the age range for defining adults specified in Healthy People 2010 objective 19.2 (ages 20 years and over).³¹ Using the 2001 BRFSS data for persons aged 18 years and over, the unadjusted California adult obesity prevalence rate was 21.9 percent. Using the data from the CHIS public use interactive data system (AskCHIS, <http://www.chis.ucla.edu/main/default.asp>), California's unadjusted adult obesity prevalence rate for persons aged 18 and over in 2001 was 19.3 percent. Although these estimates were for the same population, the difference was statistically significant.

A widely publicized CDC research study found that obesity in America was responsible for 400,000 excess deaths every year, almost as many as the number attributable to smoking.² This figure was later revised downwards to 112,000 by CDC researchers, who called for further studies to explore the factors involved in the association of obesity with morbidity and mortality.³ Our study has shown that obesity was directly responsible for an annual average of 334 deaths and 8,780 hospitalizations among adult Californians, and was a contributing cause in an additional 1,680 deaths and 86,581 hospitalizations annually. Our study also found disparities in age-adjusted obesity mortality and morbidity rates based on race/ethnicity and gender. For example, our findings indicate that while American Indians/Alaska Natives had the highest adult obesity prevalence rate, they had the next to the lowest obesity-related hospitalization rate and the lowest number of deaths due to obesity. African Americans/Blacks had the second highest adult obesity prevalence rate, but the highest death and hospitalization rates (with one exception: Whites had the highest hospitalization rate with obesity as a

principal diagnosis). Another finding of interest was that while there were no statistically significant differences in adult obesity prevalence rates and obesity-related death rates between male and female Californians, females experienced significantly higher obesity-related hospitalization rates. Using the year 2000 as a benchmark, it will be possible to examine these and other trends in the prevalence of obesity and in obesity-related morbidity and mortality among adult Californians as more data become available.

The CDC study's approach to estimating the number of deaths nationally that were attributable to obesity relied on an assumption that relative risks calculated from past cohorts would apply to the current population.³ In this case, the past cohorts were drawn from samples from the National Health and Nutrition Examination Survey (NHANES) I (1971-1975), II (1976-1980), and III (1988-1994), and the relative risks (hazard ratios) were calculated using Cox proportional hazard models with age as the time scale. Relative risk estimates were adjusted for confounding factors (sex, race, smoking status, alcohol consumption) and age effects (three age strata: 25-59, 60-69, and 70 and over), and were combined with the obesity prevalence estimates to calculate a fraction of all deaths nationally that could be attributable to obesity.

This complex methodology differs substantially from the methods used in our study for estimating adult obesity prevalence and for calculating obesity-related mortality rates among Californians. First, we used obesity prevalence estimates drawn from the 2001 CHIS, a point-in-time survey representative only of the Californian population. These data were not pooled or averaged across past cohorts, and were weighted using California population data updated from the 2000 U.S. Census.

Second, the California obesity prevalence estimates from the CHIS were not adjusted for any confounding factors such as smoking and alcohol use. Third, California mortality data were extracted directly from death certificates using ICD-10 codes to identify obesity-related deaths and were not estimated from all deaths using an attributable fraction methodology.

And finally, California obesity prevalence and mortality rates were age-adjusted for adults aged 20 years and over. Age-adjusted rates are considered to be better indices of relative mortality risk across groups and over time periods, and cannot be compared with other crude or age-specific rates.

The differences between the CDC's national estimates and the California-specific data presented here suggest that care must be taken in stating the case for the association between obesity and mortality, and that additional scrutiny is warranted when attempting to apply national estimates to state-level data.

Conclusion

California's strategies for action to prevent obesity include six key goals:¹⁶

- 1) improving access to physical activity options;
- 2) improving access to healthy foods;
- 3) improving access to culturally and linguistically appropriate nutrition and physical activity information;
- 4) developing community-based obesity prevention strategies;
- 5) implementing research projects and surveillance systems that identify effective obesity prevention strategies; and
- 6) improving the ability of health care systems and providers to implement obesity prevention strategies.

The Governor's *Summit on Health, Nutrition and Obesity to Shape Up California* is scheduled for September 15, 2005, in Sacramento. For more information on this meeting, please visit <http://www.calendow.org/index.stm>

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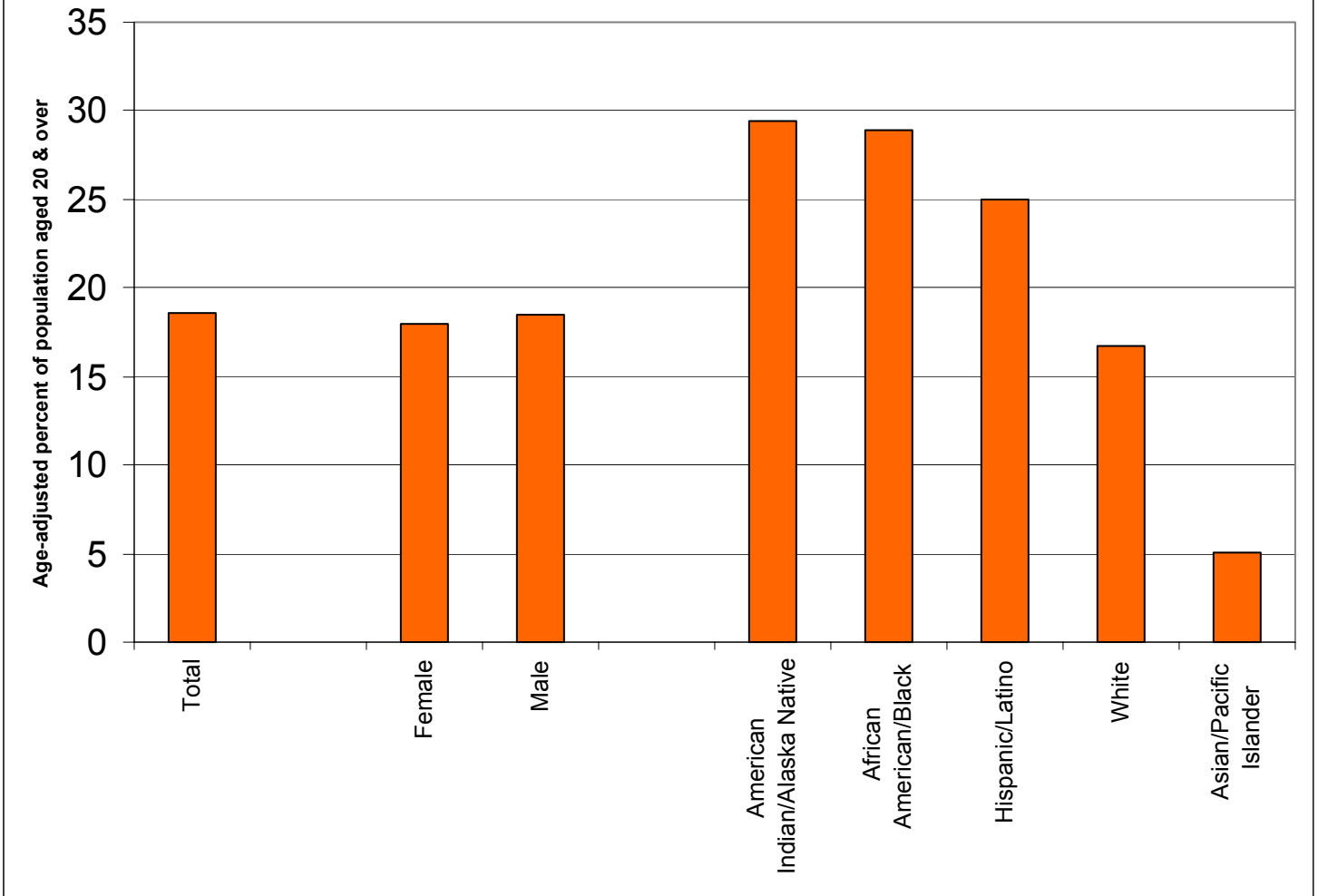
Table 1. Adult Obesity Prevalence Rates, California 2001

Adult Obesity (Ages 20 & over)	CHIS			
	N ¹	Rate ²	Lower C.I. ³	Upper C.I. ³
Healthy People 2010 Target		15.0		
CALIFORNIA TOTAL	4,516,000	18.63	18.61	18.64
Race-Ethnicity				
African American/Black	437,000	28.91	28.83	29.00
American Indian/Alaska Native	46,000	29.40	29.13	29.67
Asian/Pacific Islander	149,000	5.05	5.02	5.07
Hispanic/Latino	1,644,000	24.97	24.93	25.00
White	2,111,000	16.68	16.66	16.70
Gender				
Female	2,252,000	18.29	18.26	18.31
Male	2,264,000	18.97	18.95	19.00

SOURCES: California Department of Health Services, Center for Health Statistics, California Health Interview Survey, 2001;
California Department of Finance, Demographic Research Unit, Population Projections, May 2004.

NOTES: * Obesity defined as a Body Mass Index (BMI) of 30 or greater;
¹ Estimated number of persons aged 20 years and older who were obese;
² Age-adjusted prevalence rate (percent of population aged 20 years and over); *HP2010 Statistical Notes*, No. 20, Jan. 2001;
Numbers and rates are calculated independently and may not add to Total.

Figure 1.
Adult Obesity Prevalence Rates
California, 2001



SOURCES: California Department of Health Services, Center for Health Statistics, California Health Interview Survey, 2001; California Department of Finance, Demographic Research Unit, Population Projections, May 2004.

Table 2. Three-Year Average Obesity-Related Hospital Discharges and Discharge Rates Among Persons Aged 20 Years and Over California, 2000-2002

	TOTAL				PRINCIPAL DIAGNOSIS				OTHER DIAGNOSES			
	N ¹	Rate ²	Lower C.I. ³	Upper C.I. ³	N ⁴	Rate ²	Lower C.I. ³	Upper C.I. ³	N ⁵	Rate ²	Lower C.I. ³	Upper C.I. ³
Healthy People 2010 Target	n/a				n/a				n/a			
CALIFORNIA TOTAL	95,360	408.5	405.9	411.1	8,780	35.4	34.7	36.2	86,581	373.1	370.6	375.6
Race-Ethnicity												
African American/Black	10,770	744.1	730.1	758.2	665	41.1	38.0	44.2	10,105	703.0	689.3	716.7
American Indian/Alaska Native	332	225.9	201.6	250.2	34	20.9	13.9	28.0	298	205.0	181.7	228.3
Asian/Pacific Islander	1,995	73.6	70.4	76.8	48	1.6	1.1	2.0	1,946	72.1	68.8	75.3
Hispanic/Latino	17,519	340.5	335.5	345.6	1,099	14.8	13.9	15.7	16,420	325.7	320.7	330.7
White	61,174	466.6	462.9	470.3	6,595	54.4	53.0	55.7	54,579	412.2	408.8	415.7
Gender												
Female	63,661	520.8	516.8	524.9	7,389	59.6	58.3	61.0	56,272	461.2	457.4	465.0
Male	31,695	290.8	287.6	294.0	1,391	11.4	10.8	12.0	30,304	279.3	276.2	282.5

SOURCES: California Department of Health Services, Center for Health Statistics, OSHPD Patient Discharge Data files, 2000-2002; California Department of Finance, Demographic Research Unit, Population Projections, May 2004.

NOTES: * Obesity-related discharges are defined by ICD-9-CM code 278.0;

¹ Three-year average unduplicated number of discharges among persons aged 20 and over with obesity as a principal or other diagnosis;

² Age-adjusted discharge rate per 100,000 population aged 20 years and over; *HP2010 Statistical Notes*, No. 20, Jan. 2001;

³ Ninety-five percent confidence interval (95% C.I.);

⁴ Three-year average unduplicated number of discharges among persons aged 20 and over with obesity as a principal diagnosis;

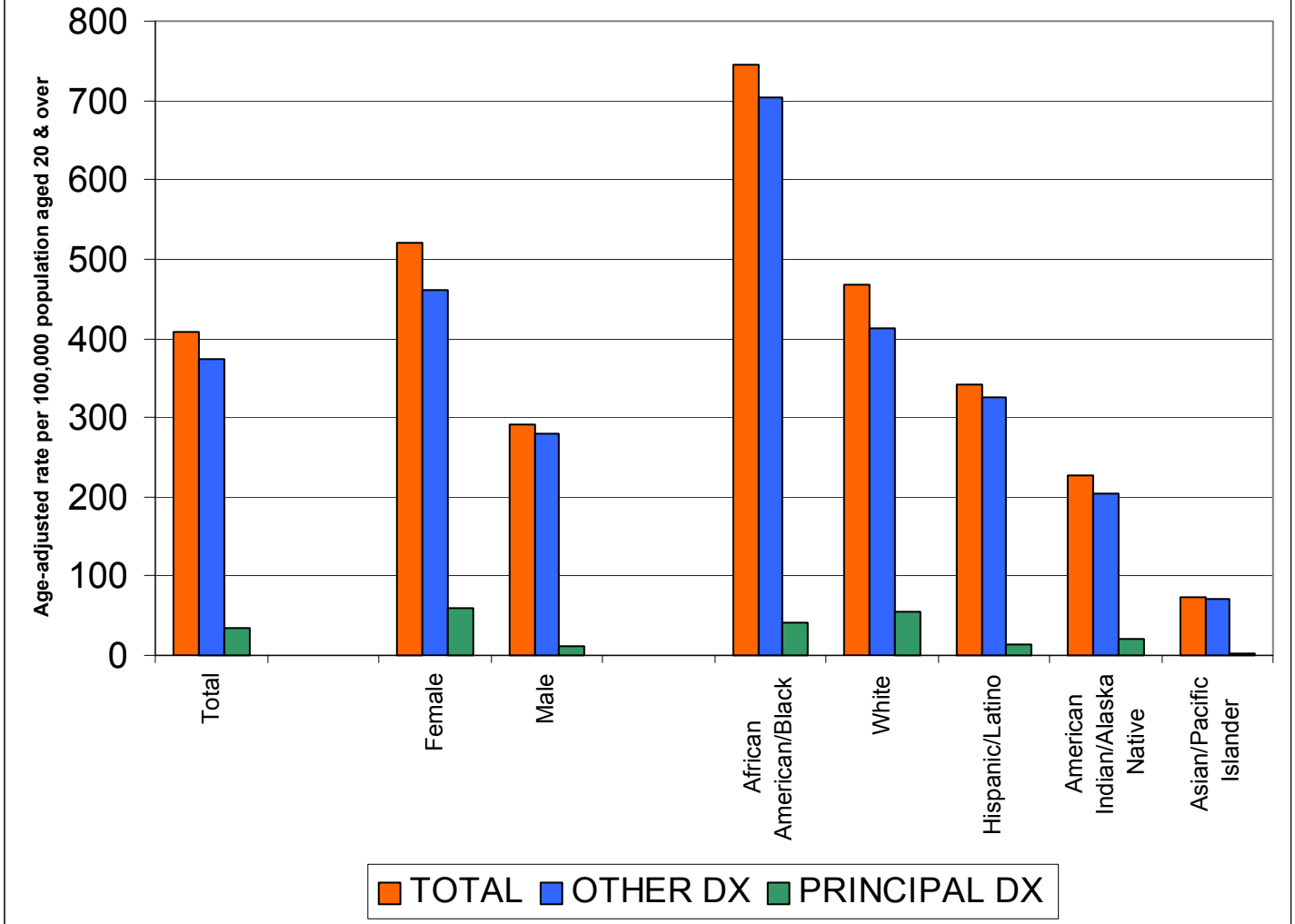
⁵ Three-year average unduplicated number of discharges among persons aged 20 and over with obesity as an other diagnosis (up to ten);

n/a Healthy People 2010 target rate not applicable;

DSU Data Statistically Unreliable due to small number of events, Relative Standard Error > 23 percent;

Numbers and rates for Principal Diagnosis and Other Diagnoses are calculated independently and may not add to Total.

Figure 2.
Three-Year Average Adult Obesity-Related Hospital Discharge Rates
California, 2000-2002



SOURCES: California Department of Health Services, Center for Health Statistics, OSHPD Patient Discharge Data 2000-2002; California Department of Finance, Demographic Research Unit, Population Projections, May 2004.

Table 3. Three-Year Average Obesity-Related Deaths and Death Rates Among Persons Aged 20 Years and Over California, 2000-2002

	TOTAL				UNDERLYING CAUSE				CONTRIBUTING CAUSE			
	N ¹	Rate ²	Lower C.I. ³	Upper C.I. ³	N ⁴	Rate ²	Lower C.I. ³	Upper C.I. ³	N ⁵	Rate ²	Lower C.I. ³	Upper C.I. ³
Healthy People 2010 Target	n/a				n/a				n/a			
CALIFORNIA TOTAL	2,014	8.8	8.4	9.2	334	1.4	1.3	1.6	1,680	7.4	7.0	7.7
Race-Ethnicity												
African American/Black	284	19.9	17.6	22.2	52	3.5	2.6	4.5	232	16.4	14.3	18.5
American Indian/Alaska Native	16	DSU	-----	-----	3	DSU	-----	-----	13	DSU	-----	-----
Asian/Pacific Islander	34	1.2	0.8	1.6	5	DSU	-----	-----	29	1.0	0.7	1.4
Hispanic/Latino	256	5.3	4.6	5.9	44	0.8	0.6	1.0	212	4.5	3.9	5.1
White	1,425	10.5	10.0	11.1	230	1.7	1.5	2.0	1,195	8.8	8.3	9.3
Gender												
Female	1,069	8.8	8.3	9.4	178	1.5	1.2	1.7	891	7.4	6.9	7.8
Male	946	8.7	8.1	9.2	156	1.4	1.1	1.6	790	7.3	6.8	7.8

SOURCES: California Department of Health Services, Center for Health Statistics, Multiple Cause of Death Files, 2000-2002; California Department of Finance, Demographic Research Unit, Population Projections, May 2004.

NOTES: * Obesity-related deaths are defined by ICD-10 codes E66.0 - E66.9;

¹ Three-year average number of deaths among persons aged 20 and over with obesity as an underlying or contributing cause of death;

² Age-adjusted mortality rate per 100,000 population aged 20 years and over; *HP2010 Statistical Notes*, No. 20, Jan. 2001;

³ Ninety-five percent confidence interval (95% C.I.);

⁴ Three-year average number of deaths among persons aged 20 and over with obesity as an underlying cause of death;

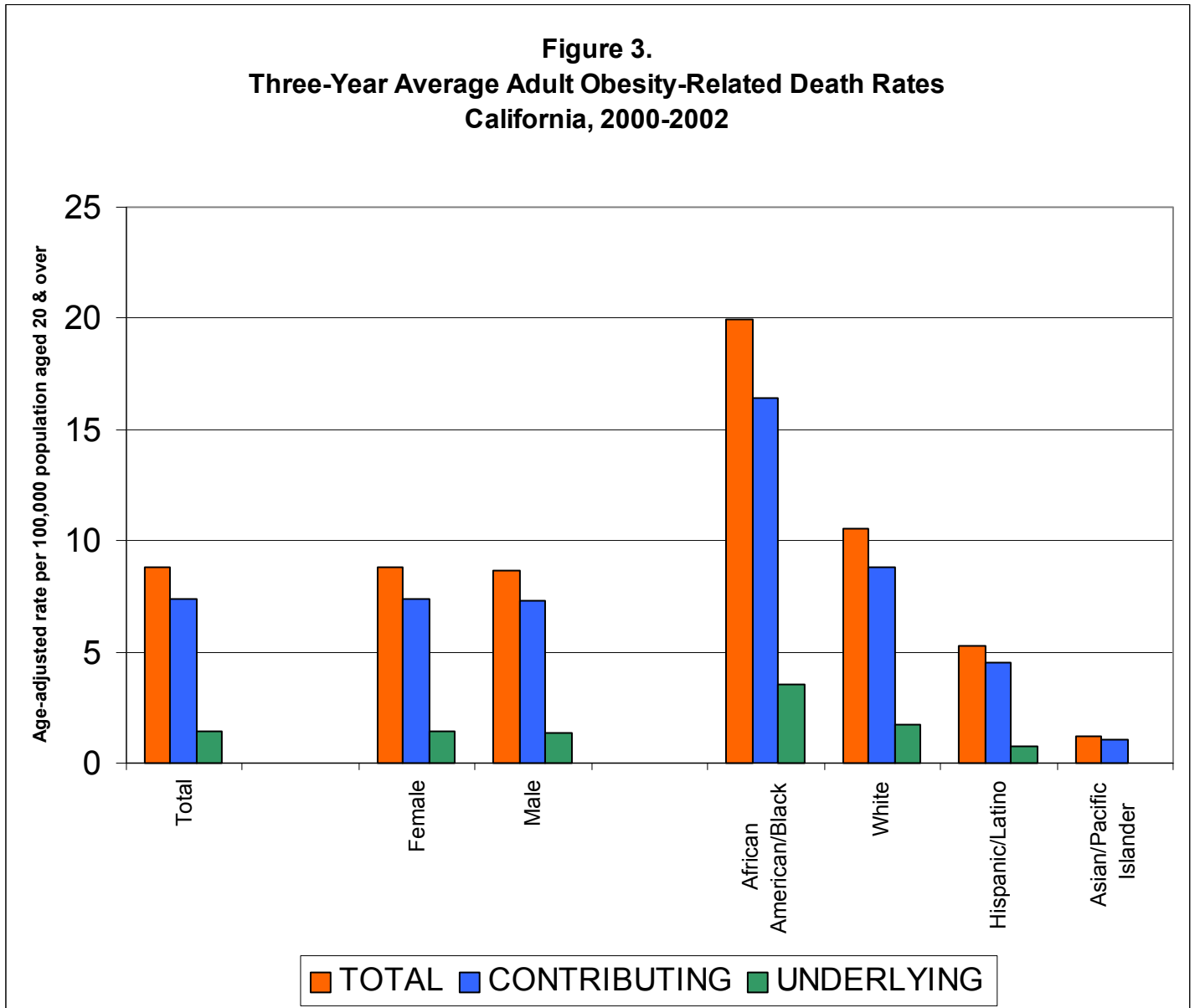
⁵ Three-year average number of deaths among persons aged 20 and over with obesity as a contributing cause of death;

n/a Healthy People 2010 target rate not applicable;

DSU Data Statistically Unreliable due to small number of events, Relative Standard Error > 23 percent;

Numbers and rates for Underlying Cause and Contributing Cause are calculated independently and may not add to Total.

Figure 3.
Three-Year Average Adult Obesity-Related Death Rates
California, 2000-2002



SOURCES: California Department of Health Services, Center for Health Statistics, Multiple Cause of Death Files 2000-2002; California Department of Finance, Demographic Research Unit, Population Projections, May 2004.