Nevada Body Mass Index Report
2008-2012 Department of Motor Vehicles Data

Department of Health and Human Services
Division of Public and Behavioral Health
Bureau of Child, Family and Community Wellness
Chronic Disease Prevention and Health Promotion

Brian Sandoval, Governor
State of Nevada

Richard Whitley, MS, Director
Department of Health and Human Services

Aug 2015
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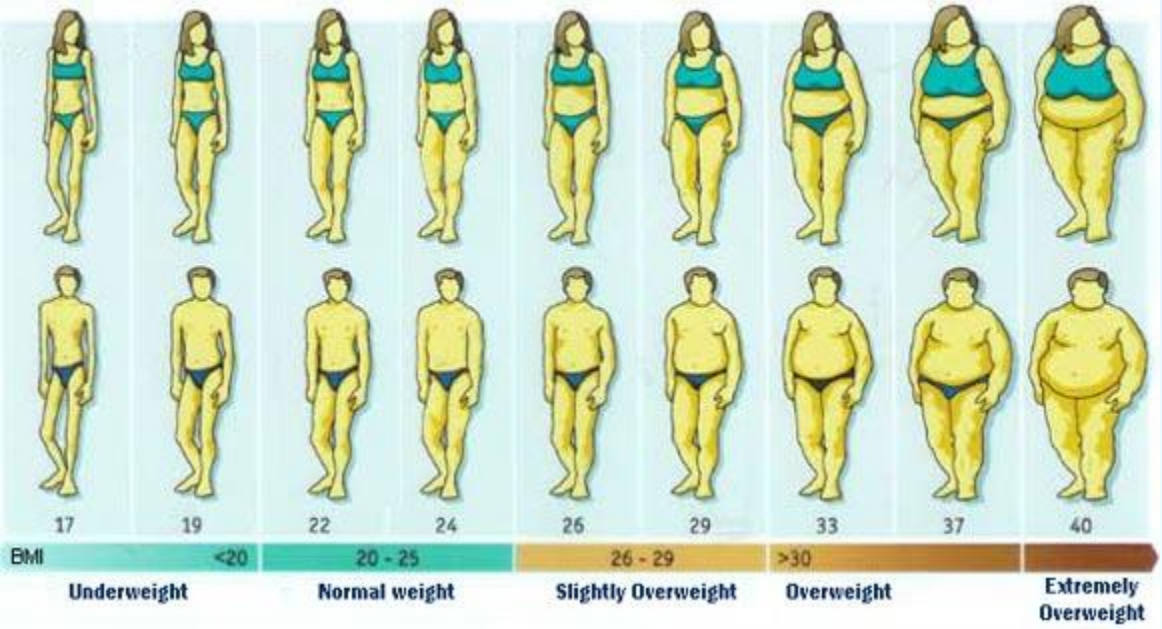
Marta Jensen, Acting Administrator
Division of Public of Behavioral Health

Tracey Green, MD, Chief Medical Officer
Division of Public and Behavioral Health

Acknowledgements

The Division of Public and Behavioral Health, Bureau of Child, Family, and Community Wellness wishes to thank the Nevada Department of Motor Vehicles (DMV) for providing the data in this report.



Authors:

Chungten Pai, Dr.P.H., Chronic Disease Evaluation Manager
Adel Mburia-Mwalili, MPH, Chronic Disease Biostatistician
Jessica Lamb, Obesity Prevention Program Coordinator
Monica Morales, MPA, Chronic Disease Section Manager
Brian Darakyan, MD, MPH, Tobacco Program Evaluator
John Whitehill, Jr., MPH, Surveillance and Evaluation Manager
Andrea Esp, MPH, CPH, CHES, Tobacco Prevention and Control Coordinator

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Acronyms and Abbreviations

BMI	Body Mass Index
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
DMV	Department of Motor Vehicles

Executive Summary

Small area obesity rate prevalence information is important for public health strategy and resourcing equity. Monitoring and surveillance of obesity has been an effective way for most states to monitor trends, highlight disparities, identify risk factors, guide prevention programs, and evaluate interventions. Data from both driver licenses and ID cards provided by the Nevada Department of Motor Vehicles (DMV) were used for body mass index (BMI) and BMI-for-age analysis. The results were also compared with that of the Behavioral Risk Factor Surveillance System (BRFSS).

Key findings from this report are as follows:

1) From 2008 to 2012, 22.3% of Nevada's adults, age 20 and older, were obese (range 14.3-31.2%) based on DMV data. The prevalence of obesity was higher among males (25.2%) than females (19.3%). The range in Nevada was 14.3 to 31.2%.

2) From 2008 to 2012, 11.3% of Nevada's youth, ages 10-19 years old, were obese based on DMV data. The prevalence of obesity was higher among males (14.5%) than females (8.1%).

3) The five counties identified as having the highest prevalence of obesity were Pershing (31.2%), Lander (31.0%), Mineral (30.9%), Humboldt (29.2%), and Nye (28.3%) counties.

4) When comparing obesity status with overall health outcomes in Nevada, we found overall health outcomes are negatively correlated with obesity.

5) Overall, BRFSS and DMV BMI estimates appear similar. The BMI estimates in DMV data are 7% and 16% lower than that of BRFSS estimates for men and women, respectively.

6) Even though height and weight information on a driver license or ID card may be predictably biased, DMV data is still useful for population-based monitoring of obesity. It is strongly encouraged that public health agencies explore using DMV records for obesity tracking, particularly in Nevada's rural areas where the baseline estimates are often not easy to identify.

Recommendations:

It is recommended that Nevada continues to compare DMV data will that of BRFSS data to ensure the evaluation and surveillance of obesity in Nevada is consistent for consecutive years before choosing one data source over the other. Although analyzed estimates appear to be similar, DMV data does present a larger sample size and an adequate reliability advantage over BRFSS data at this point. Caution should be taken when interpreting data from both data sources as they are based on self-reported surveys in which individuals are asked to self-report their height and weight for BMI and BMI-for-age analysis. In future analysis, data quality could be improved by measuring each individual's height and weight in DMV offices and require all height and weight information to be updated upon every renewal.

Introduction

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems (Haslam & James, 2005). Obesity in the United States has been increasingly cited as a major public health issue in recent decades, with more than one-third of U.S. adults being obese (Ogden, et al., 2012). Research has shown obesity as a contributing factor to approximately 100,000–400,000 deaths in the United States per year (Blackburn, et al., 2005). It has increased health care use and expenditures (Andreyeva et al., 2004; Finkelstein & Fiebelkom, 2003; Sturm &Roland, 2002; Walf, 1998) resulting in an estimated $117 billion in direct (preventive, diagnostic, and treatment services related to weight) and indirect (absenteeism, loss of future earnings due to premature death) costs to society (Weight-control Information Network, 2006).

Monitoring and surveillance of obesity has been an effective way for most states to follow obesity trends, highlight disparities, identify risk factors, guide prevention programs, and evaluate interventions. Further, using DMV data is a cited source of data used track obesity rates (Smith, et al., 2008; Zick, et al., 2009; Walsh, Trentham-Dietz, & Palta, 2011). However, no official report has investigated DMV data for these purposes for the state of Nevada. This report aimed to calculate the obesity rate in Nevada by using data from the Nevada DMV and compare the results with the CDC's BRFSS calculations.

This report intends to inform the Nevada State Wellness program staff, governmental and nongovernmental stakeholders, and the public about Nevada's obesity prevention activities and evaluation efforts. In addition, it provides recommendations for continual improvement. This information will serve as the moving force behind improvements that will ultimately strengthen Nevada's Wellness Program and the broader collective efforts of those seeking to reduce the burden of obesity in Nevada.

Technical Notes

Using DMV data

Data was collected from the Nevada Department of Motor Vehicles' (DMV) ID cards and driver's licenses. Information collected included age, sex, height, weight, date of birth, date of issue, and mailing and physical address for the years of 2008 through 2012. The minimum age for an ID card in Nevada is 10 years. To obtain an ID or driver's license, an individual must be a Nevada resident and must provide a valid Nevada street address. A Nevada driver's license is valid for four years, except for motorists with certain medical conditions and convicted sex offenders who have annual renewals. ID cards and driver's licenses must be renewed in person once every eight years. Height and weight data are self-reported and may or may not be updated by the individual since the original issue date.

In 2012, there were 2,154,289 existing records. We excluded the following records:

- ID/Driver's license issued between 1976 and 2007
- Duplicates
- Did not contain a physical address in Nevada
- Age was between 10 and 19 years old in 2012
- Biologically implausible values for height and BMI

A total of 1,843,801 records for adult (20+ years) were analyzed.

Using SAS software to analyze the data

SAS software was used for data analysis.

Using BMI to Estimate Overweight and Obesity

BMI is a measure for human body shape based on an individual's mass and height. The BMI was originally invented by the Belgian polymath, Adolphe Quetelet, between 1830 and 1850, defined as the individual's body mass divided by the square of their height – with the value universally being given in units of kg/m^2 (Eknoyan, Garabed, 2007).

$$\mathrm{BMI} = \frac{\mathrm{mass(kg)}}{(\mathrm{height(m)})^2}$$

However, the term "BMI" was not used until a milestone paper by Ancel Keys was published in the Journal of Chronic Disease. She found the BMI to be the best proxy for body fat percentage among ratios of weight and height (Jeremy Singer-Vine, 2009; Keys et al., 1972). BMI is now the tool most commonly used to estimate overweight and obesity in children and adults. It is endorsed by the Centers for Disease Control and Prevention (CDC) because it is inexpensive and easy to use for clinicians and the general public. Additionally, the use of BMI allows people to compare their own weight status to that of the general population (CDC, 2011).

For adults, overweight and obesity ranges are measured by using weight and height to compute the person's BMI. The BMI is used because, typically, it correlates with the amount of fat in the body.

The standard weight status categories associated with BMI ranges for adults (20+ years) are shown in the following table:

Weight Status	BMI
Underweight	Below 18.5
Healthy Weight	18.5 – 24.9
Overweight	25.0 – 29.9
Obese	30.0 and Above

BMI-for-Age

Children grow at different rates at different times, so it is not always easy to tell if a child is overweight. BMI charts for children compare their height and weight to other children of their same sex and age.

BMI-for-Age categories (10-19 years):

Weight Status	Percentile Range
Underweight	Less than the 5th percentile
Healthy Weight	5th percentile to less than the 85th percentile
Overweight	85th percentile to less than the 95th percentile
Obese	Equal to or greater than the 95th percentile

Results

Nevada Statewide BMI

Among Nevadans with an ID card or driver's license who are over the age of 20 years old, 1.8% are underweight, 39% are healthy weight, 36.9% are overweight, and 22.3% are obese. Of those considered overweight or obese, 71.1% are male and 47.0% are female.

Figure 1: Adult BMI (20+ years), State of Nevada

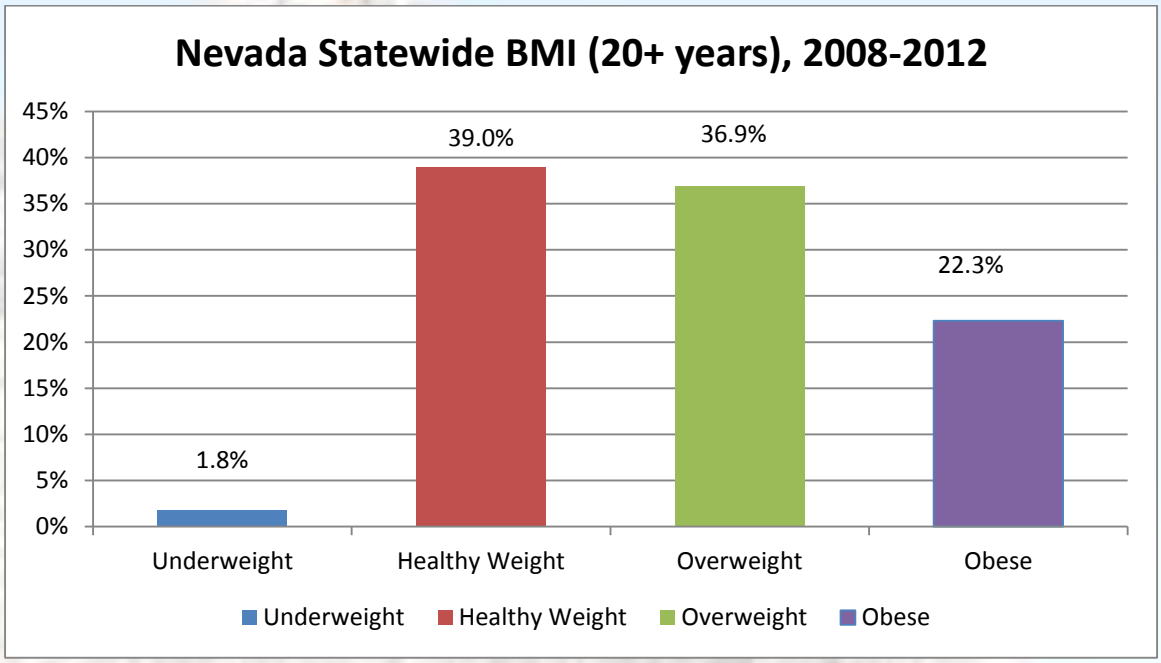
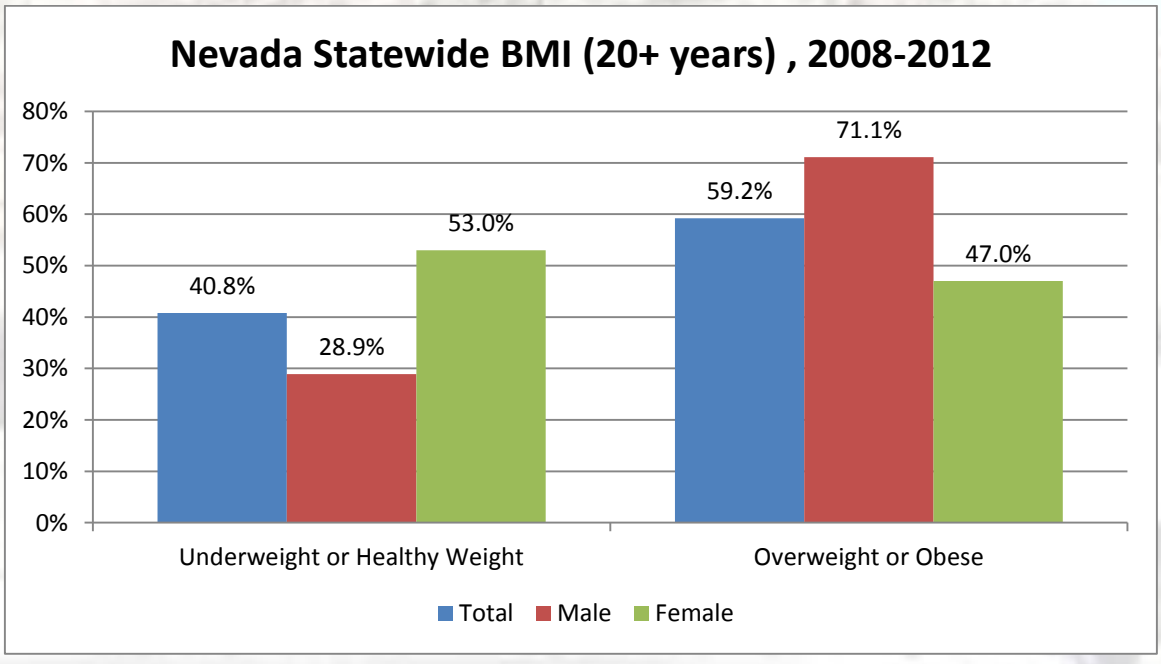
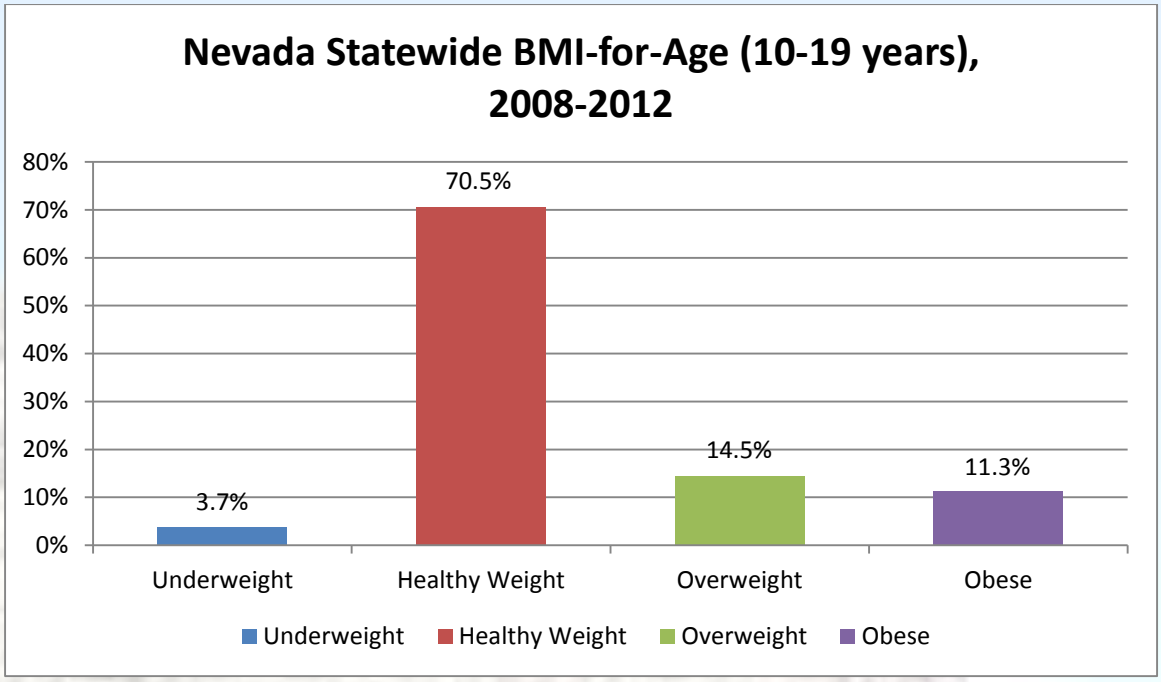


Figure 2: Adult BMI, Males and Females, State of Nevada



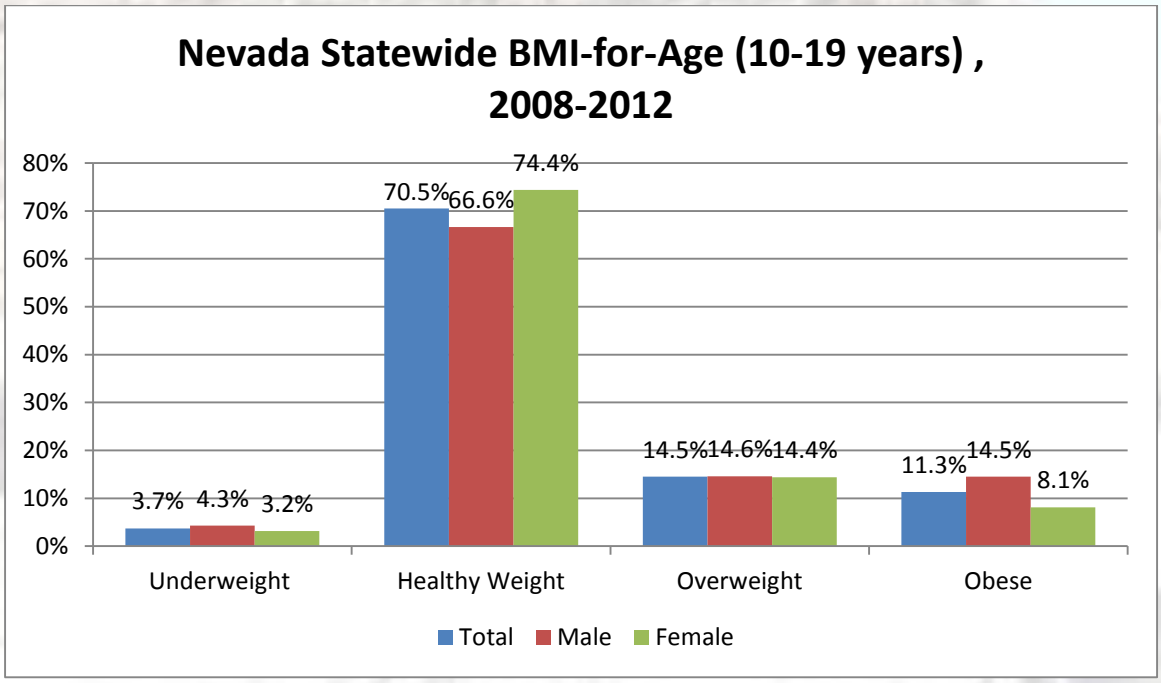
The percentage of Nevada youth (10-19 years) who are overweight and obese are 14.5% and 11.3% respectively.

Figure 3: Nevada Statewide BMI-for-Age (10-19 years)



70% of the state's youth are healthy weight. A combined 74.2% of youth were underweight or healthy weight, while a combined 25.8% were overweight or obese.

Figure 4: BMI-for-Age, Males and Females, State of Nevada



Nevada BMI-for-Age

Figure 5: Nevada Adult BMI (20+ years), 2008-2012

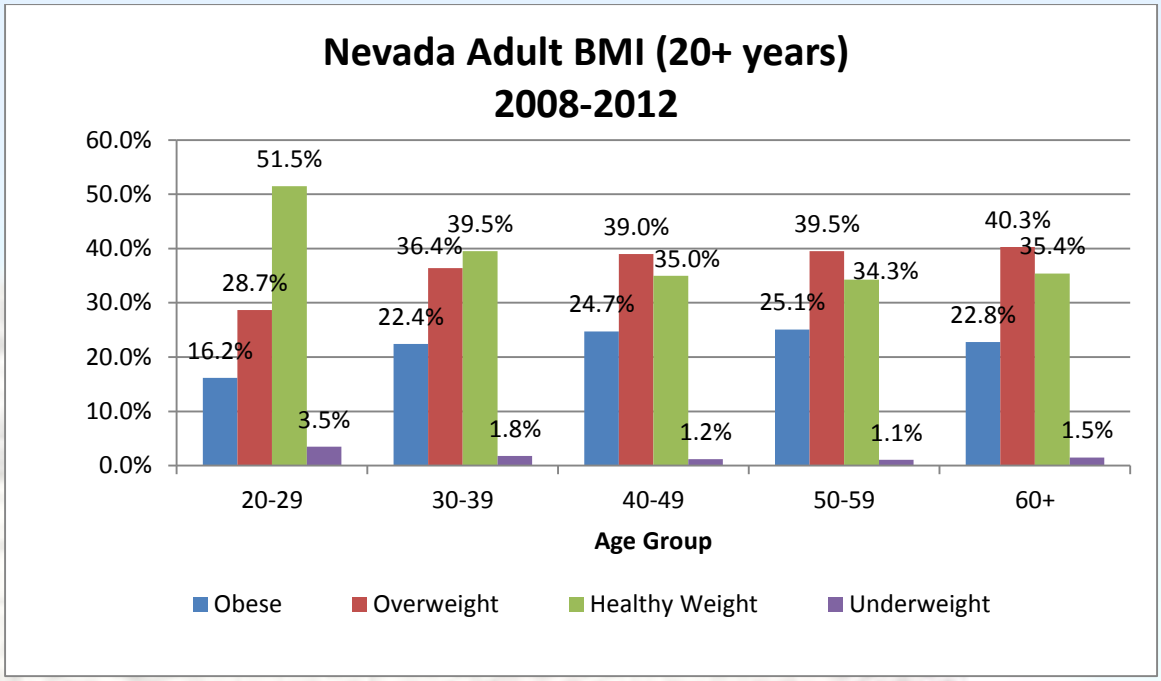
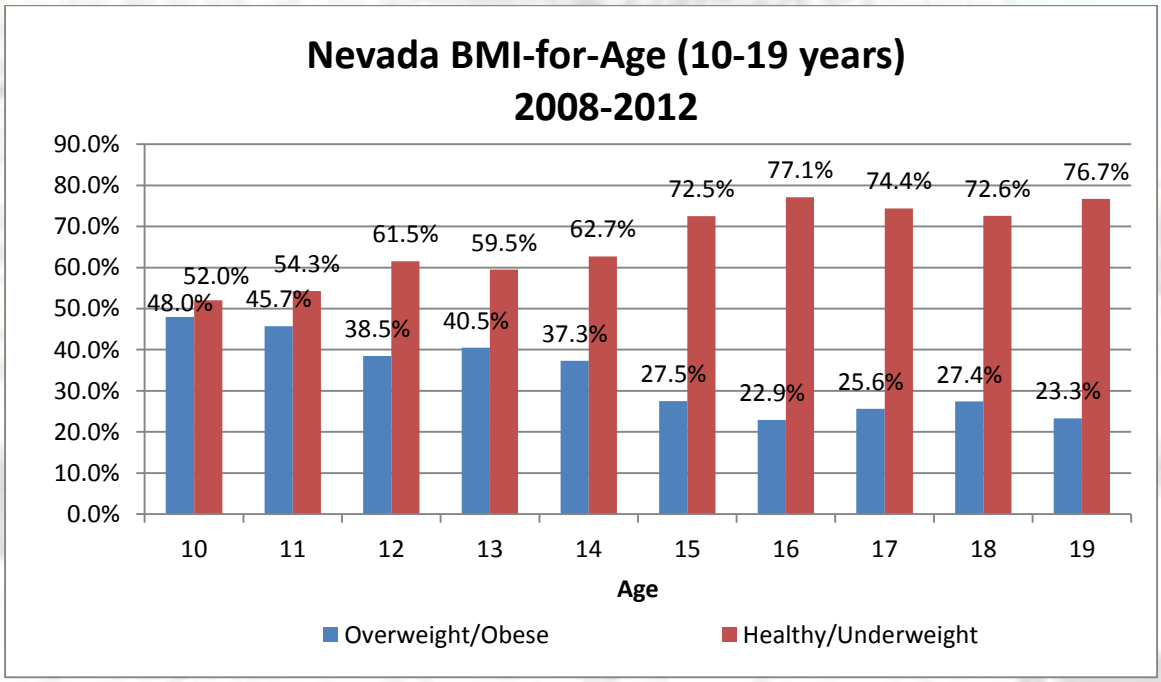


Figure 6: Nevada BMI-for-Age (10-19 years), 2008-2012

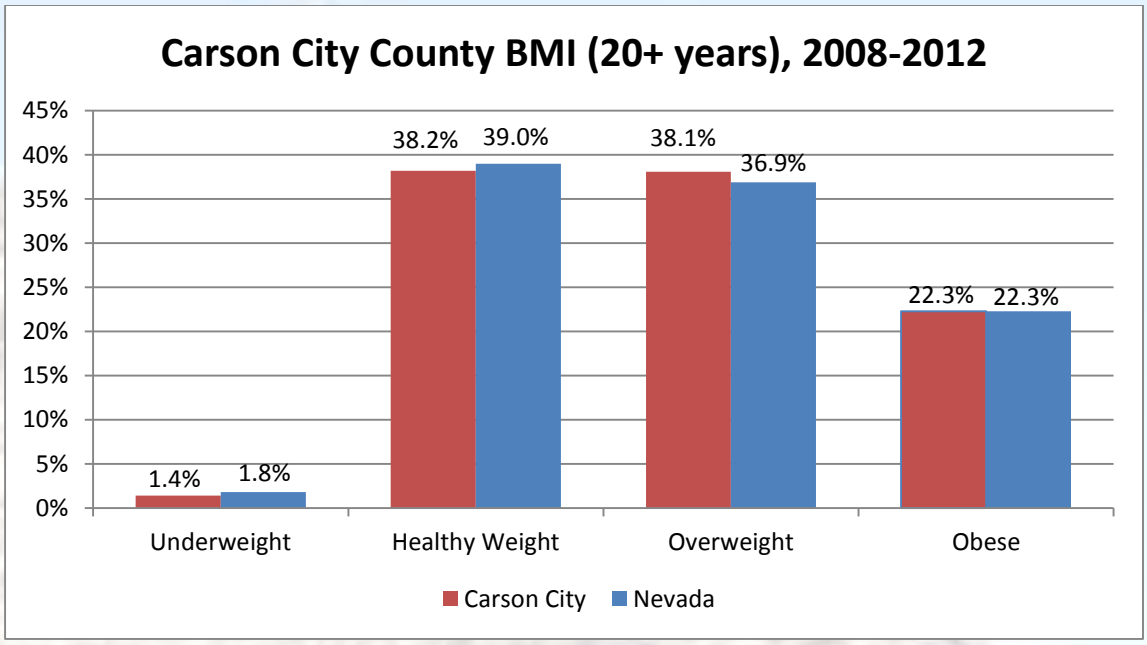


BMI by County

Carson City

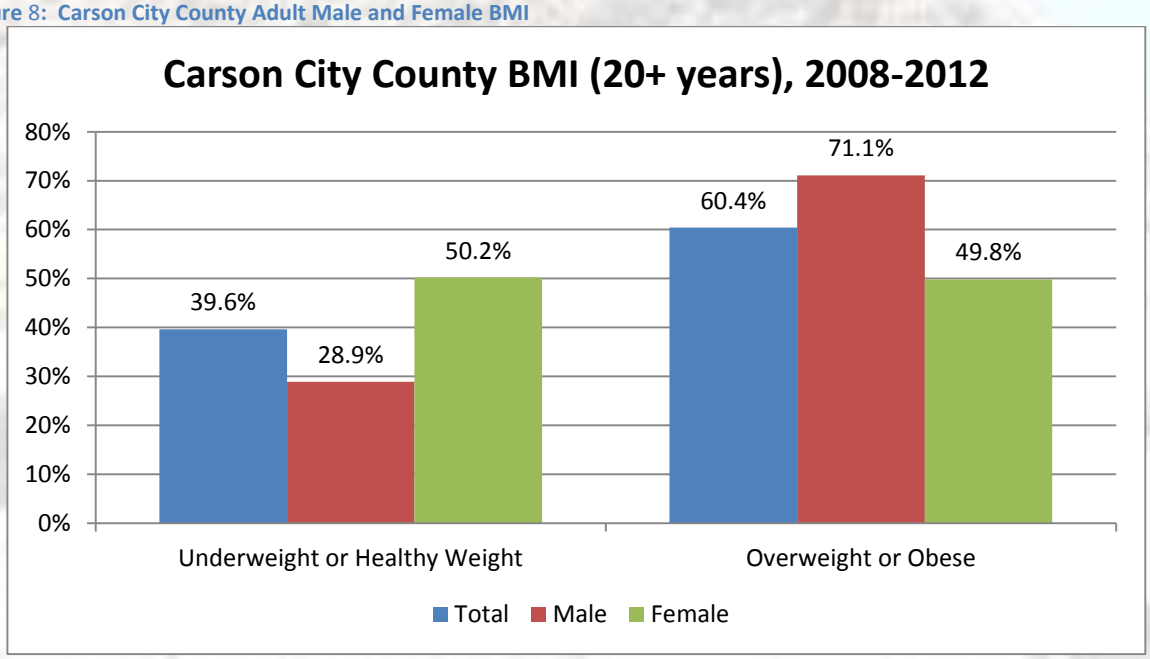
The percentage of Carson City adults (20+ years) who are overweight and obese are 38.1% and 22.3% as compared to statewide averages of 36.9% and 22.3%, respectively.

Figure 7: Carson City County Adult BMI



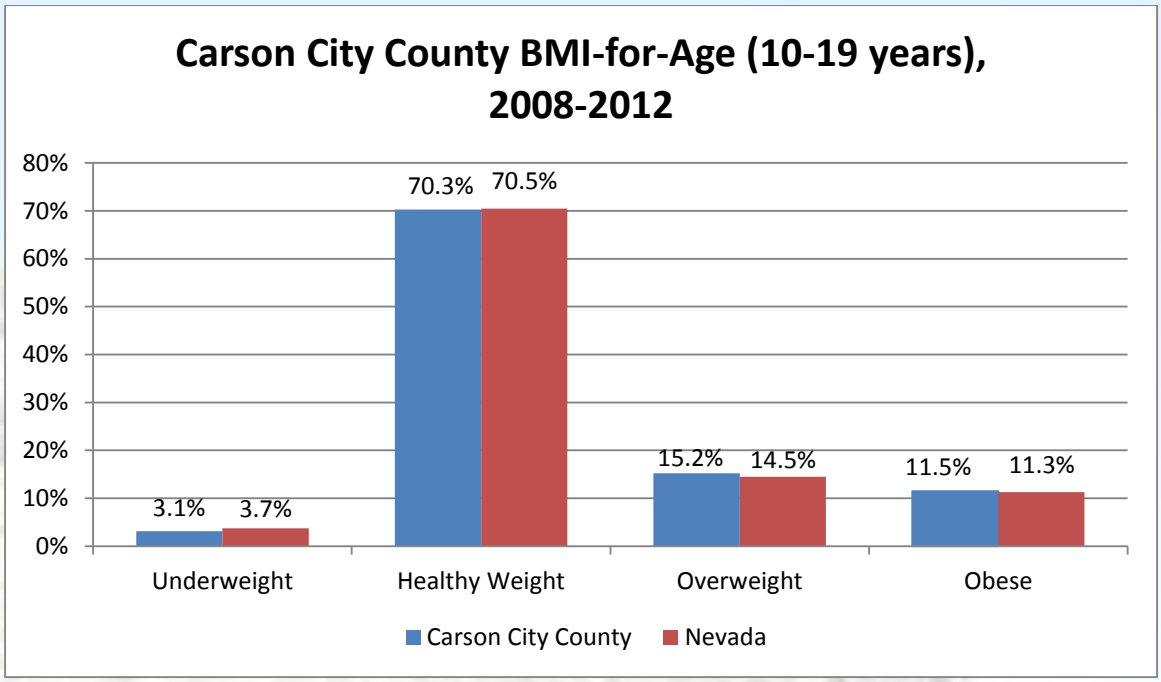
Data indicate that more male adults (20+ years) in Carson City are overweight or obese when compared to females (20+ years).

Figure 8: Carson City County Adult Male and Female BMI



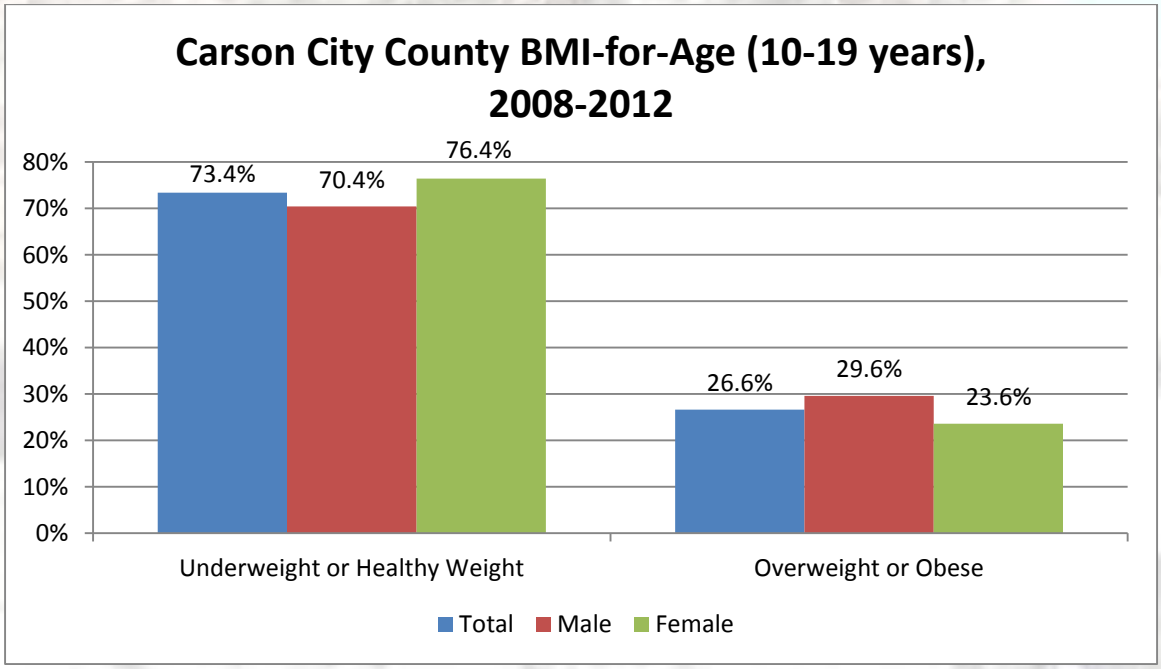
The rates of Carson City residents (10-19 years) collectively who are overweight and obese are 14.5% and 11.3%, respectively, compared to the statewide average of 14.5% and 11.3%.

Figure 9: Carson City County BMI-for-Age



Data indicate that more male youth in Carson City County are overweight or obese when compared to female youth.

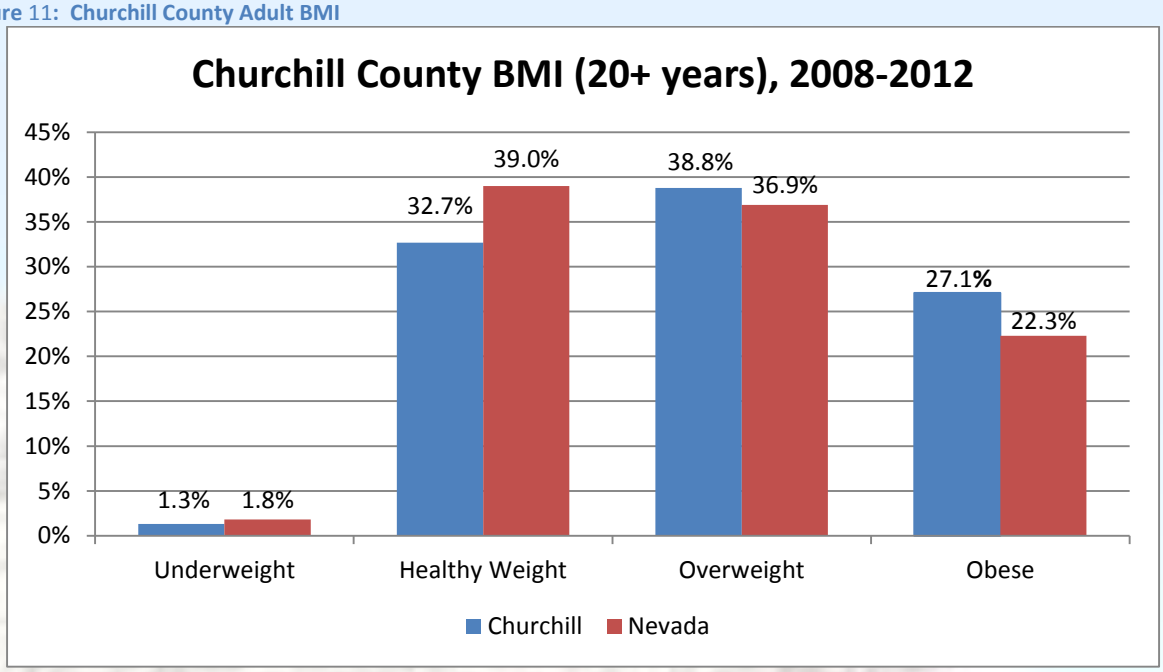
Figure 10: Carson City County Male and Female BMI-for-Age



Churchill County

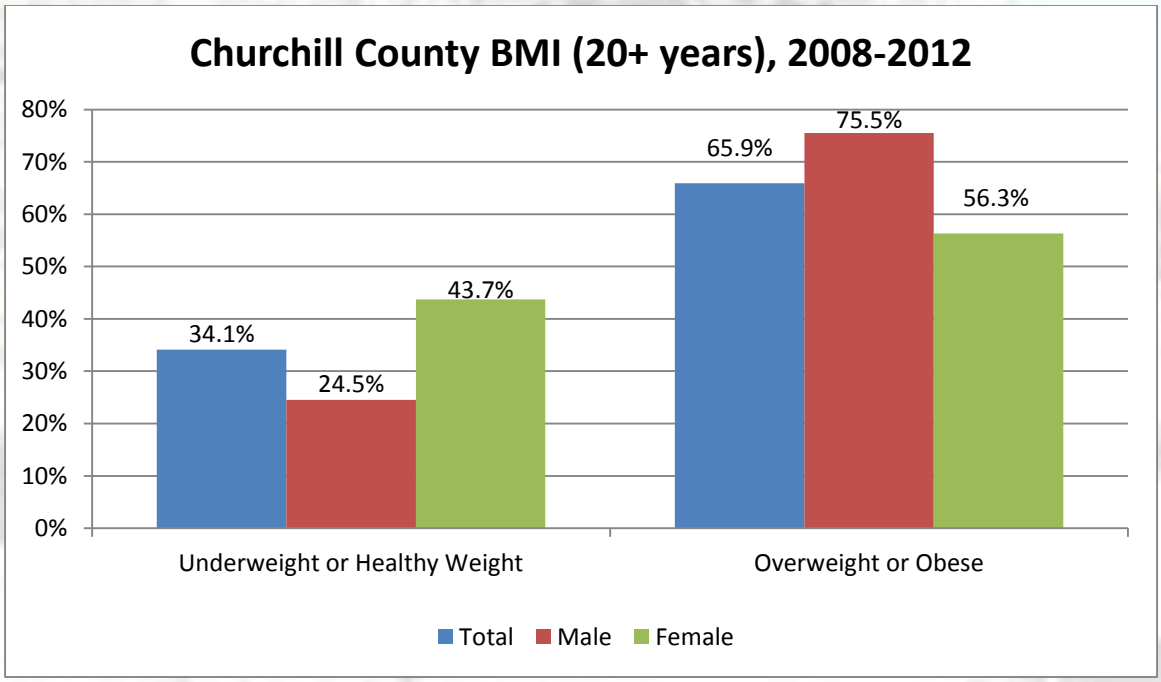
The rates of Churchill County Adults (20+ years) who are overweight and obese are 38.8% and 27.1%, respectively, compared to statewide averages of 36.9% and 22.3%.

Figure 11: Churchill County Adult BMI



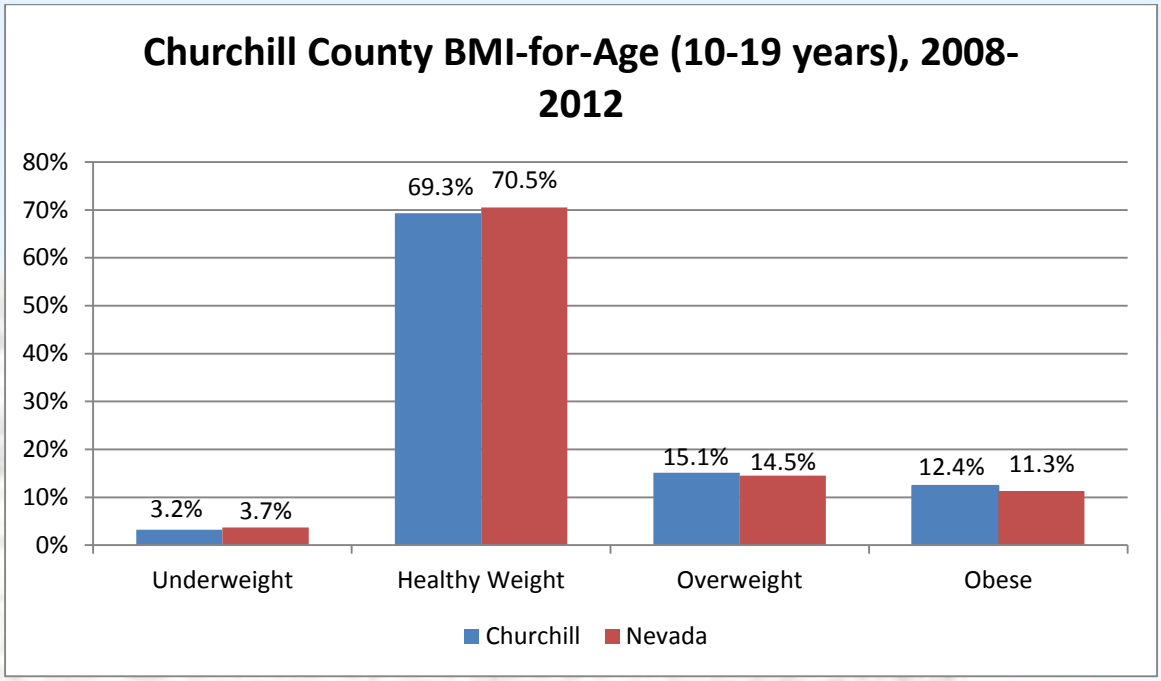
Data indicate that more male adults (20+ years) in Churchill are overweight or obese when compared to females (20+ years).

Figure 12: Churchill County Adult Male and Female BMI



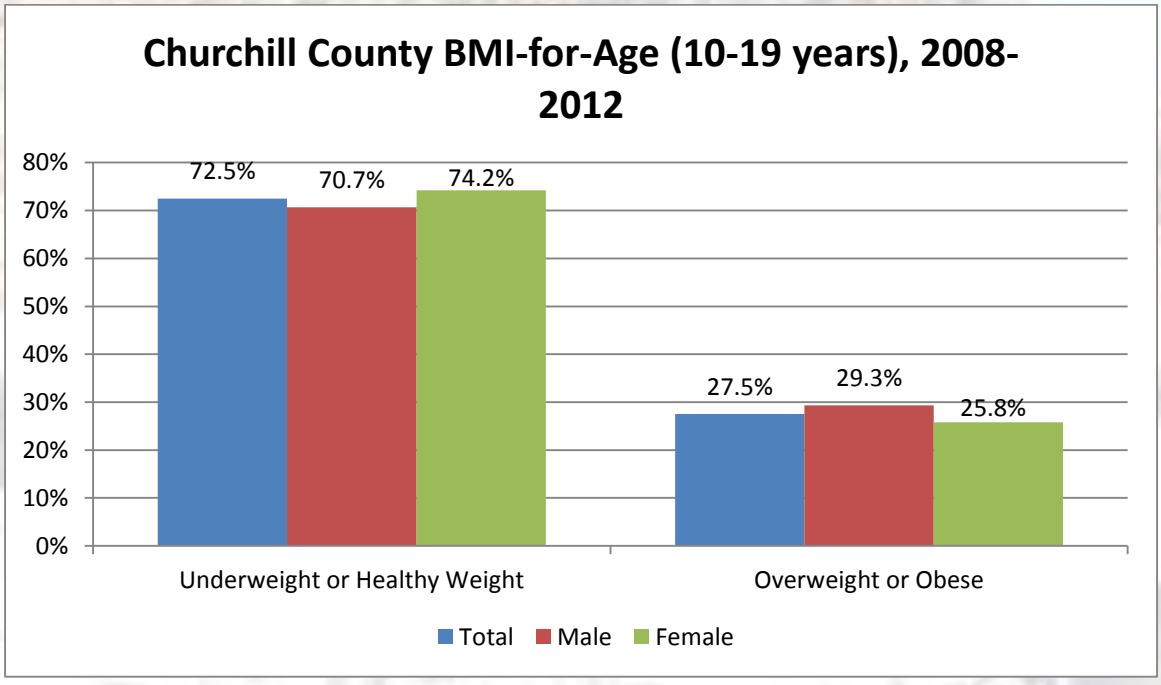
The rates of Churchill County youth (10-19 years) who are overweight and obese are 15.1% and 12.4%, respectively, compared to statewide averages of 14.5% and 11.3%.

Figure 13: Churchill County BMI-for-Age



Data indicate that slightly more male youth (10-19 years) in Churchill are overweight or obese when compared to females (10-19 years).

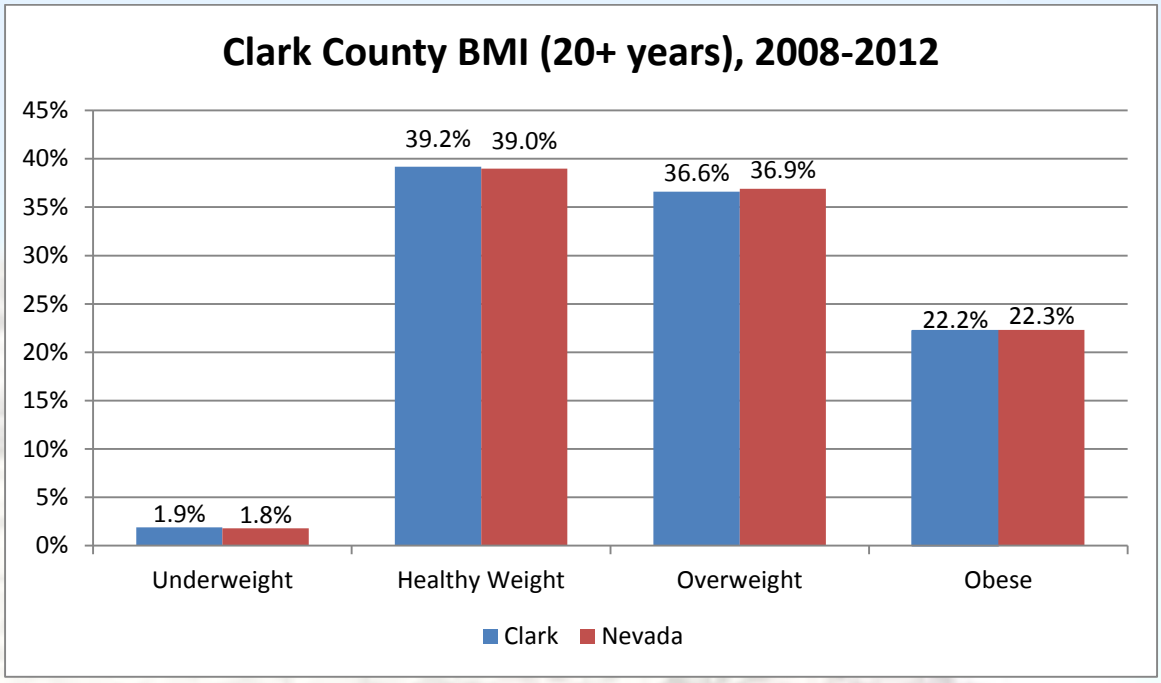
Figure 14: Churchill County Male and Female BMI-for-Age



Clark County

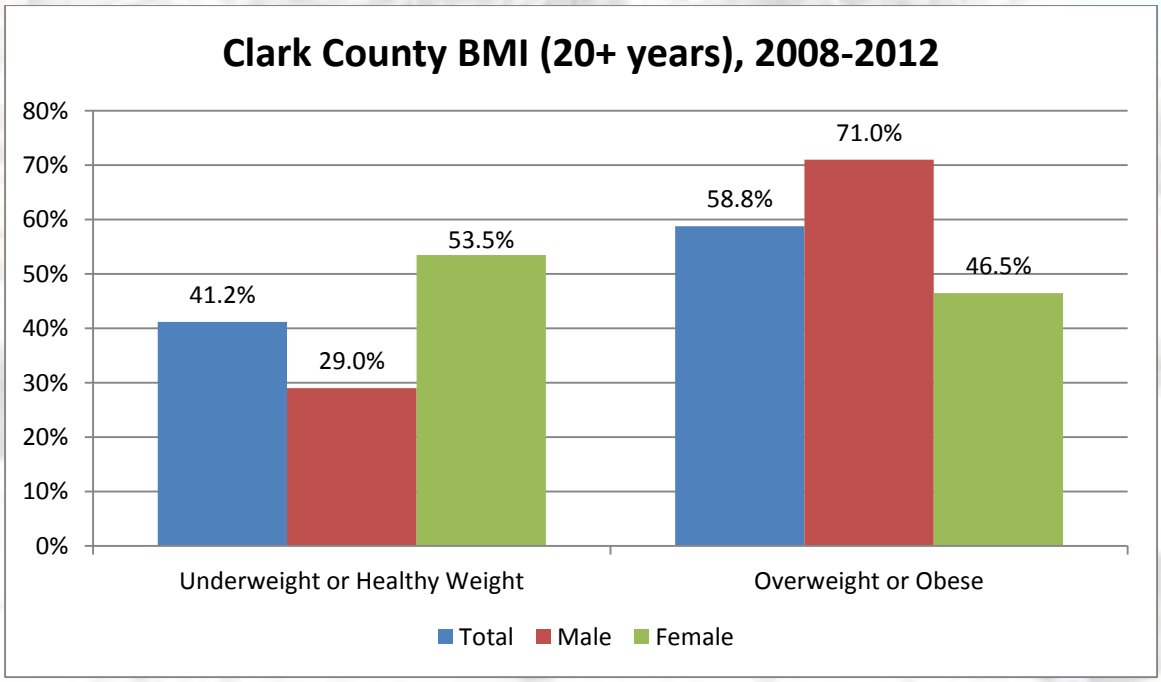
The rates of Clark County adults (20+ years) who are overweight and obese are 36.6% and 22.2%, respectively, compared to statewide averages of 36.9% and 22.3%.

Figure 15: Clark County Adult BMI



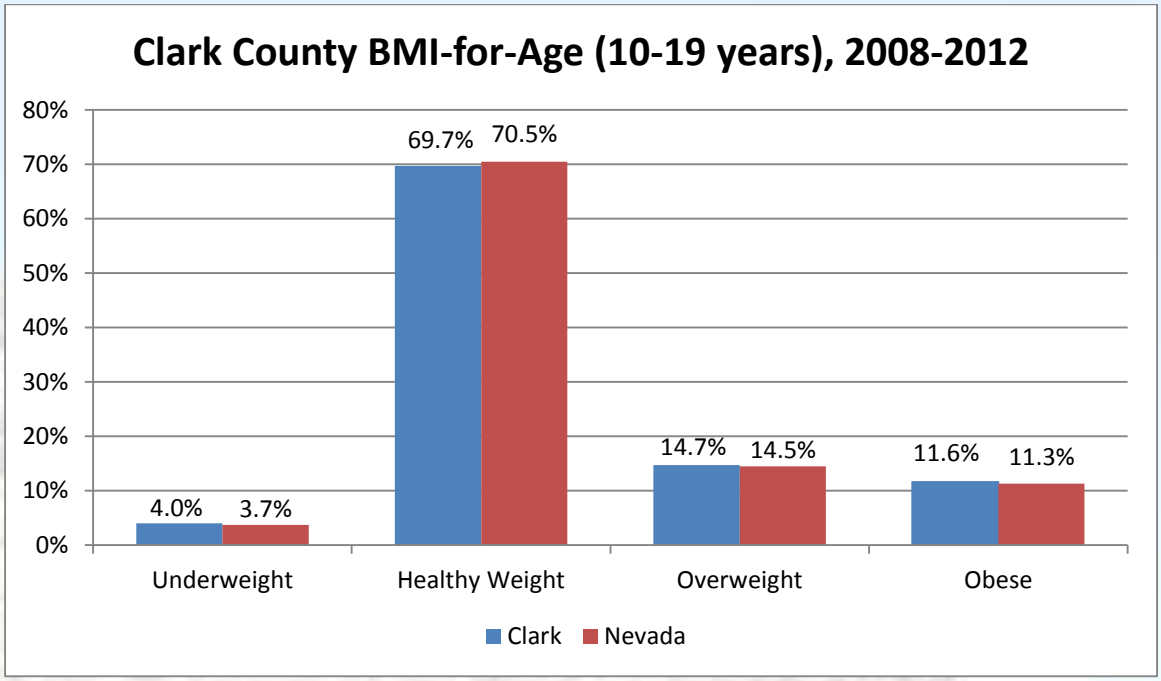
Data indicate that more male adults (20+ years) in Clark County are overweight or obese when compared to females (20+ years).

Figure 16: Clark County Adult Male and Female BMI



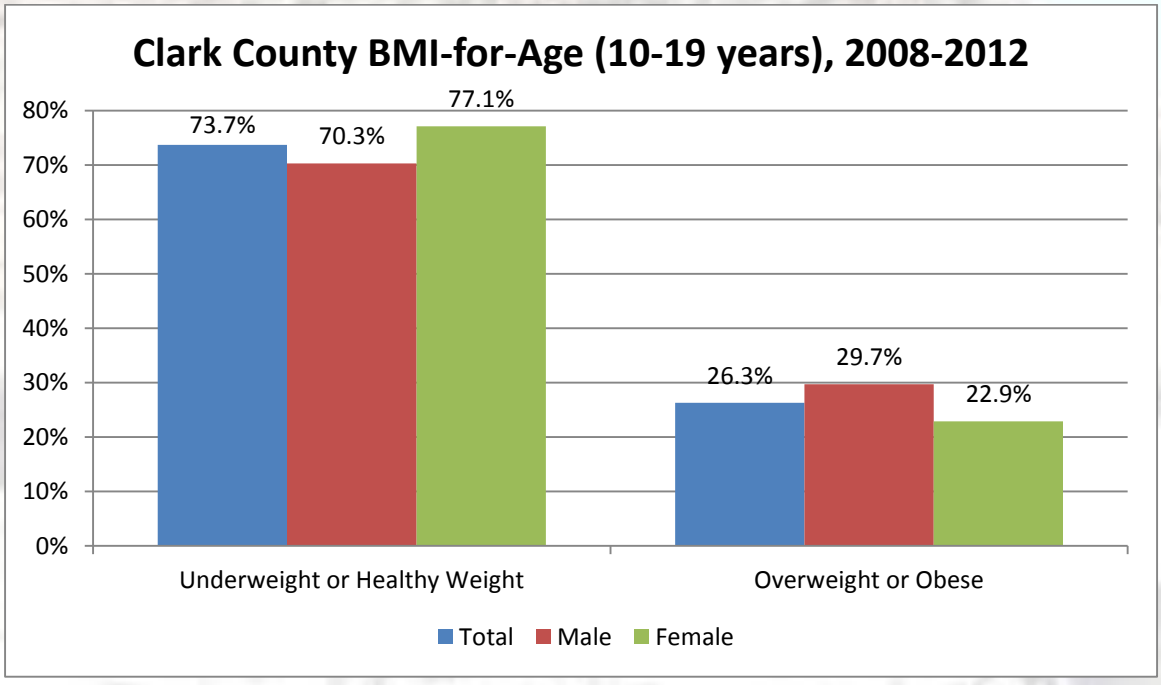
The rates of Clark County youth (10-19 years) who are overweight and obese are 14.7% and 11.6%, respectively, compared to statewide averages of 14.5% and 11.3%.

Figure 17: Clark County BMI-for-Age



Data indicate that more male youth (10-19 years) in Clark County are overweight or obese when compared to females (10-19 years).

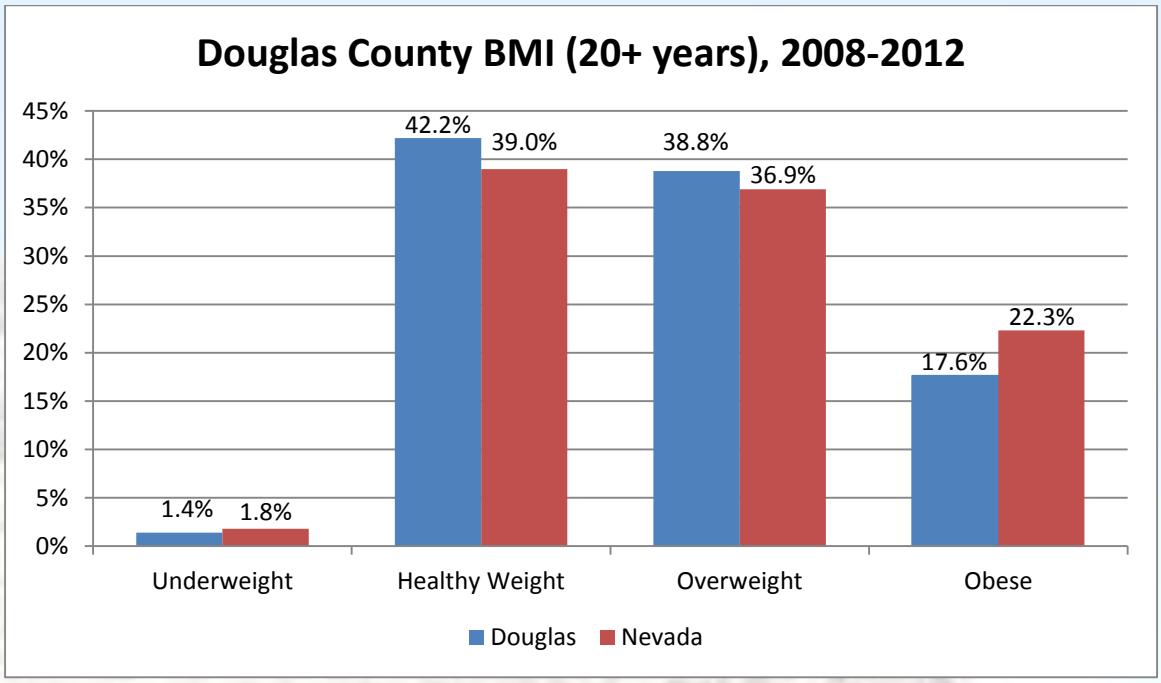
Figure 18: Clark County Male and Female BMI-for-Age



Douglas County

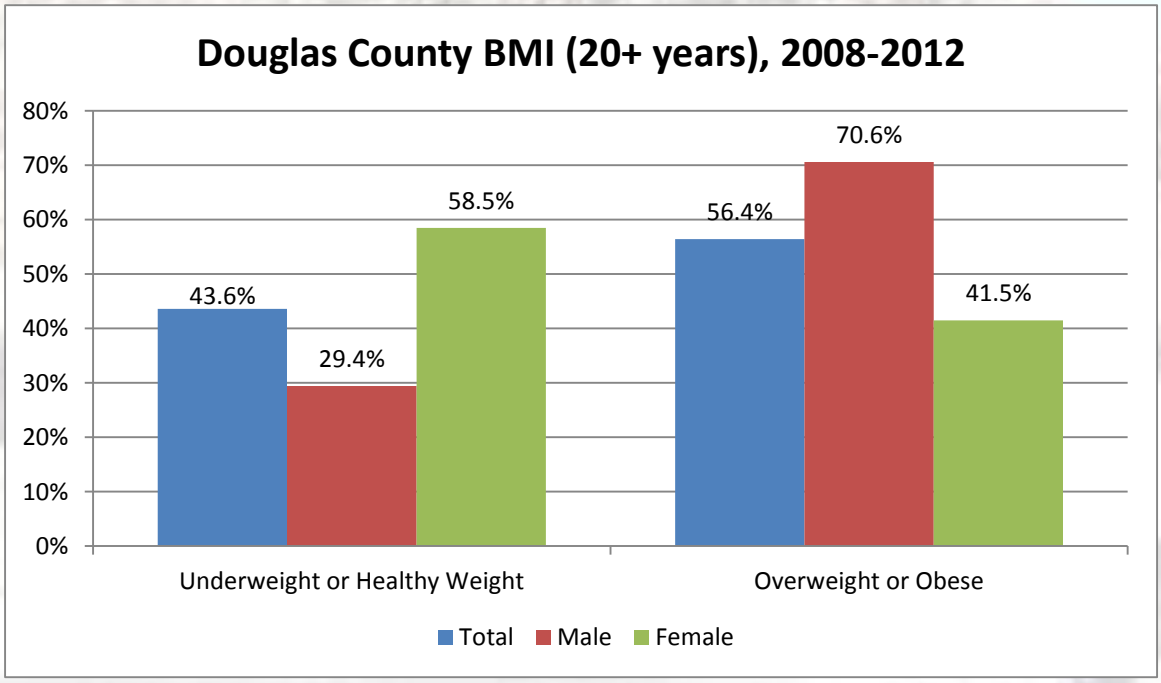
The rates of Douglas County adults (20+ years) who are overweight and obese are 38.8% and 27.1%, respectively, compared to statewide averages of 36.9% and 22.3%.

Figure 19: Douglas County Adult BMI



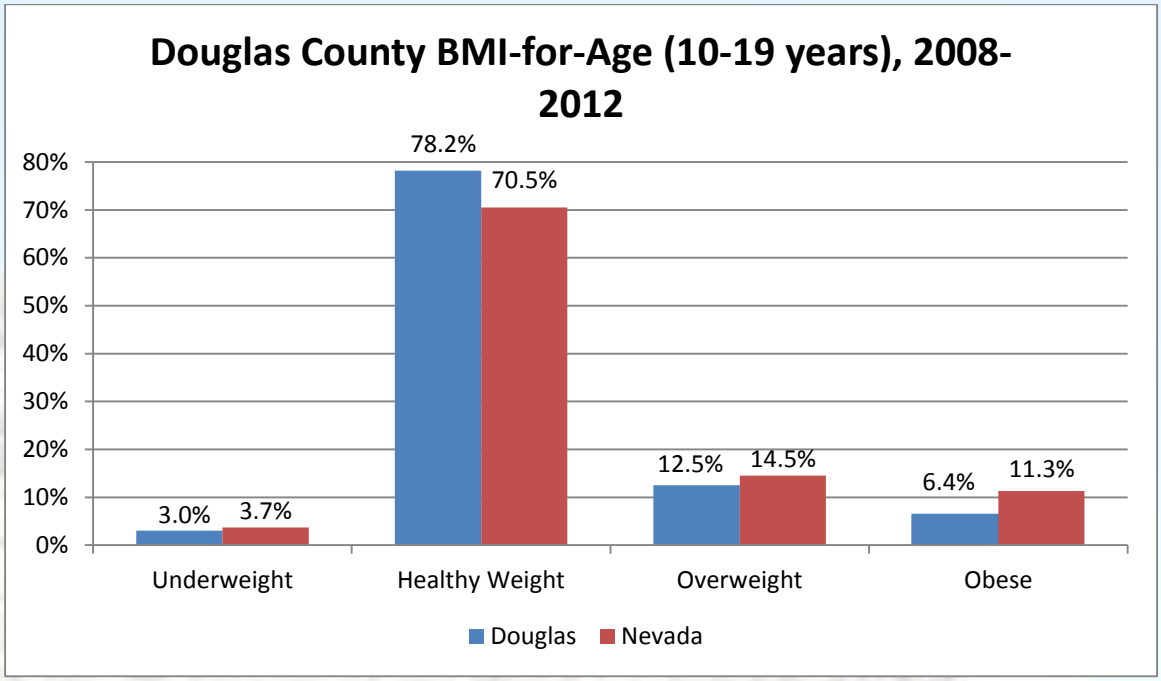
Data indicate that more male adults (20+ years) in Douglas County are overweight or obese when compared to females (20+ years).

Figure 20: Douglas County Adult Male and Female BMI



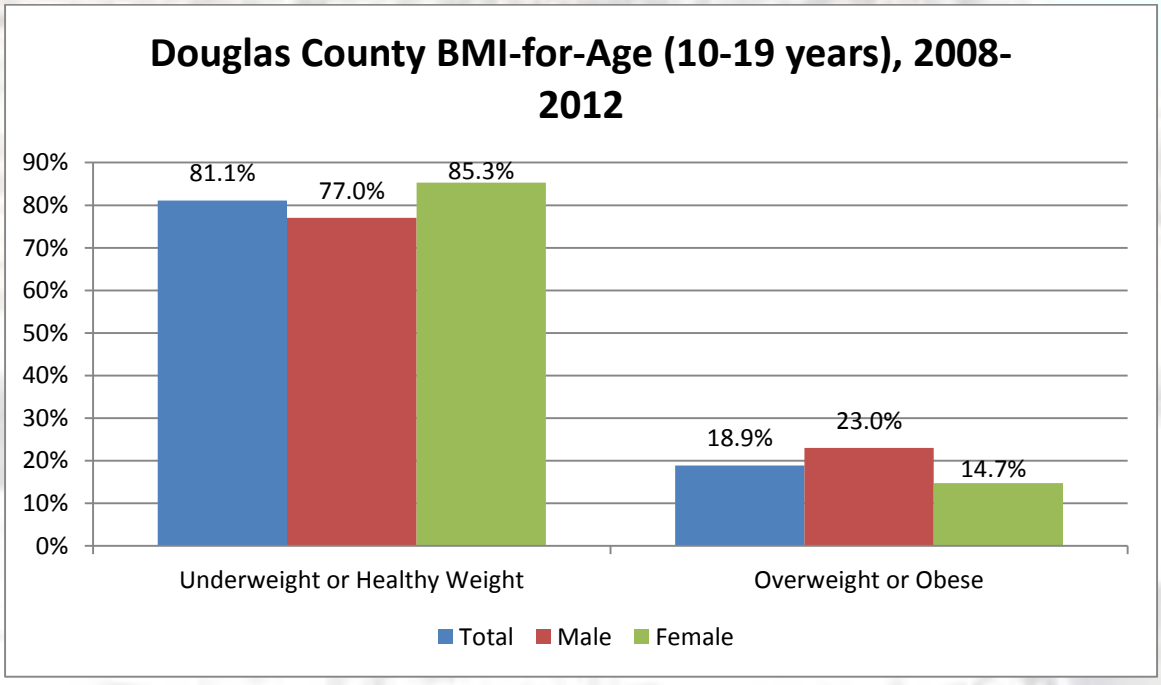
The rates of Douglas County youth (10-19 years) who are overweight and obese are 12.5% and 6.4%, respectively, compared to statewide averages of 14.5% and 11.3%.

Figure 21: Douglas County BMI-for-Age



Data indicate that more male youth (10-19 years) in Douglas County are overweight or obese when compared to females (10-19 years).

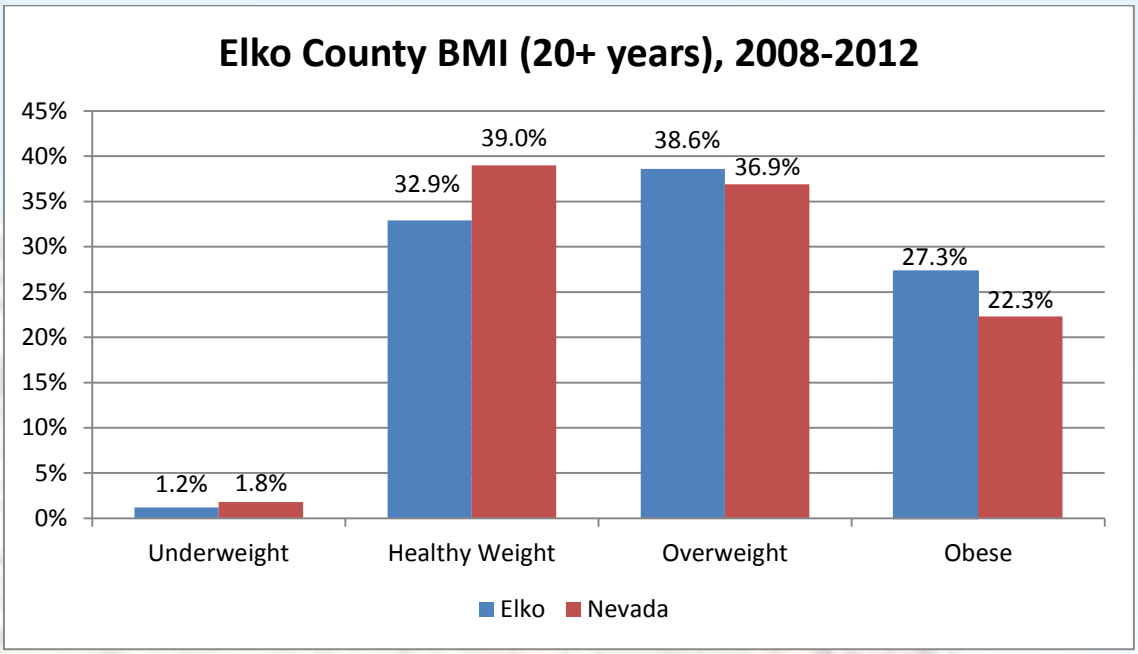
Figure 22: Douglas County Male and Female BMI-for-Age



Elko County

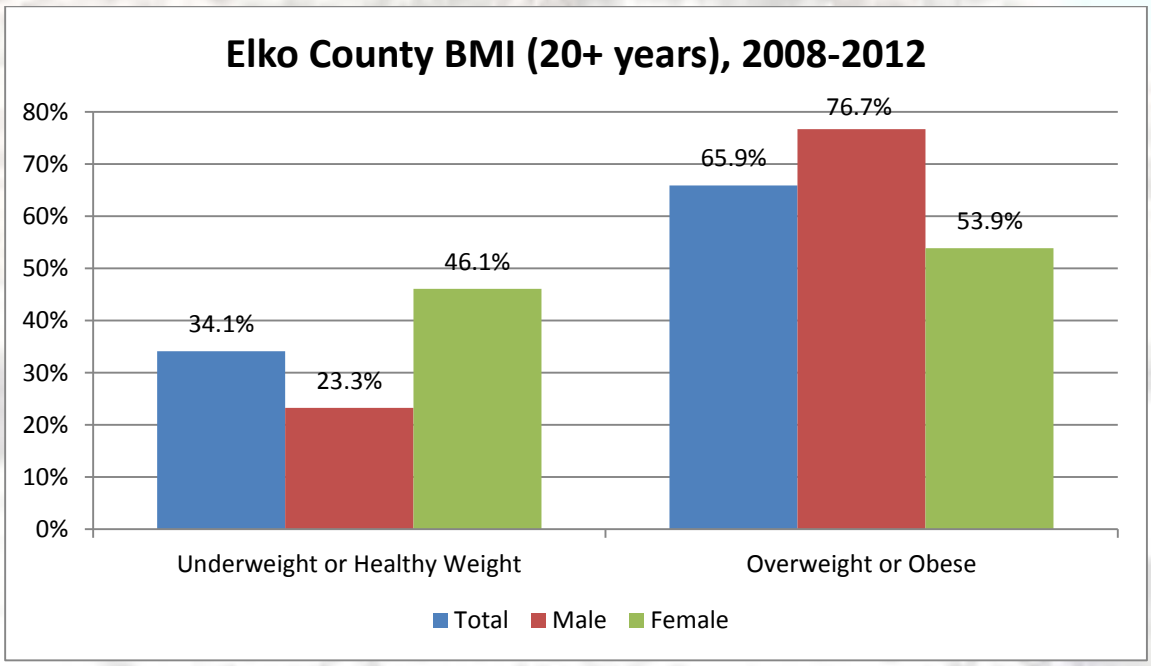
The rates of Elko County adults (20+ years) collectively who are overweight and obese are 38.6% and 27.3%, respectively, compared to statewide averages of 36.9% and 22.3%.

Figure 23: Elko County Adult BMI



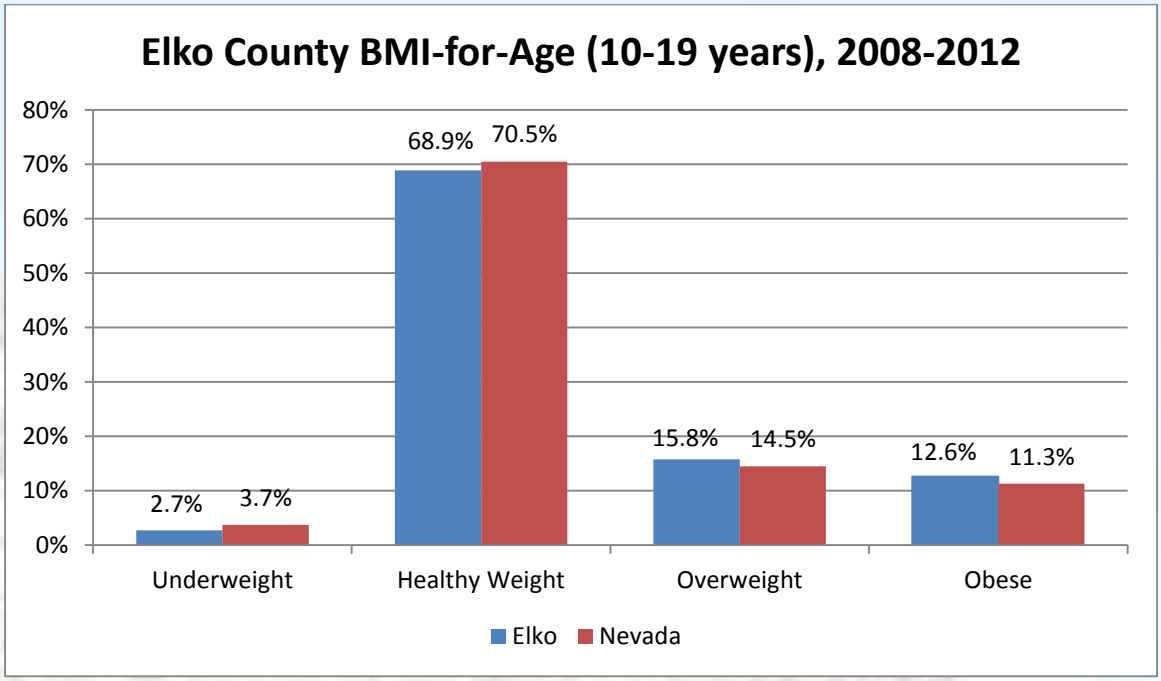
Data indicate that more male adults (20+ years) in Elko County are overweight or obese when compared to females (20+ years).

Figure 24: Elko County Adult Male and Female BMI



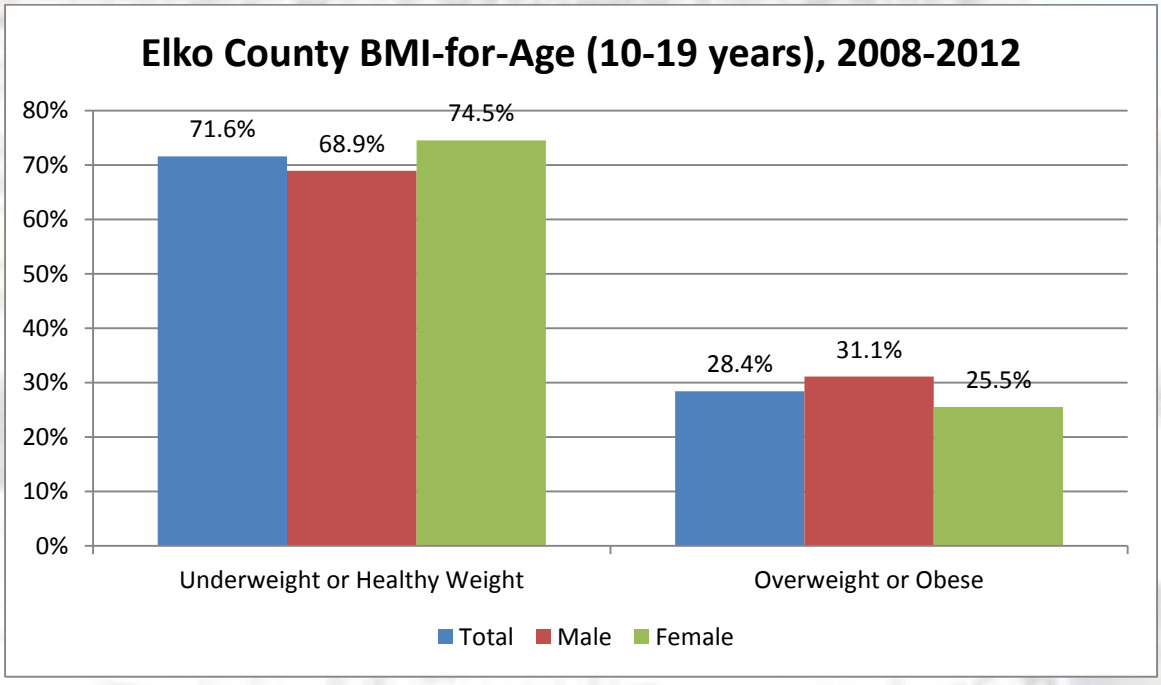
The rates of Elko County youth (10-19 years) who are overweight and obese are 15.8% and 12.6%, respectively, compared to statewide averages of 14.5% and 11.3%.

Figure 25: Elko County BMI-for-Age



Data indicate that more male youth (10-19 years) in Elko County are overweight or obese when compared to females (10-19 years).

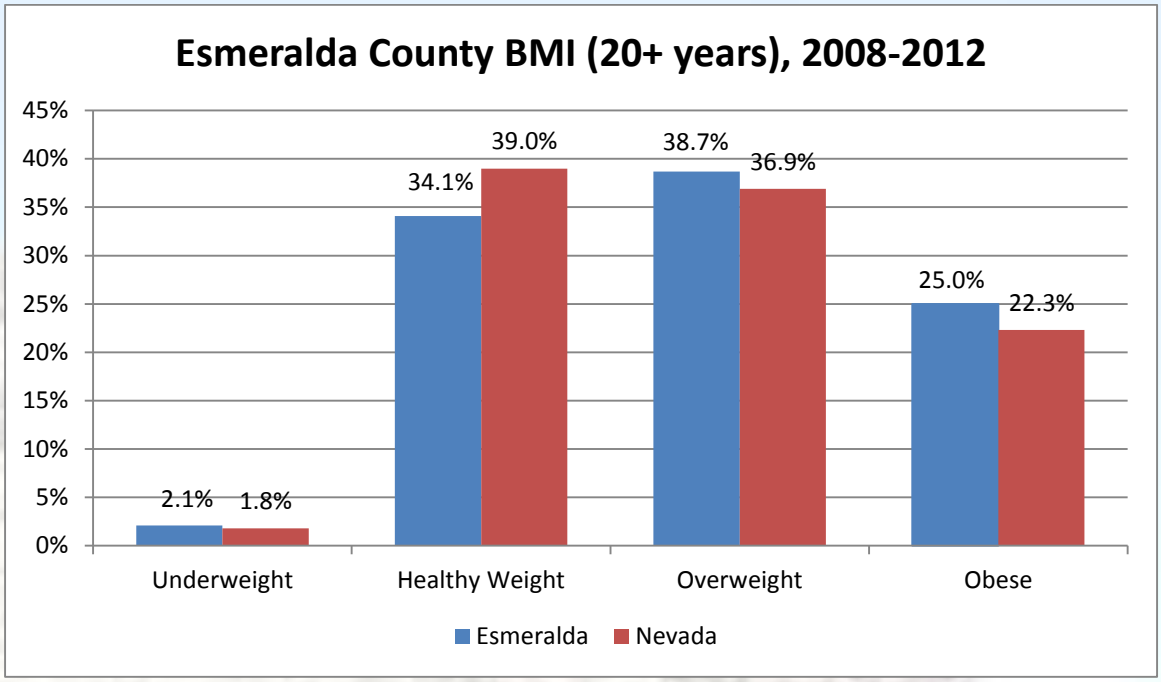
Figure 26: Elko County Male and Female BMI-for-Age



Esmeralda County

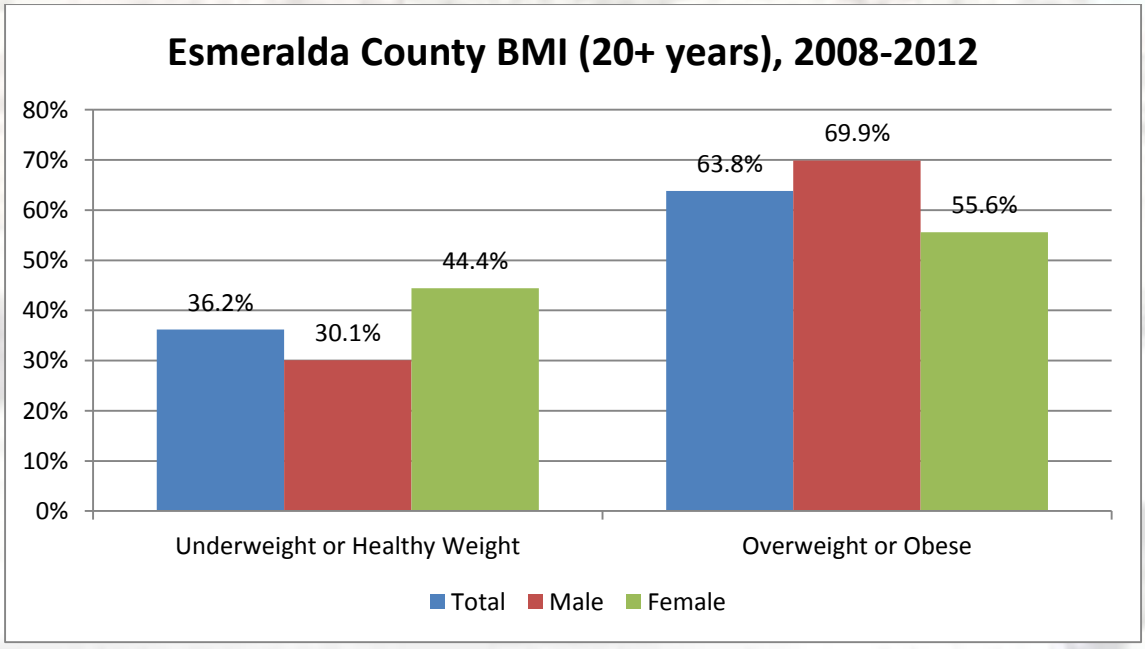
The rates of Esmeralda County adults (20+ years) who are overweight and obese are 38.7% and 25.0% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 27: Esmeralda County Adult BMI



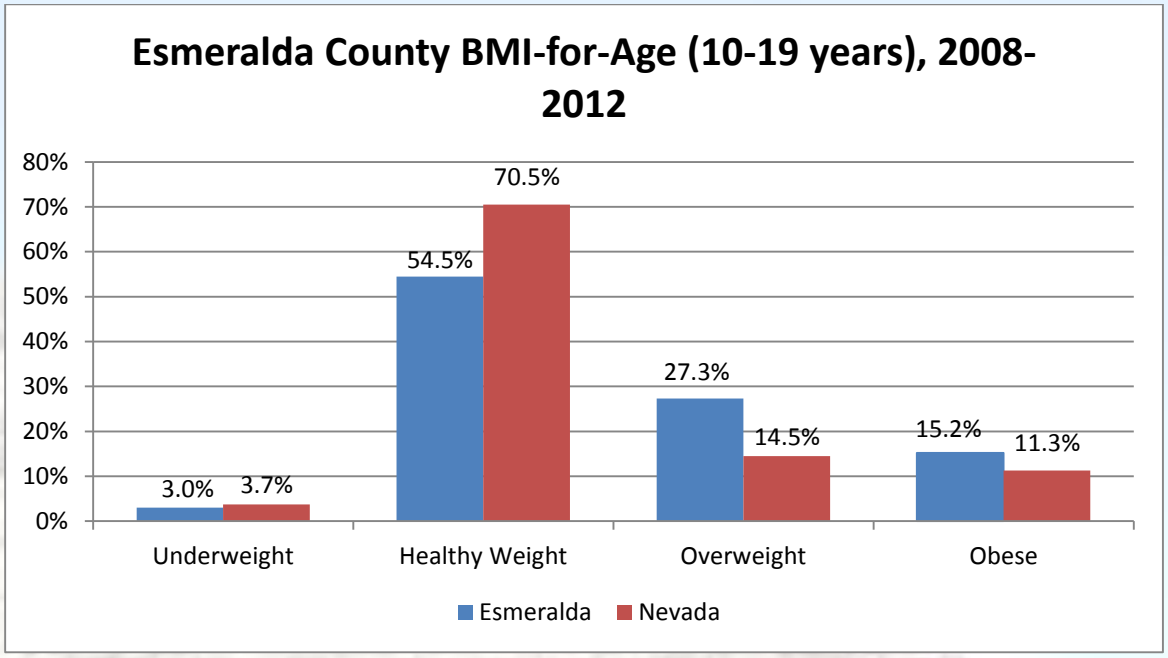
Data indicate that more male adults (20+ years) in Esmeralda County are overweight or obese when compared to females (20+ years).

Figure 28: Esmeralda County Adult Male and Female BMI



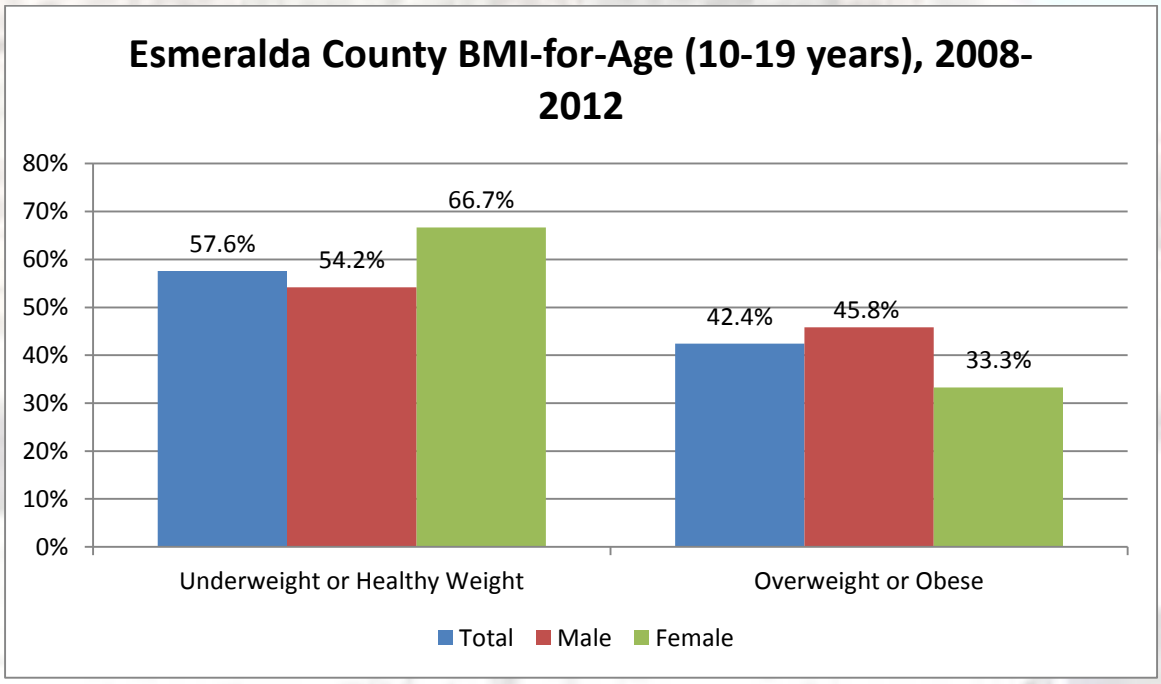
The rates of Esmeralda County youth (10-19 years) who are overweight and obese are 27.3% and 15.2% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 29: Esmeralda County BMI-for-Age



Data indicate that more male youth (10-19 years) in Esmeralda County are overweight or obese when compared to females (10-19 years).

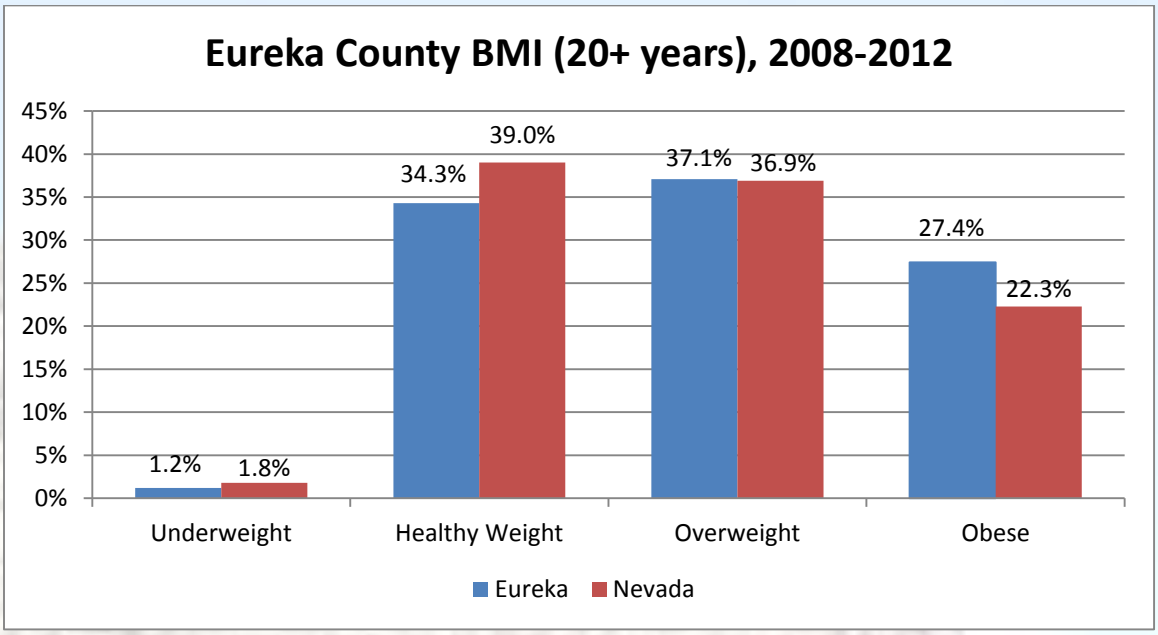
Figure 30: Esmeralda County Male and Female BMI-for-Age



Eureka County

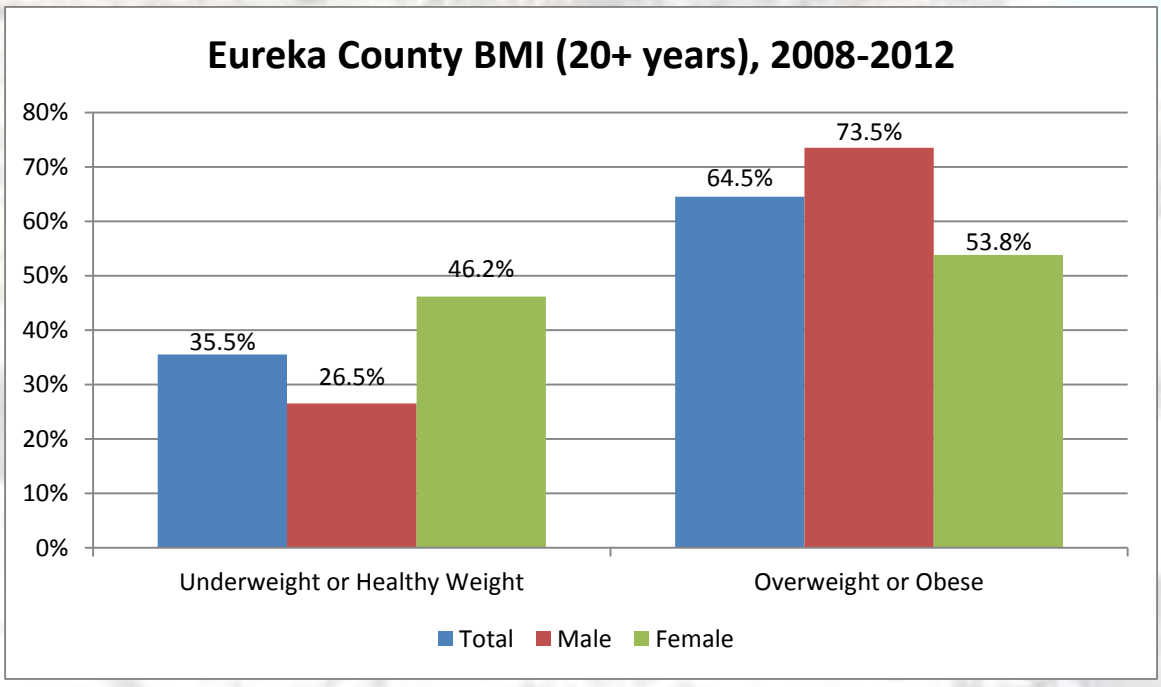
The rates of Eureka County adults (20+ years) who are overweight and obese are 37.1% and 27.4% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 31: Eureka County Adult BMI



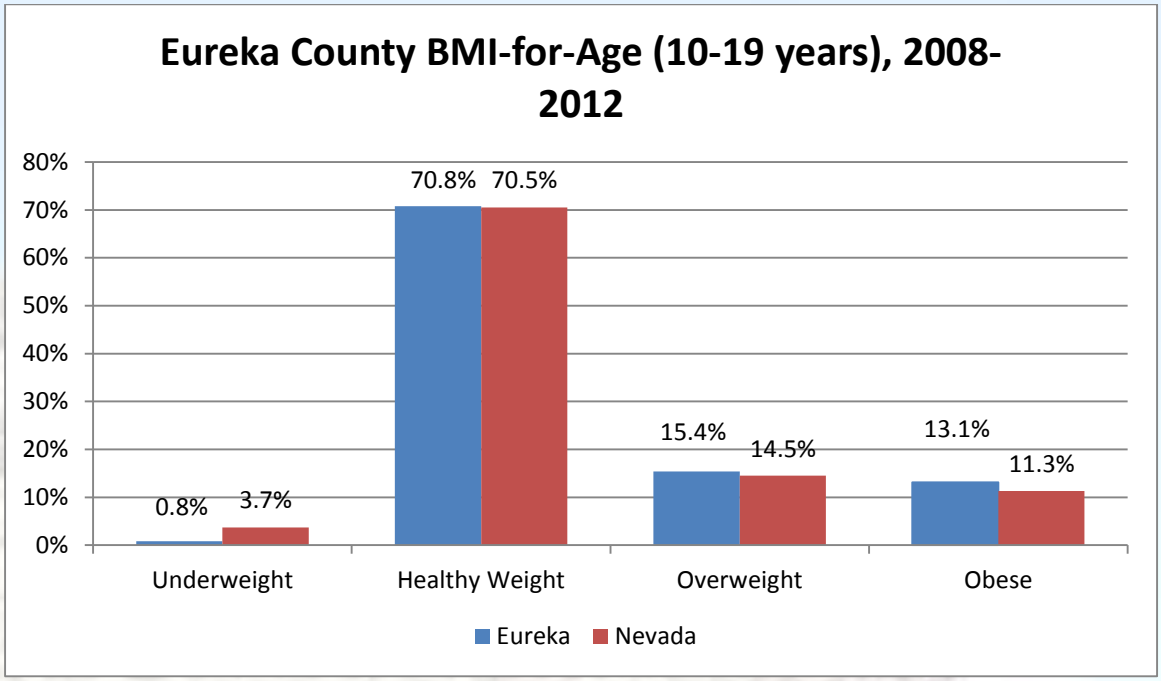
Data indicate that more male adults (20+ years) in Eureka County are overweight or obese when compared to females (20+ years).

Figure 32: Eureka County Adult Male and Female BMI



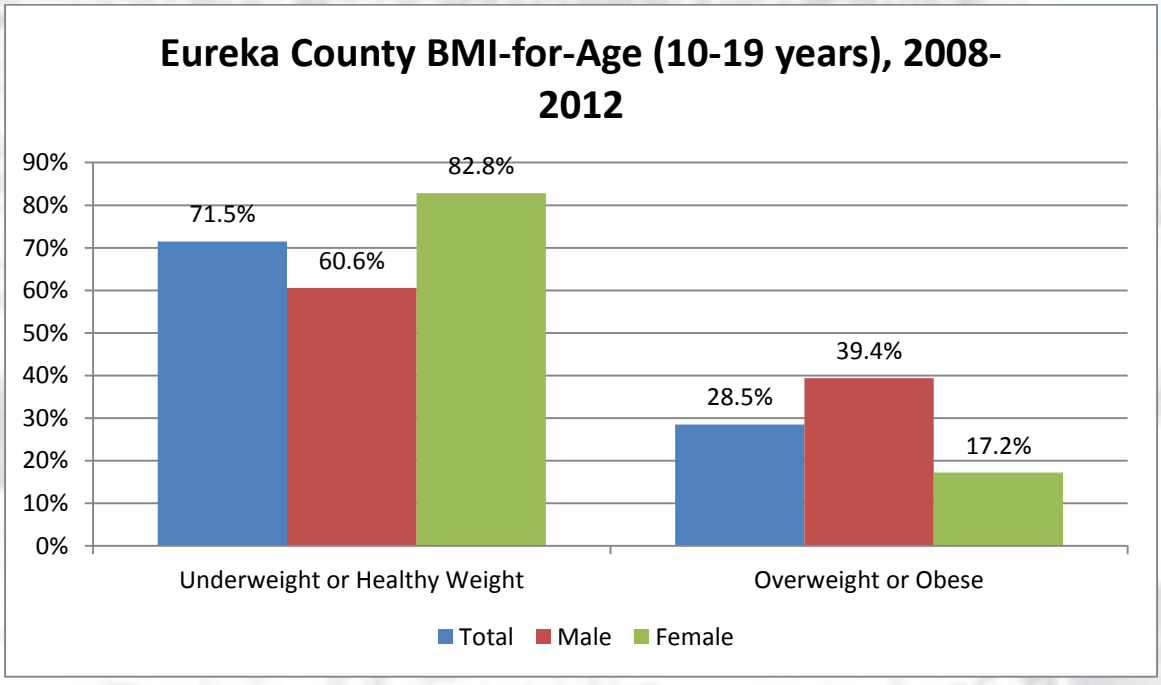
The rates of Eureka County adults (10-19 years) who are overweight and obese are 15.4% and 13.1% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 33: Eureka County BMI-for-Age



Data indicate that more male adults (10-19 years) in Eureka are overweight or obese when compared to females (10-19 years).

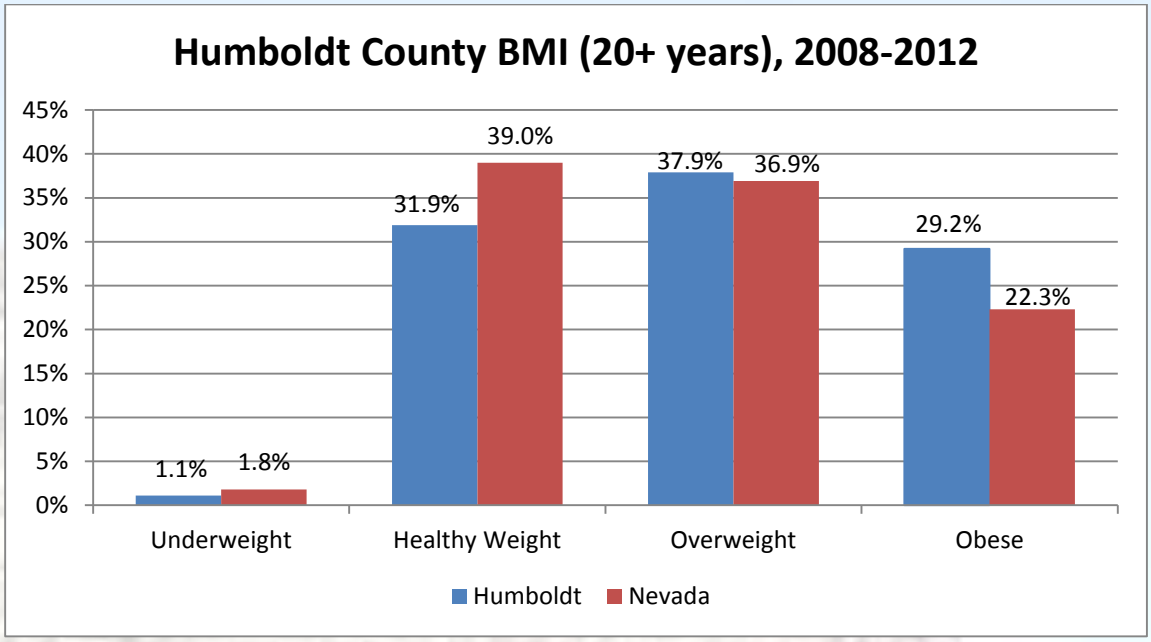
Figure 34: Eureka County Male and Female BMI-for-Age



Humboldt County

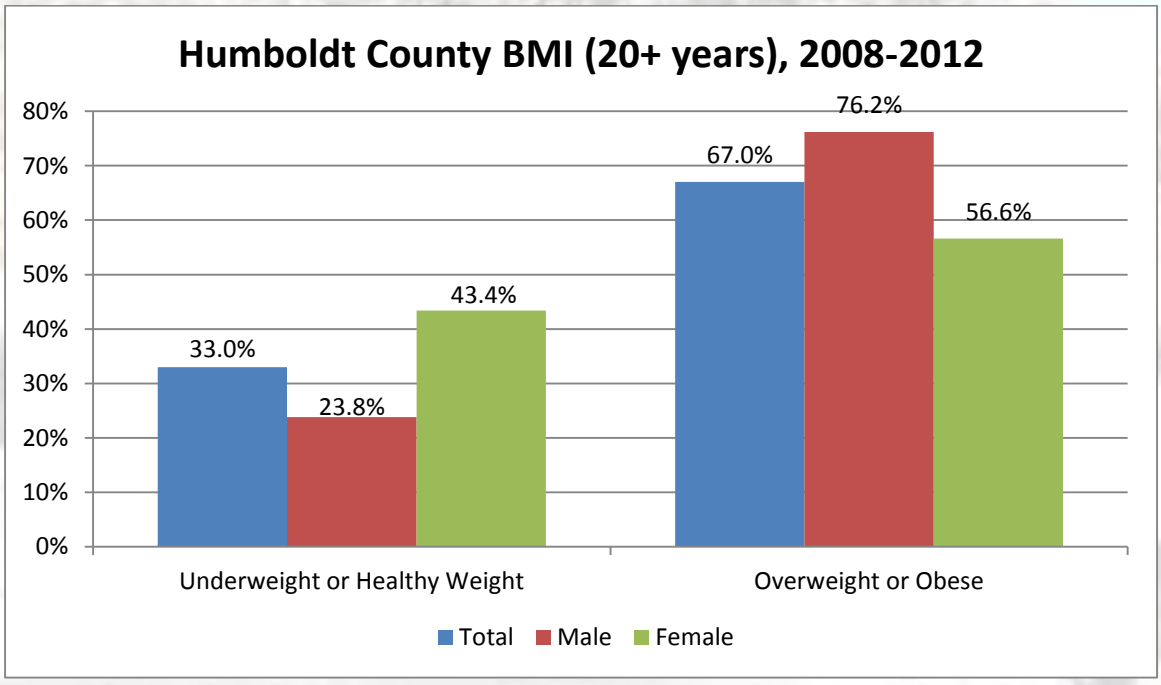
The rates of Humboldt County adults (20+ years) who are overweight and obese are 37.9% and 29.2% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 35: Humboldt County Adult BMI



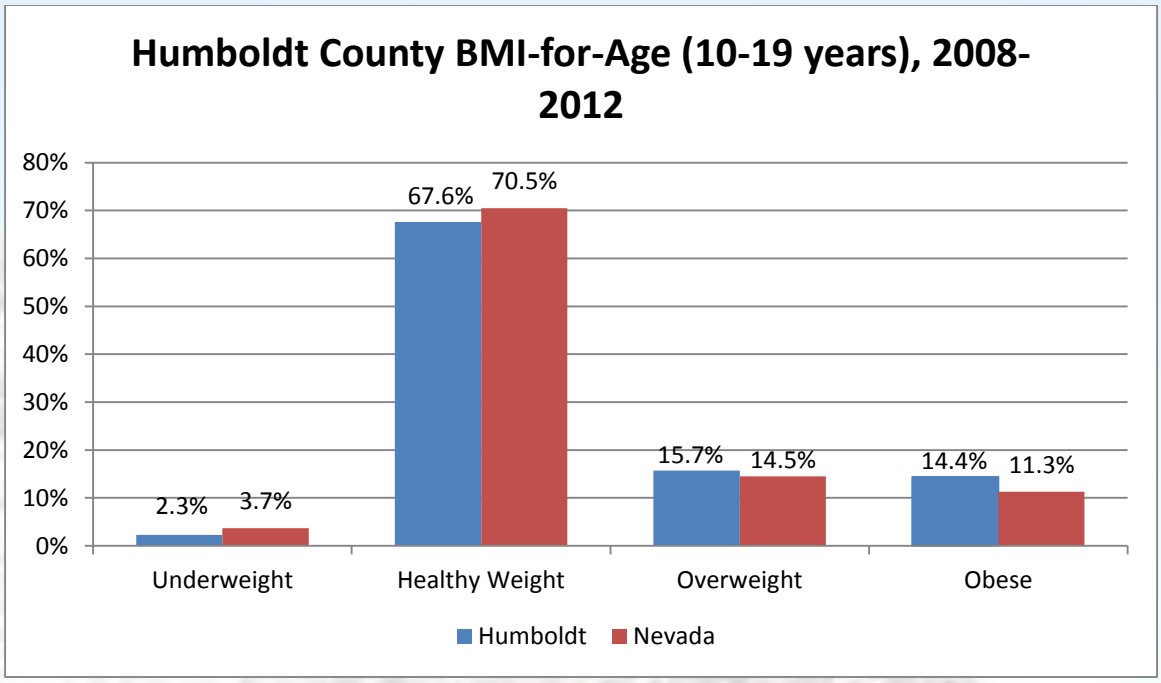
Data indicate that more male adults (20+ years) in Humboldt County are overweight or obese when compared to female (20+ years).

Figure 36: Humboldt County Adult Male and Female BMI



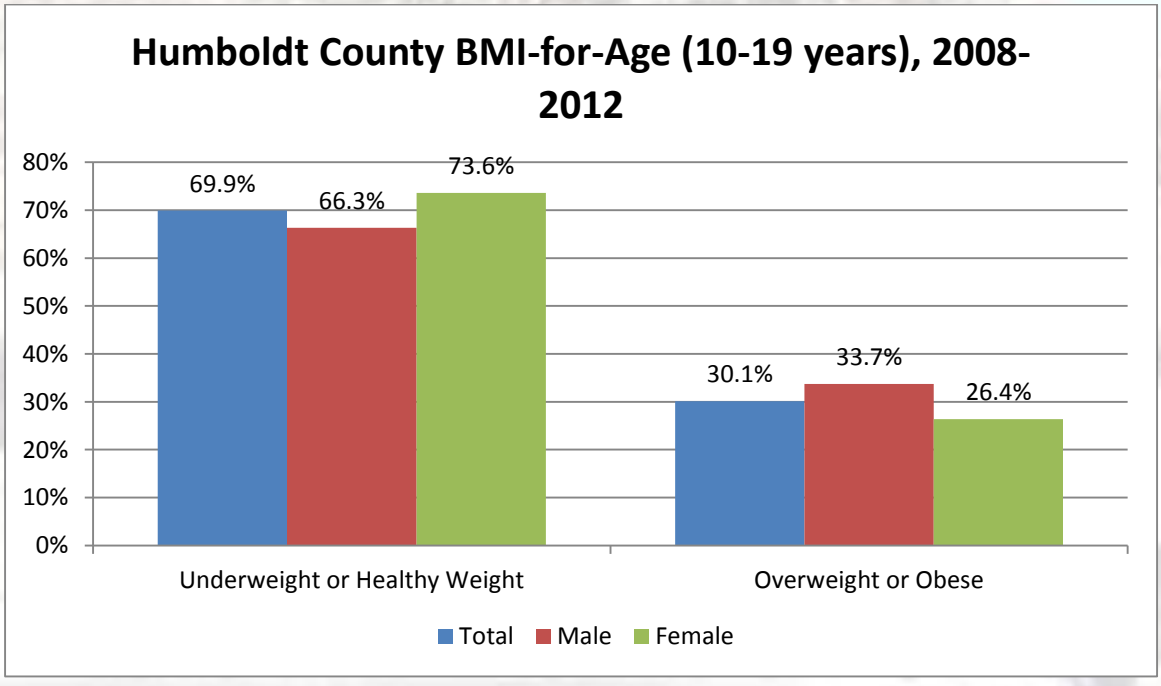
The rates of Humboldt County youth (10-19 years) who are overweight and obese are 15.7% and 14.4% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 37: Humboldt County BMI-for-Age



Data indicate that more male youth (10-19 years) in Humboldt County are overweight or obese when compared to females (10-19 years).

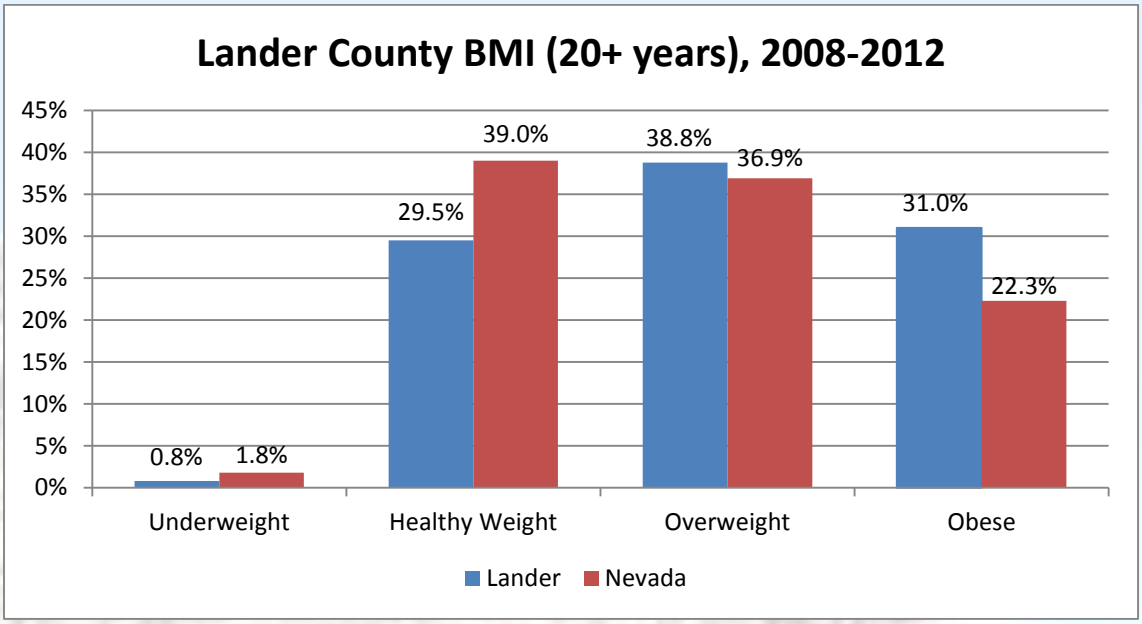
Figure 38: Humboldt County Male and Female BMI-for-Age



Lander County

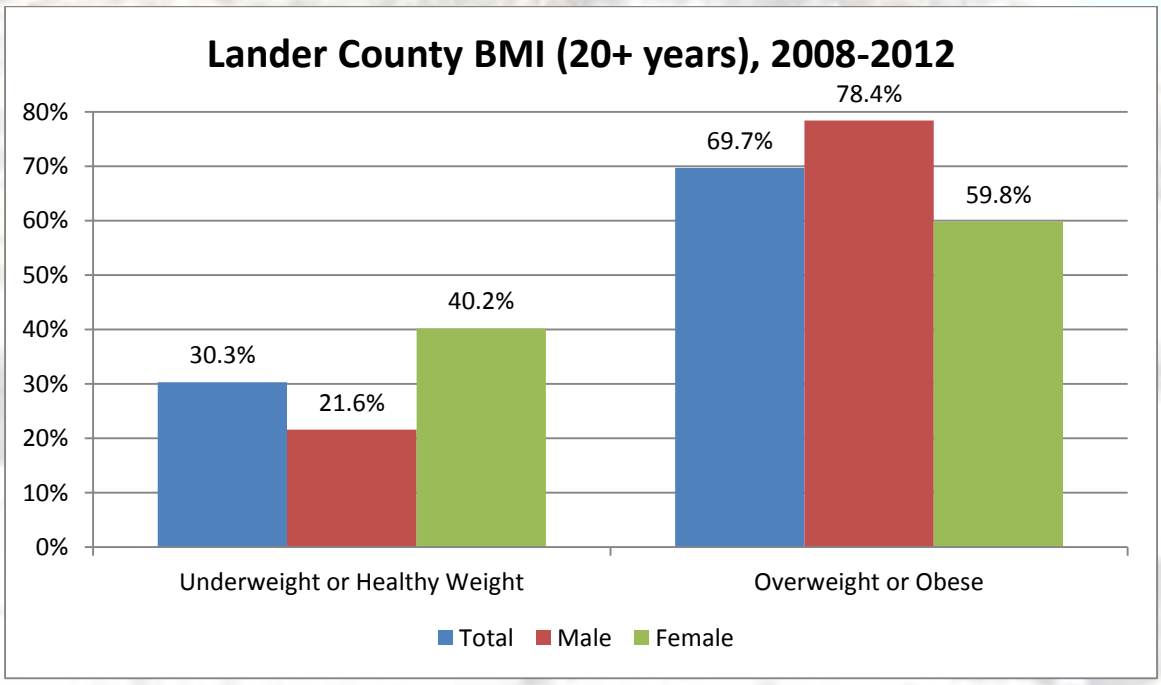
The rates of Lander County adults (20+ years) who are overweight and obese are 38.8% and 31.0% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 39: Lander County Adult BMI



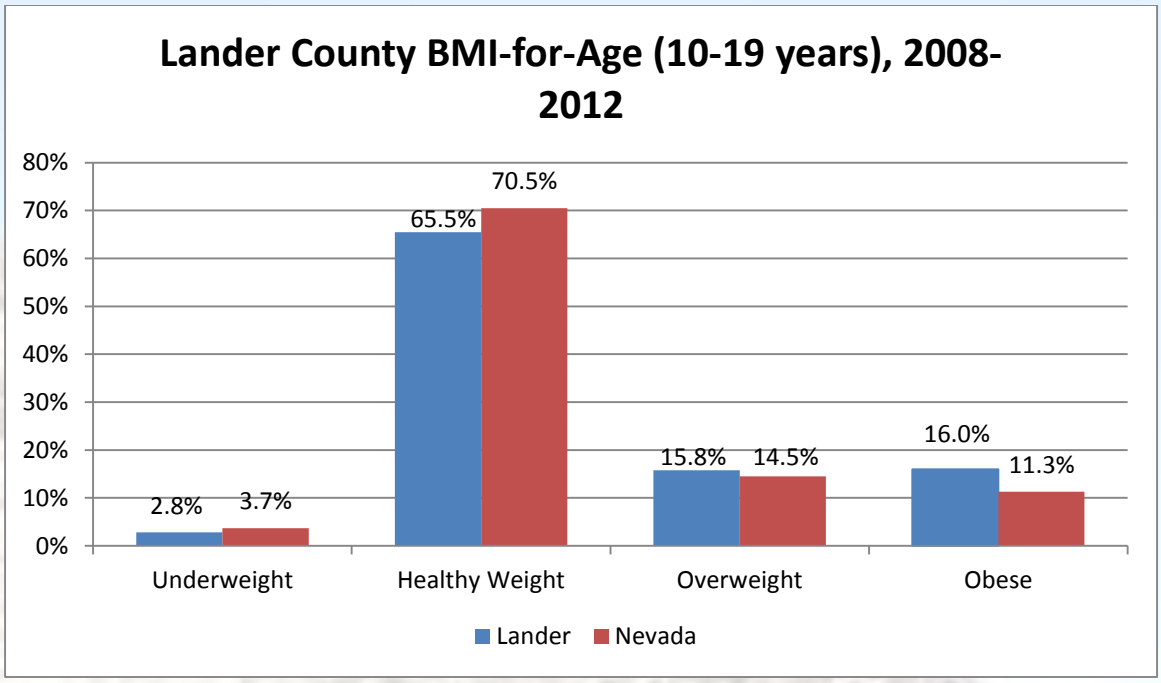
Data indicate that more male adults (20+ years) in Lander County are overweight or obese when compared to females (20+ years).

Figure 40: Lander County Adult Male and Female BMI



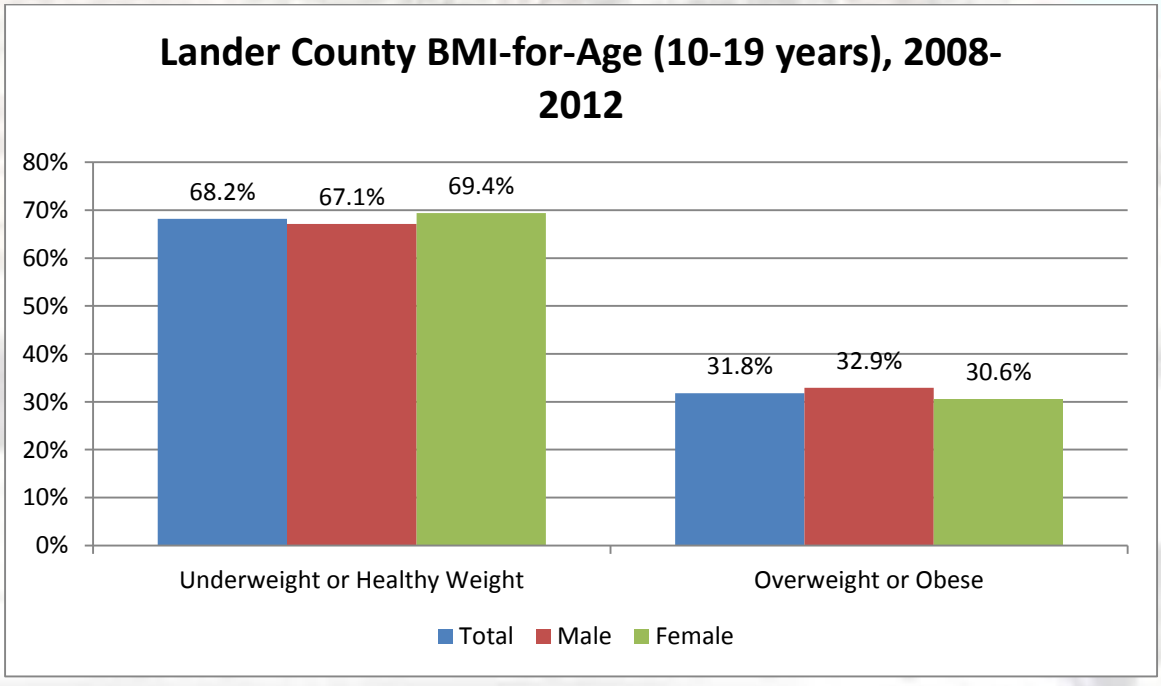
The rates of Lander County youth (10-19 years) who are overweight and obese are 15.8% and 16.0% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 41: Lander County BMI-for-Age



Data indicate that more male youth (10-19 years) in Lander County are overweight or obese when compared to females (10-19 years).

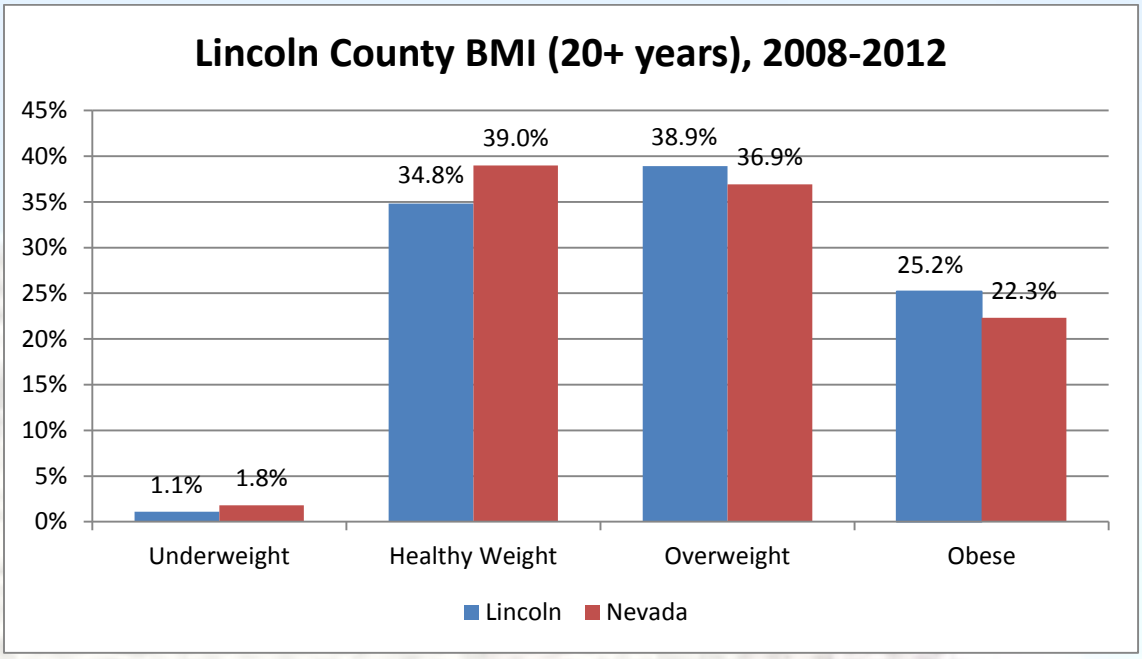
Figure 42: Lander County Male and Female BMI-for-Age



Lincoln County

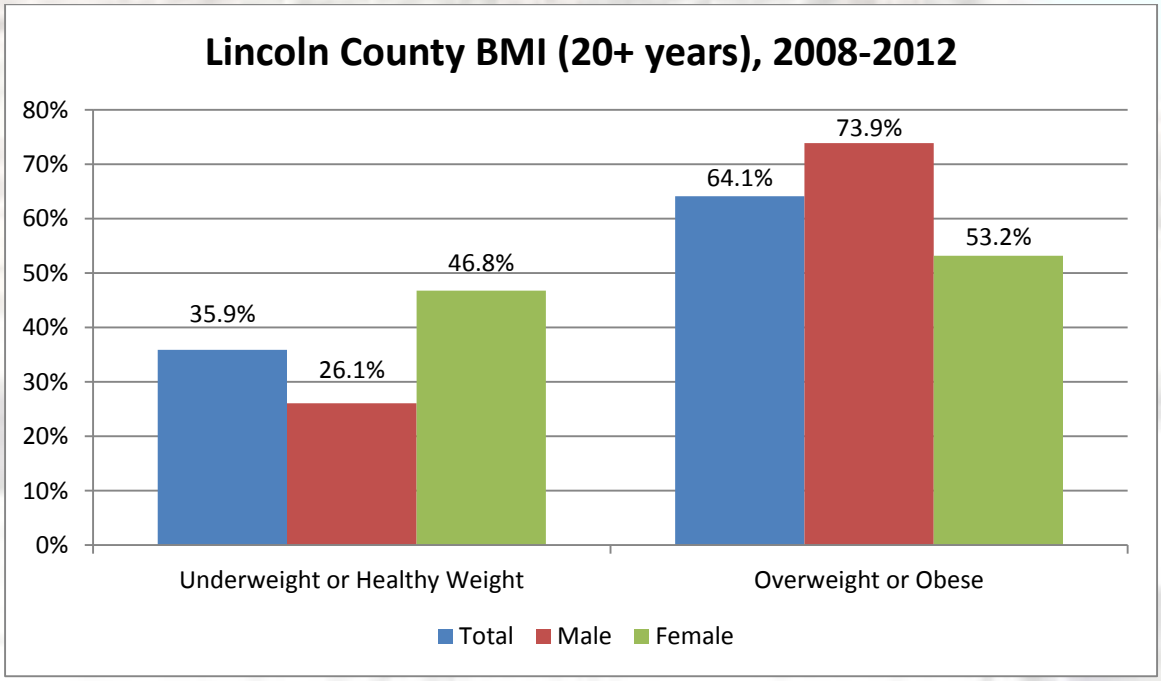
The rates of Lincoln County adults (20+ years) who are overweight and obese are 39.8% and 25.2% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 43: Lincoln County Adult BMI



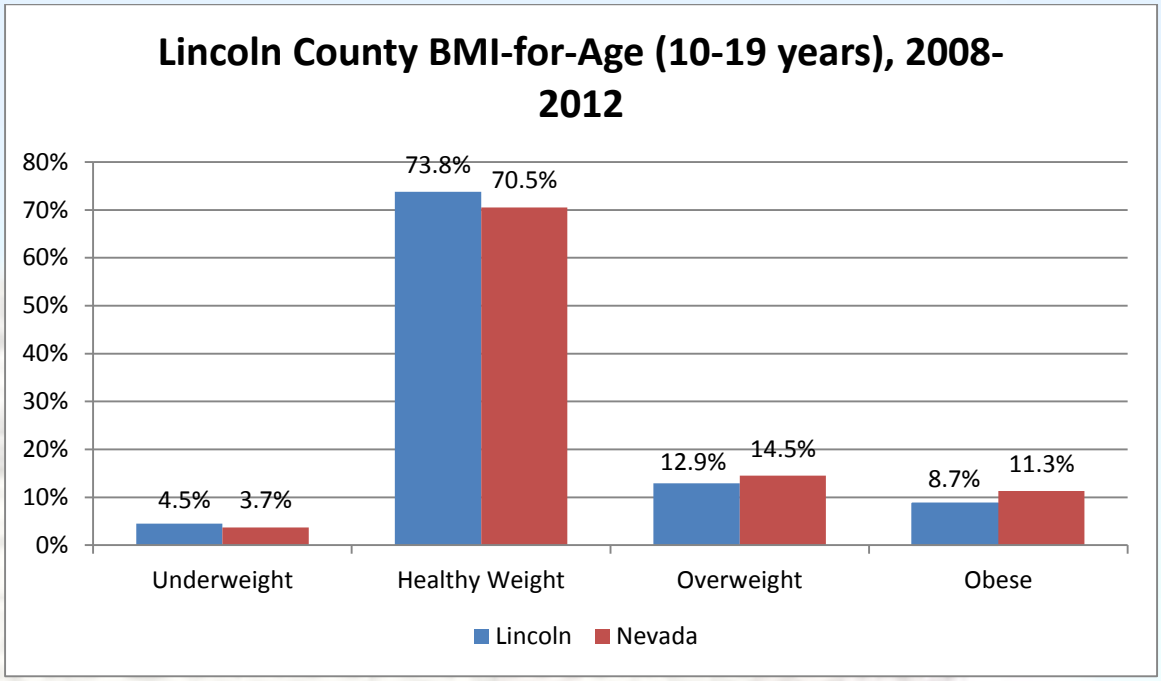
Data indicate that more male adults (20+ years) in Lincoln are overweight or obese when compared to females (20+ years).

Figure 44: Lincoln County Adult Male and Female BMI



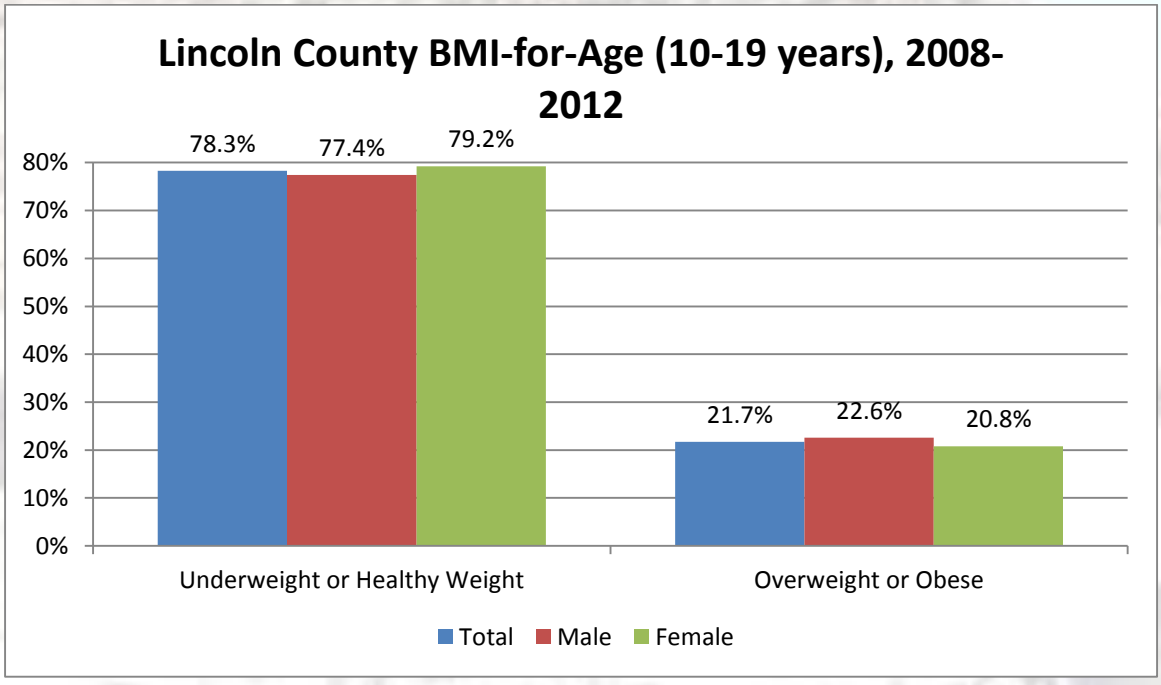
The rates of Lincoln County youth (10-19 years) who are overweight and obese are 12.9% and 8.7% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 45: Lincoln County BMI-for-Age



Data indicate that more male youth (10-19 years) in Lincoln County are overweight or obese when compared to females (10-19 years).

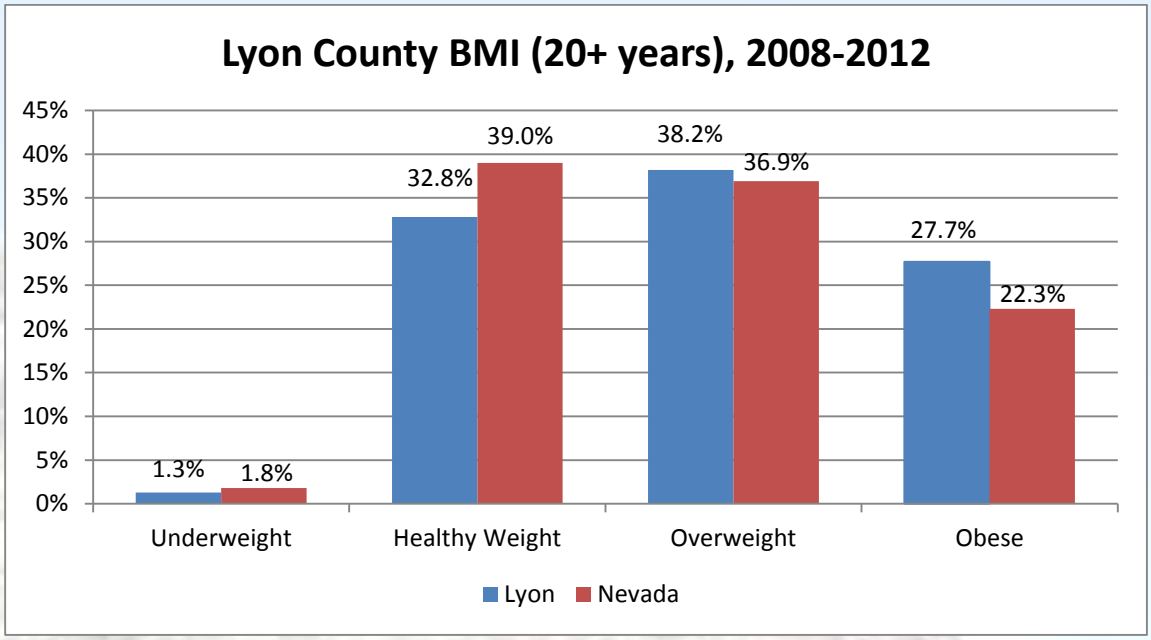
Figure 46: Lincoln County Male and Female BMI-for-Age



Lyon County

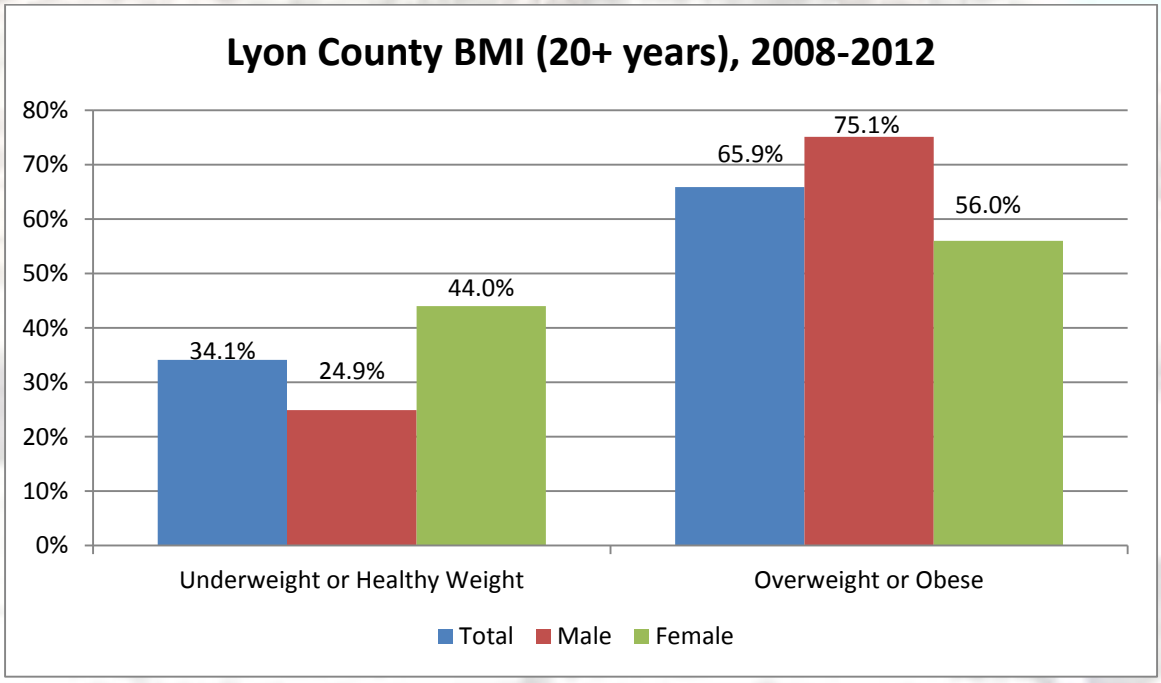
The rates of Lyon County adults (20+ years) who are overweight and obese are 38.2% and 27.7% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 47: Lyon County Adult BMI



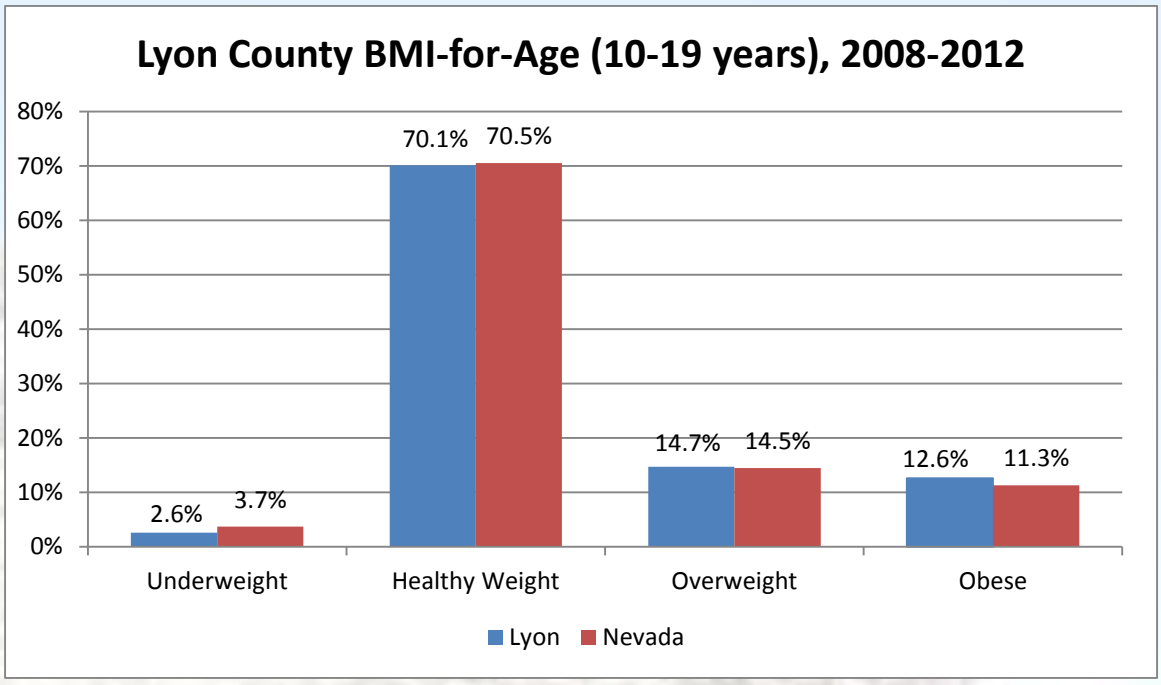
Data indicate that more male adults (20+ years) in Lyon County are overweight or obese when compared to females (20+ years).

Figure 48: Lyon County Adult Male and Female BMI



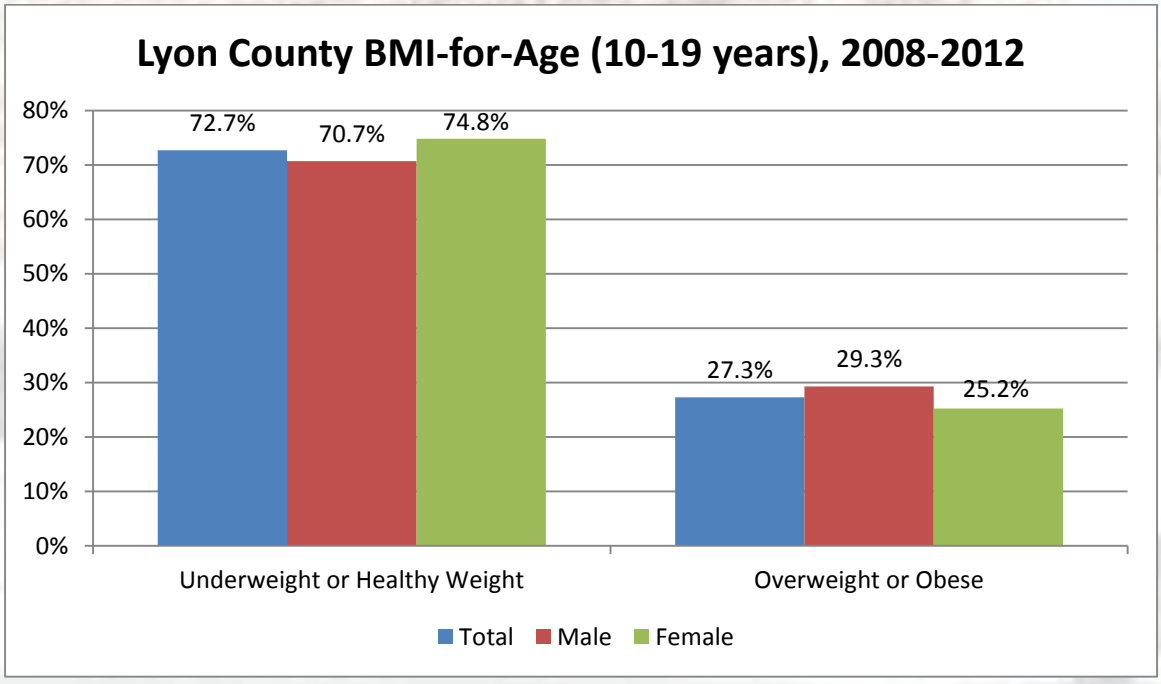
The rates of Lyon County youth (10-19 years) who are overweight and obese are 14.7% and 12.6% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 49: Lyon County BMI-for-Age



Data indicate that more male youth (10-19 years) in Lyon County are overweight or obese when compared to females (10-19 years), as seen in Figure 50.

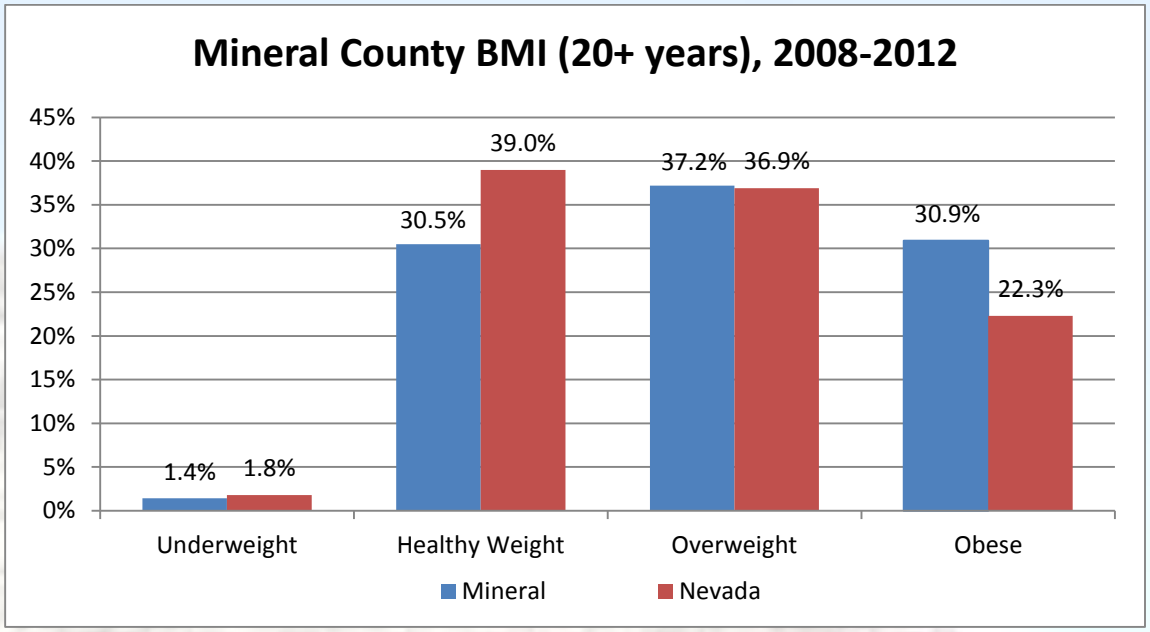
Figure 50: Lyon County Male and Female BMI-for-Age



Mineral County

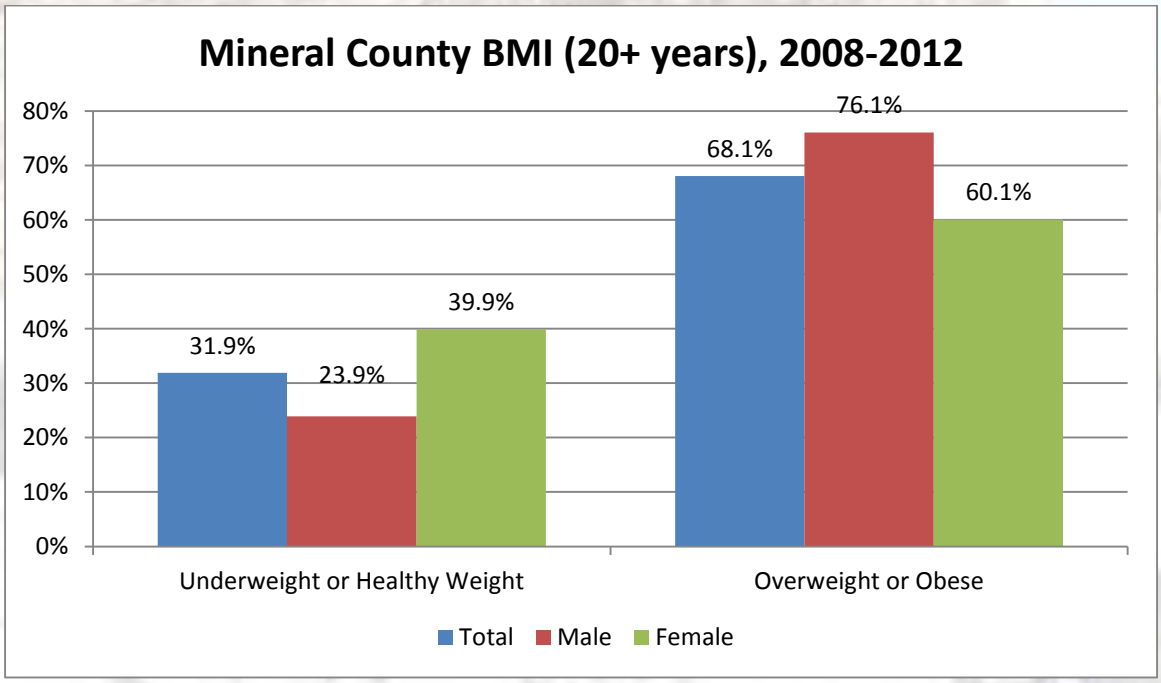
The rates of Mineral County adults (20+ years) who are overweight and obese are 37.2% and 30.9% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 51: Mineral County Adult BMI



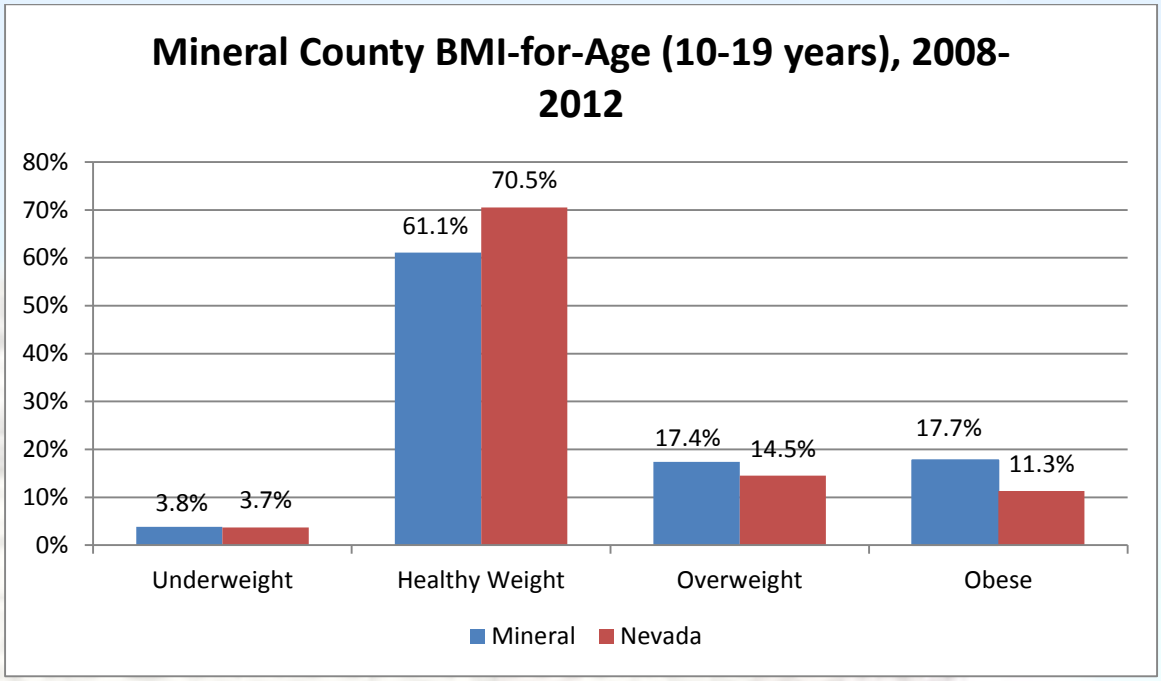
Data indicate that more male adults (20+ years) in Mineral County are overweight or obese when compared to females (20+ years), as seen in Figure 52.

Figure 52: Mineral County Adult Male and Female BMI



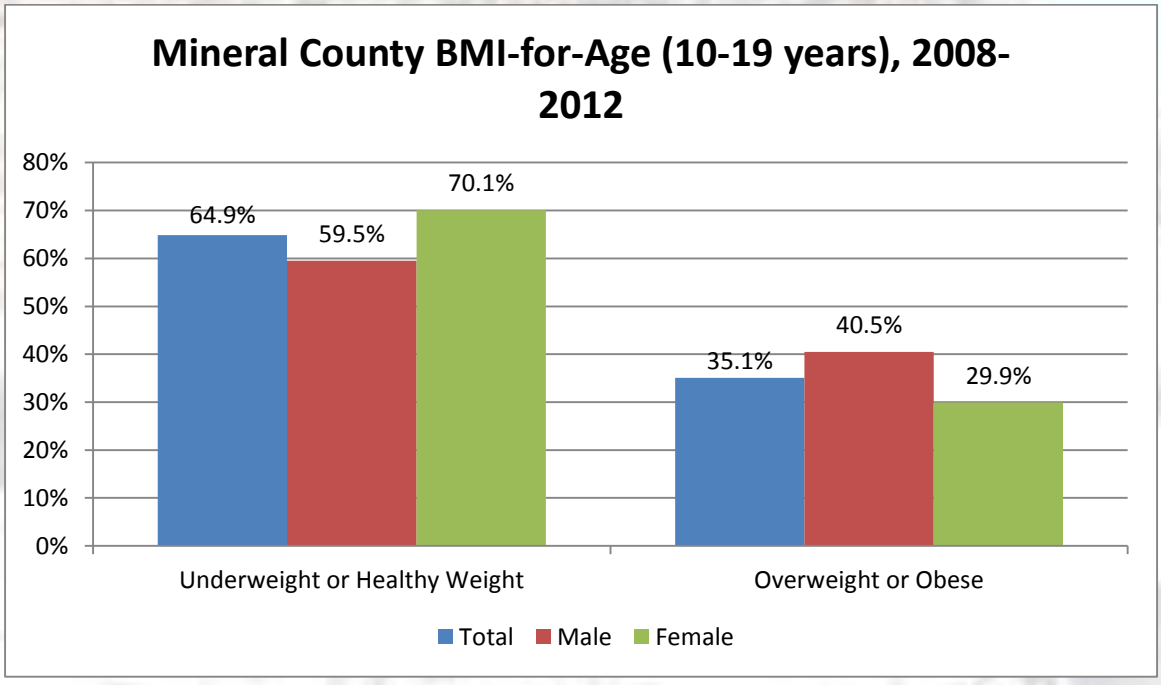
The rates of Mineral County youth (10-19 years) who are overweight and obese are 17.4% and 17.7% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 53: Mineral County BMI-for-Age



Data indicate that more male youth (10-19 years) in Mineral County are overweight or obese when compared to females (10-19 years).

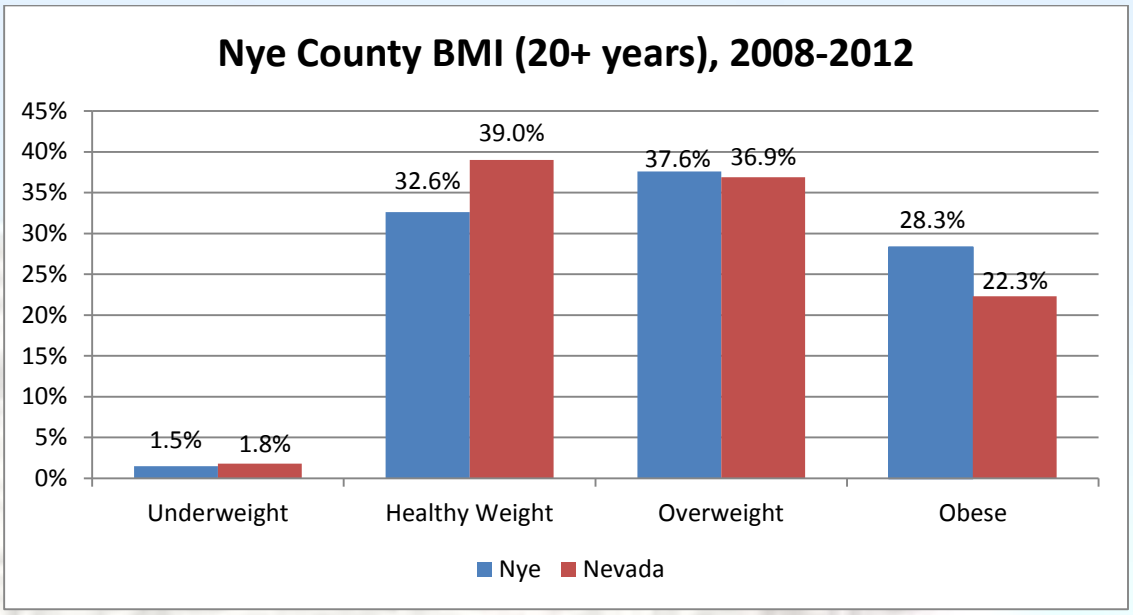
Figure 54: Mineral County Male and Female BMI-for-Age



Nye County

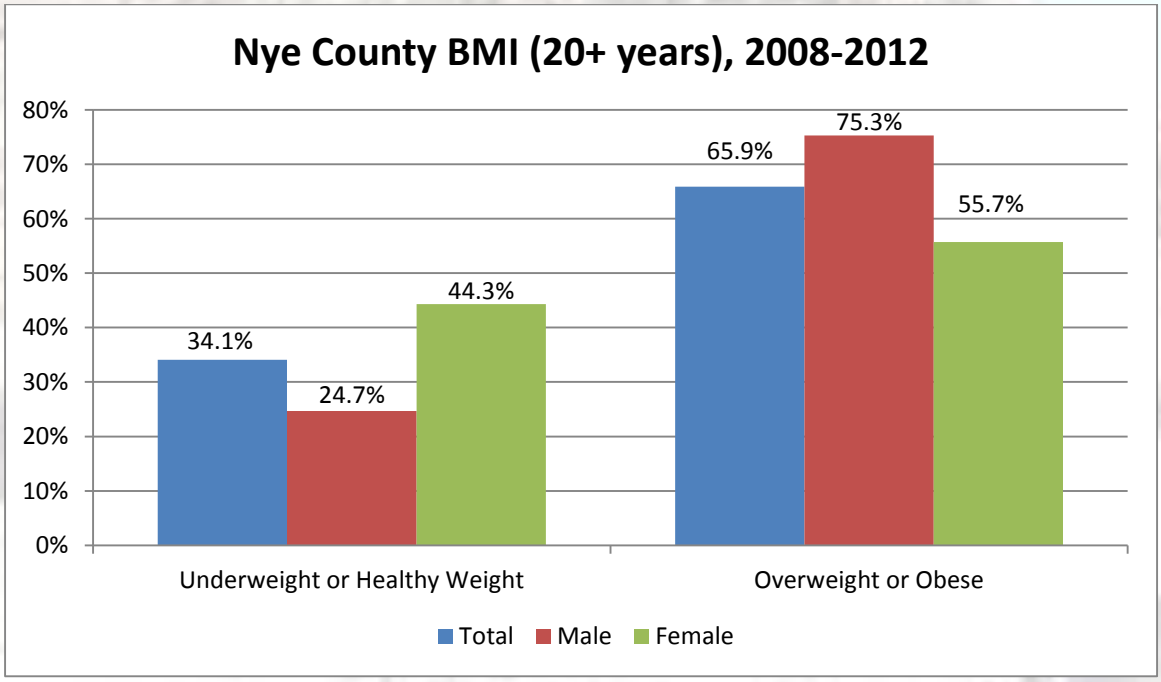
The rates of Nye County adults (20+ years) who are overweight and obese are 37.6% and 28.3% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 55: Nye County Adult BMI



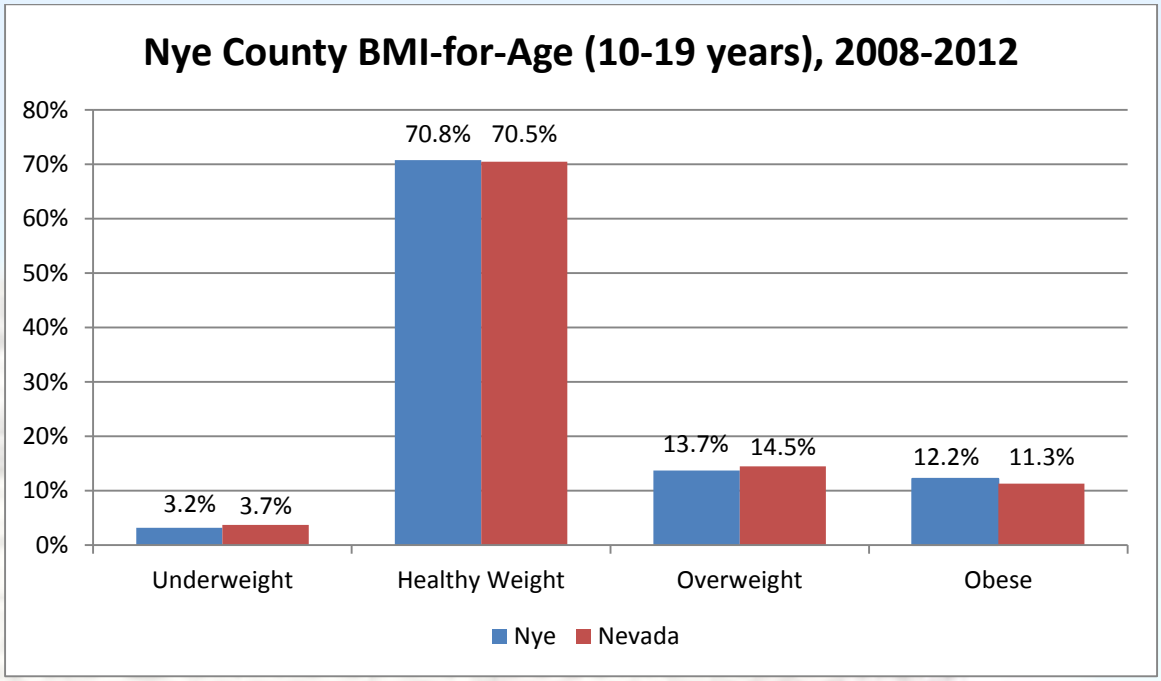
Data indicate that more male adults (20+ years) in Nye County are overweight or obese when compared to females (20+ years).

Figure 56: Nye County Adult Male and Female BMI



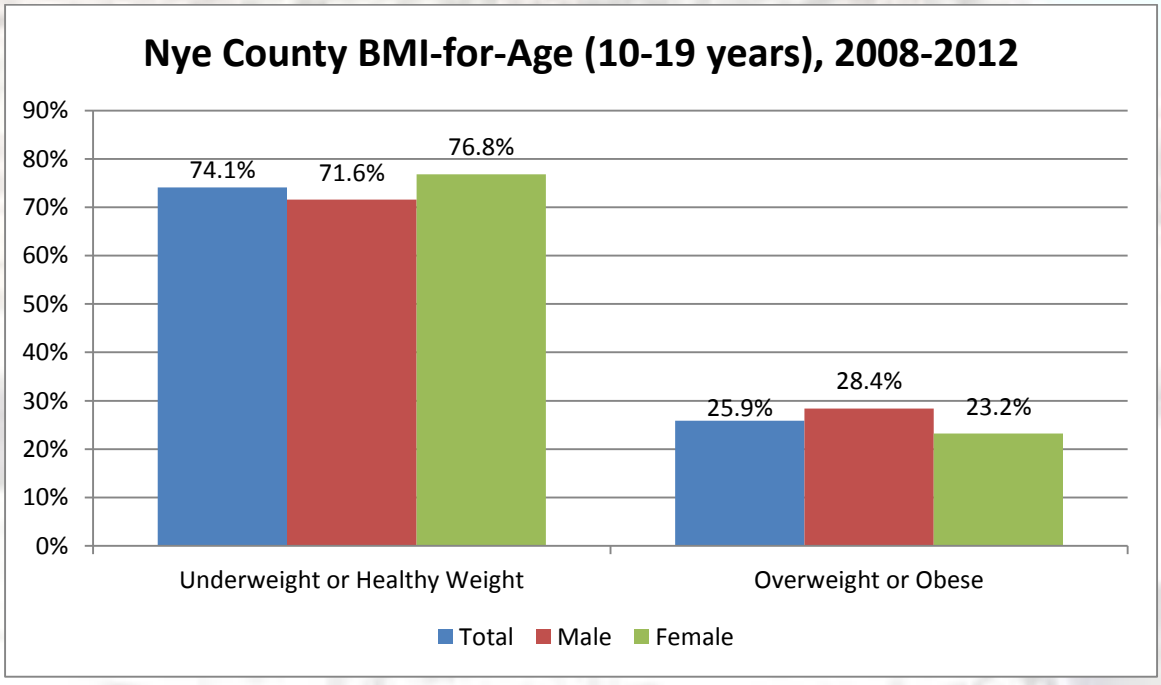
The rates of Nye County youth (10-19 years) who are overweight and obese are 13.7% and 12.2% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 57: Nye County BMI-for-Age



Data indicate that more male youth (10-19 years) in Nye County are overweight or obese when compared to females (10-19 years).

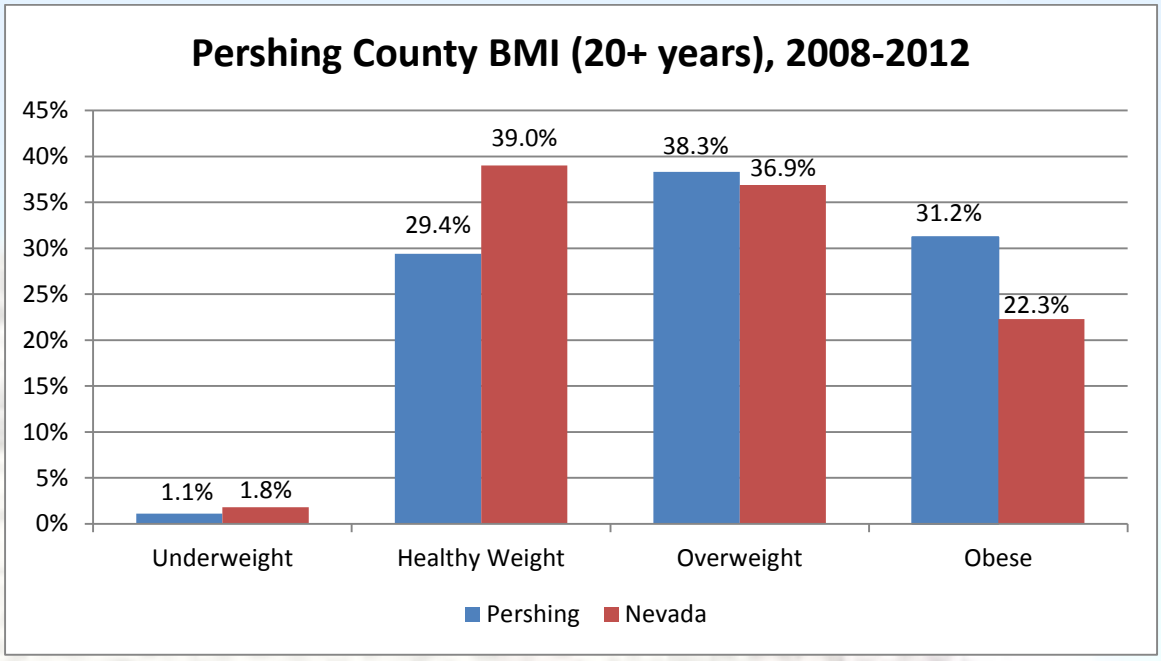
Figure 58: Nye County Male and Female BMI-for-Age



Pershing County

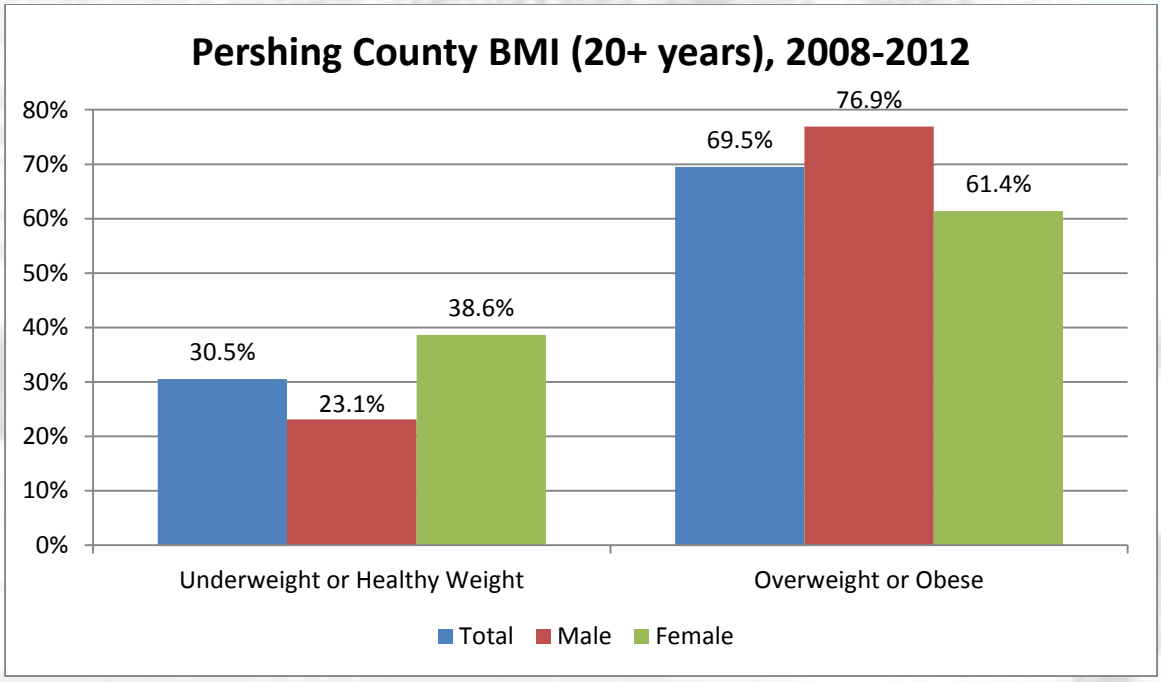
The rates of Pershing County adults (20+ years) collectively who are overweight and obese are 38.3% and 31.2% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 59: Pershing County Adult BMI



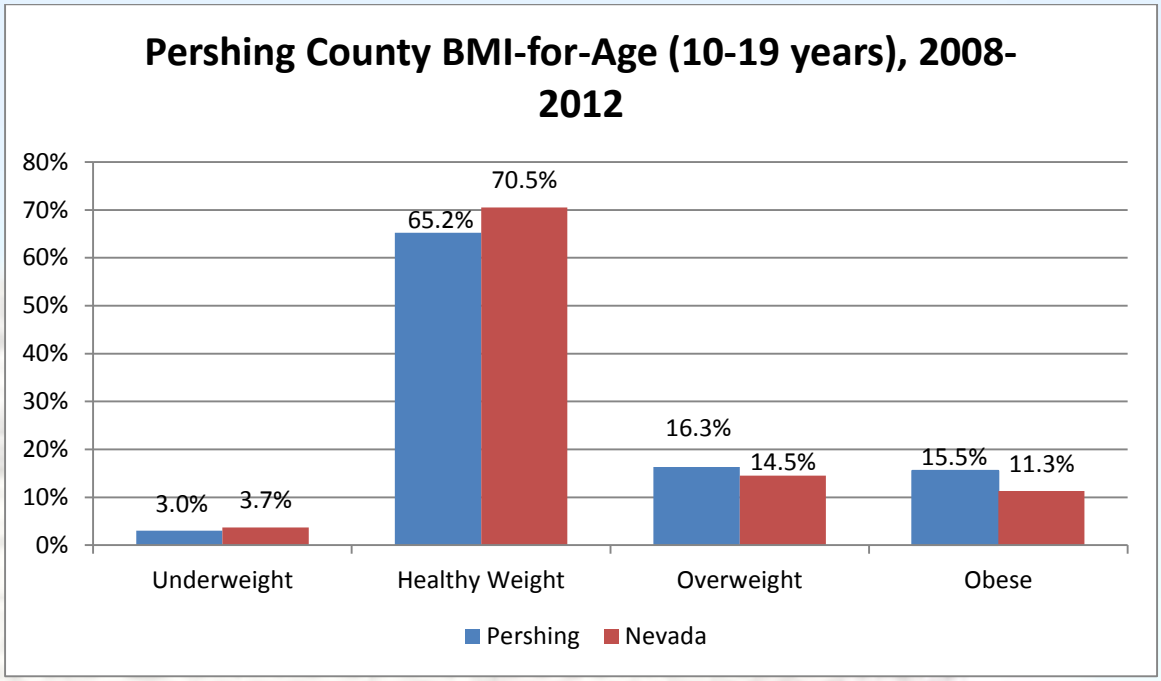
Data indicate that more male adults (20+ years) in Pershing County are overweight or obese when compared to females (20+ years).

Figure 60: Pershing County Adult Male and Female BMI



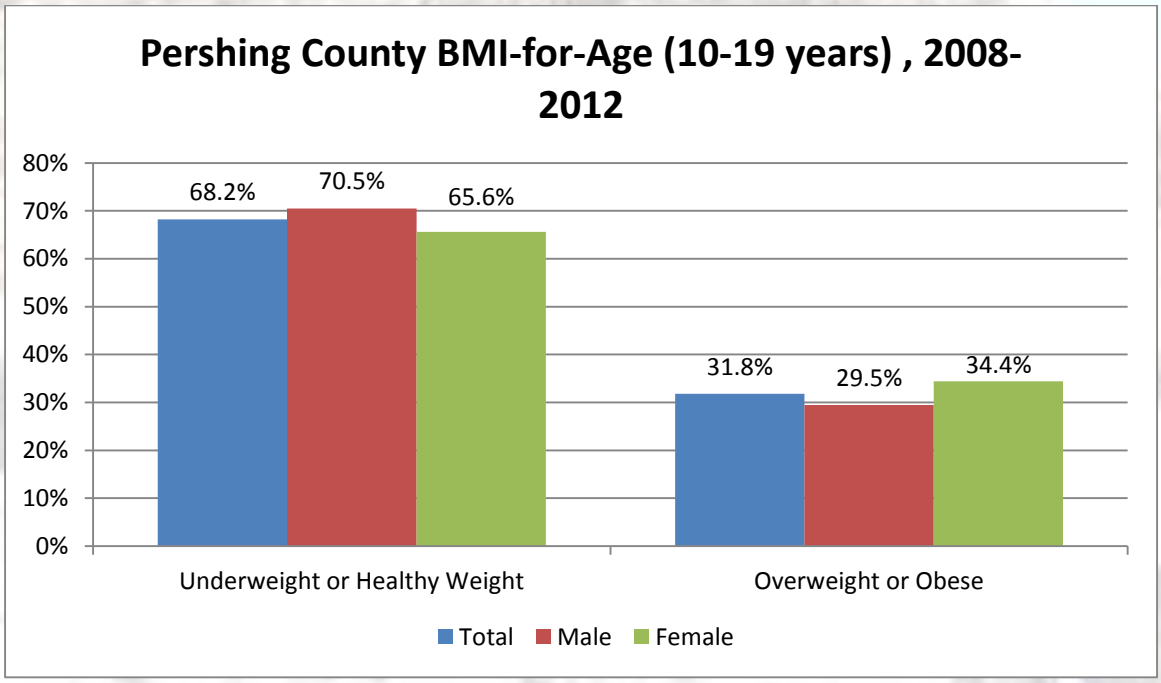
The rates of Pershing County youth (10-19 years) collectively who are overweight and obese are 16.3% and 15.5% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 61: Pershing County BMI-for-Age



Data indicate that more female youth (10-19 years) in Pershing County are overweight or obese when compared to males (10-19 years).

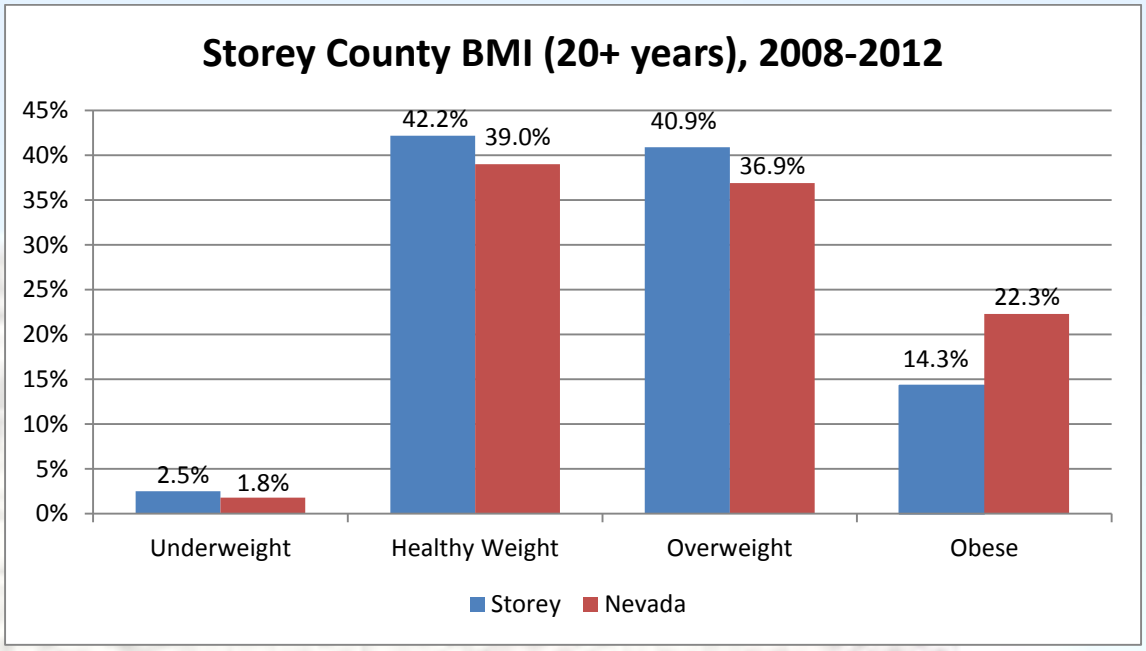
Figure 62: Pershing County Male and Female BMI-for-Age



Storey County

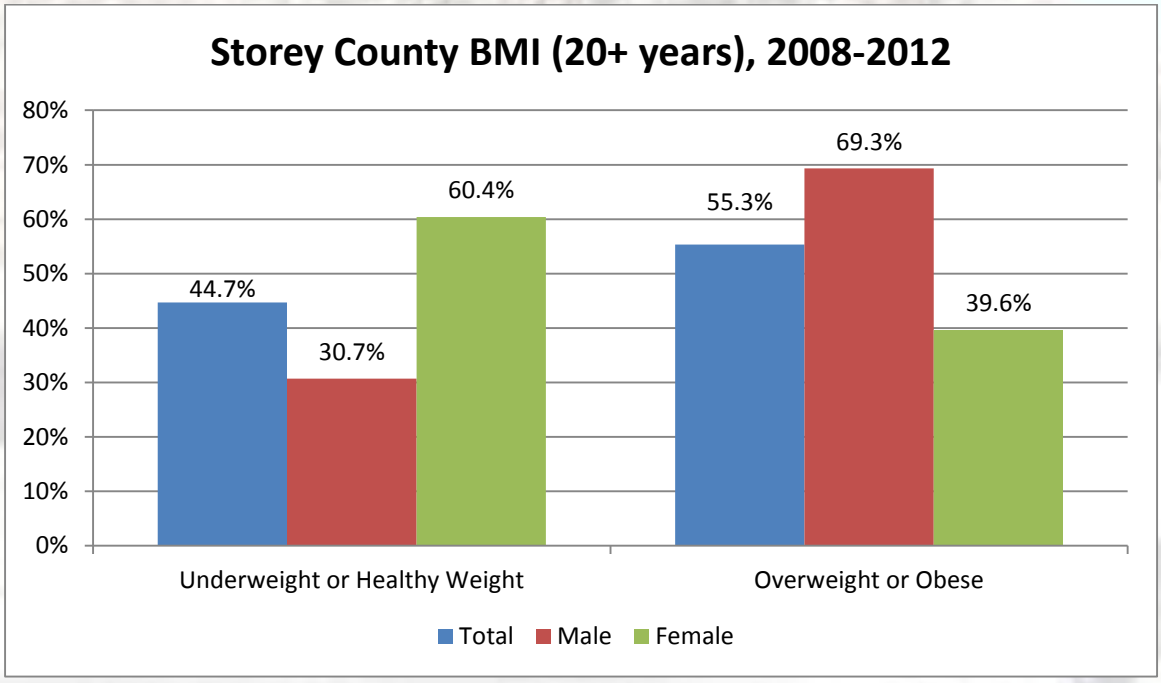
The rates of Storey County adults (20+ years) collectively who are overweight and obese are 40.9% and 14.3% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 63: Storey County Adult BMI



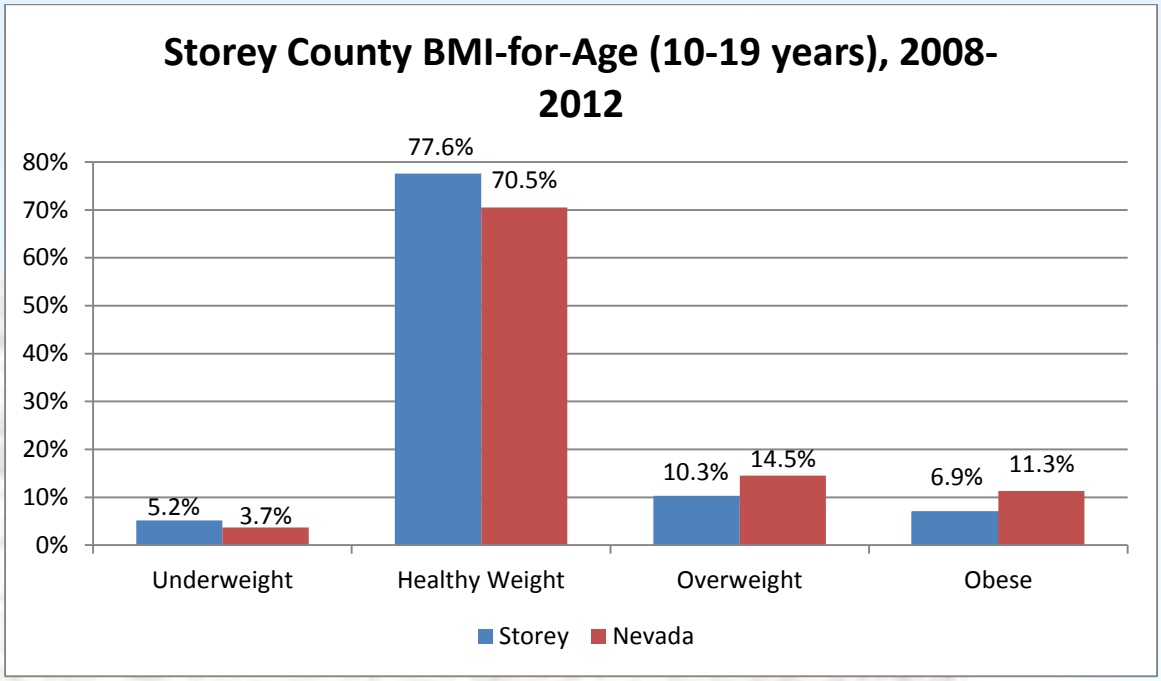
Data indicate that more male adults (20+ years) in Storey County are overweight or obese when compared to females (20+ years).

Figure 64: Storey County Adult Male and Female BMI



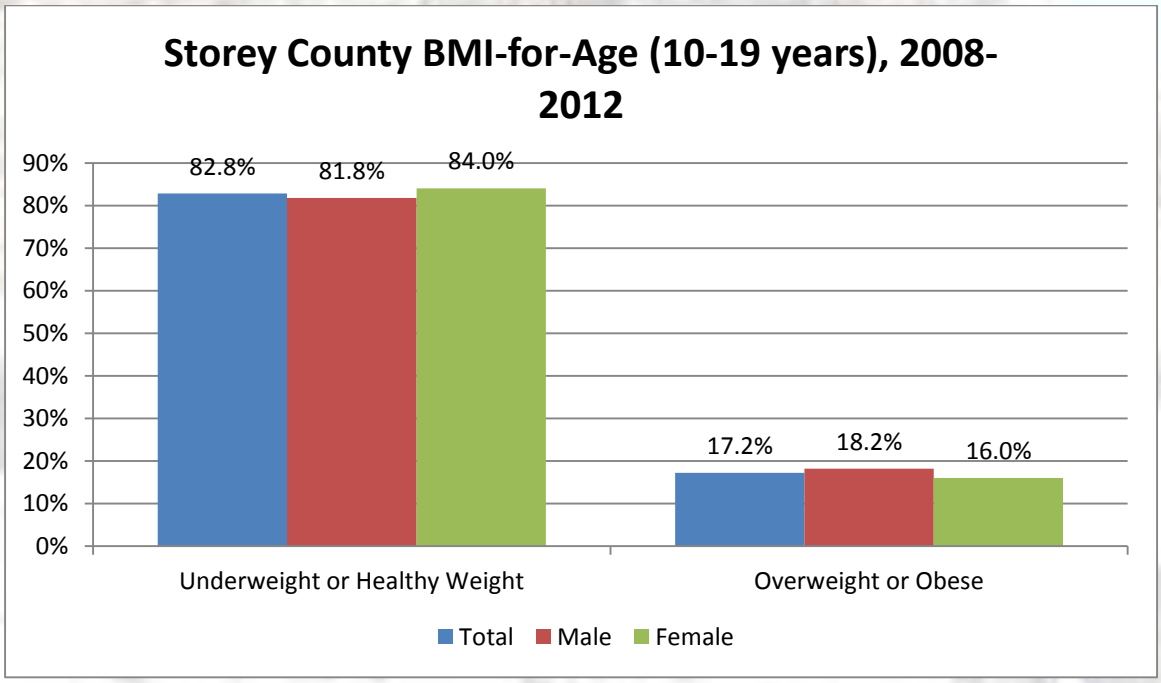
The rates of Storey County youth (10-19 years) collectively who are overweight and obese are 10.3% and 6.9% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 65: Storey County BMI-for-Age



Data indicate that more male youth (10-19 years) in Storey County are overweight or obese when compared to females (10-19 years).

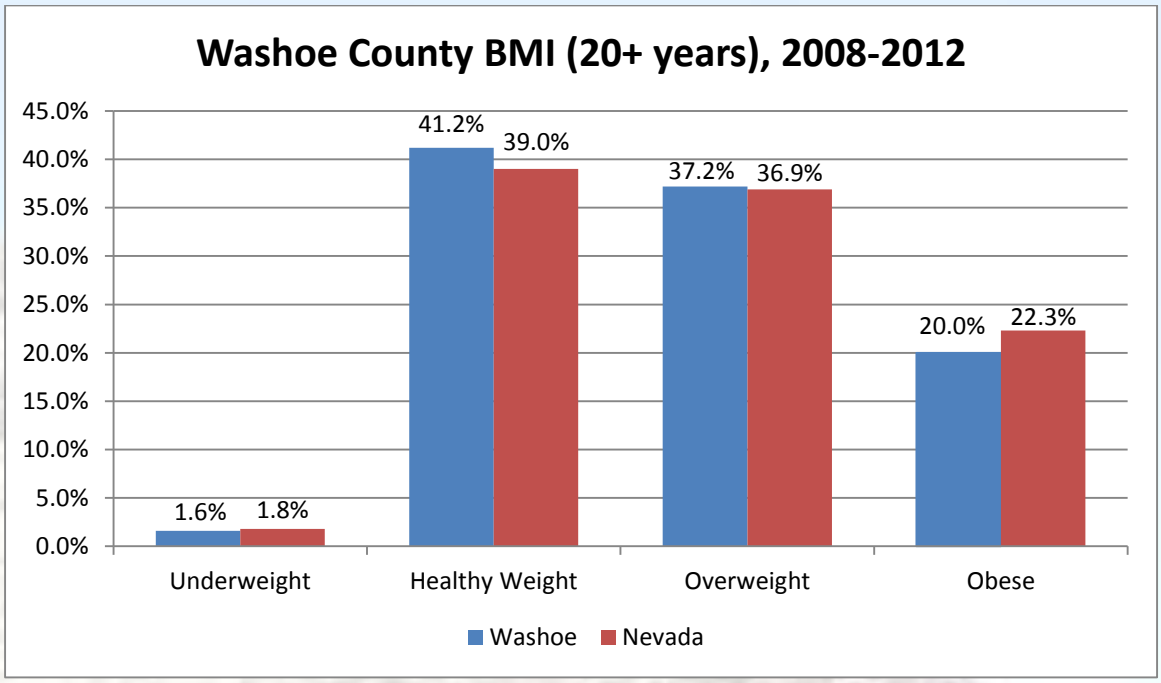
Figure 66: Storey County Male and Female BMI-for-Age



Washoe County

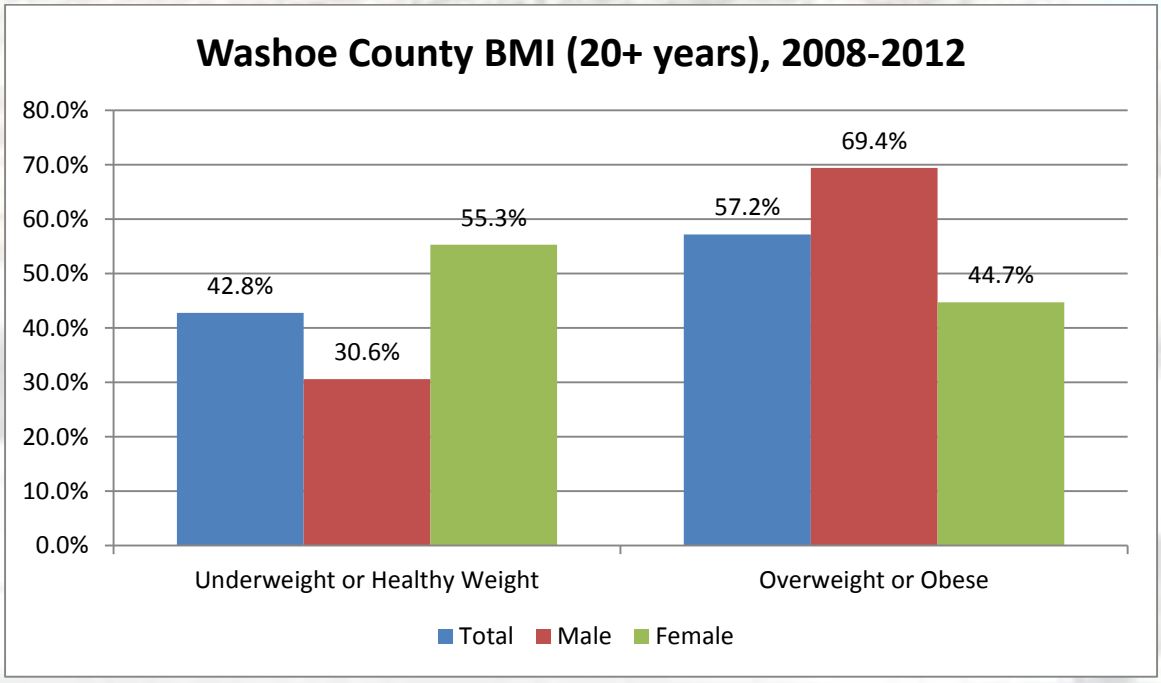
The rates of Washoe County adults (20+ years) who are overweight and obese are 37.2% and 20.0% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 67: Washoe County Adult BMI



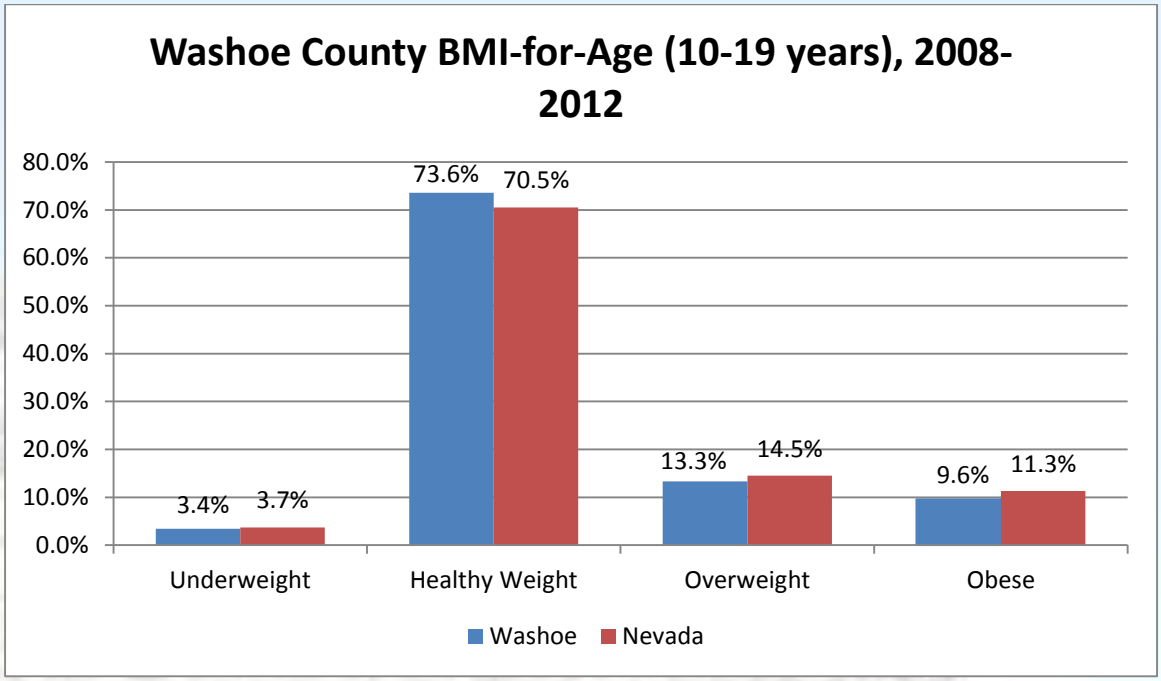
Data indicate that more male adults (20+ years) in Washoe County are overweight or obese when compared to females (20+ years).

Figure 68: Washoe County Adult Male and Female BMI



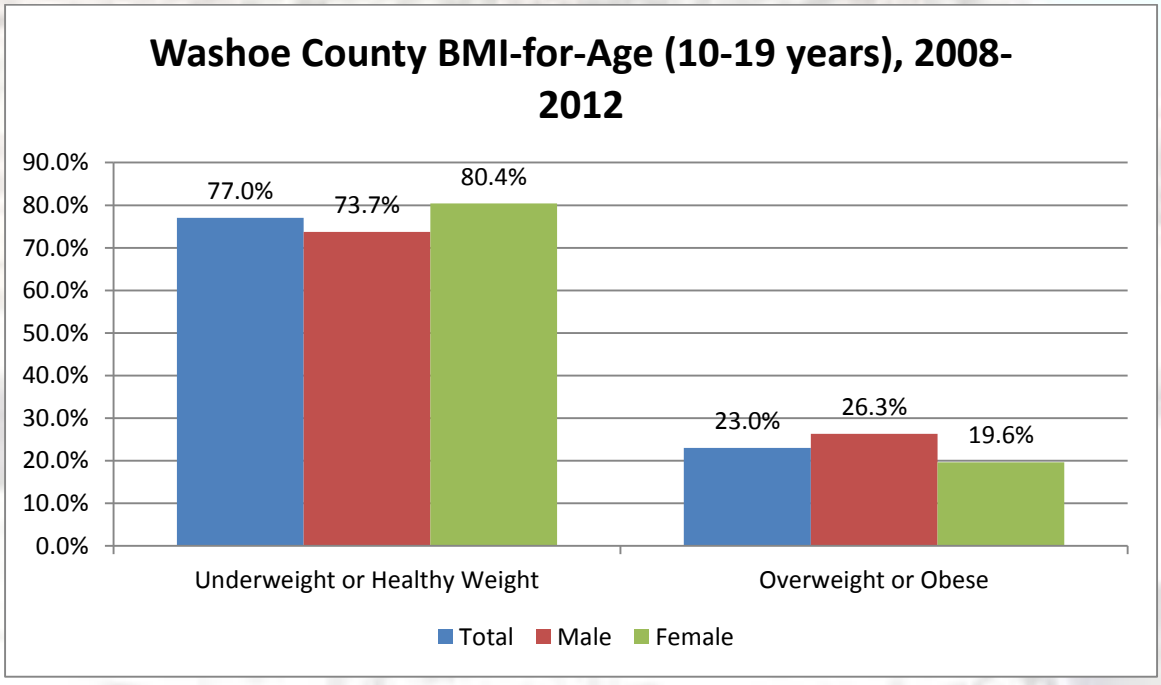
The rates of Washoe County youth (10-19 years) who are overweight and obese are 13.3% and 9.6% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 69: Washoe County BMI-for-Age



Data indicate that more male youth (10-19 years) in Washoe County are overweight or obese when compared to females (10-19 years).

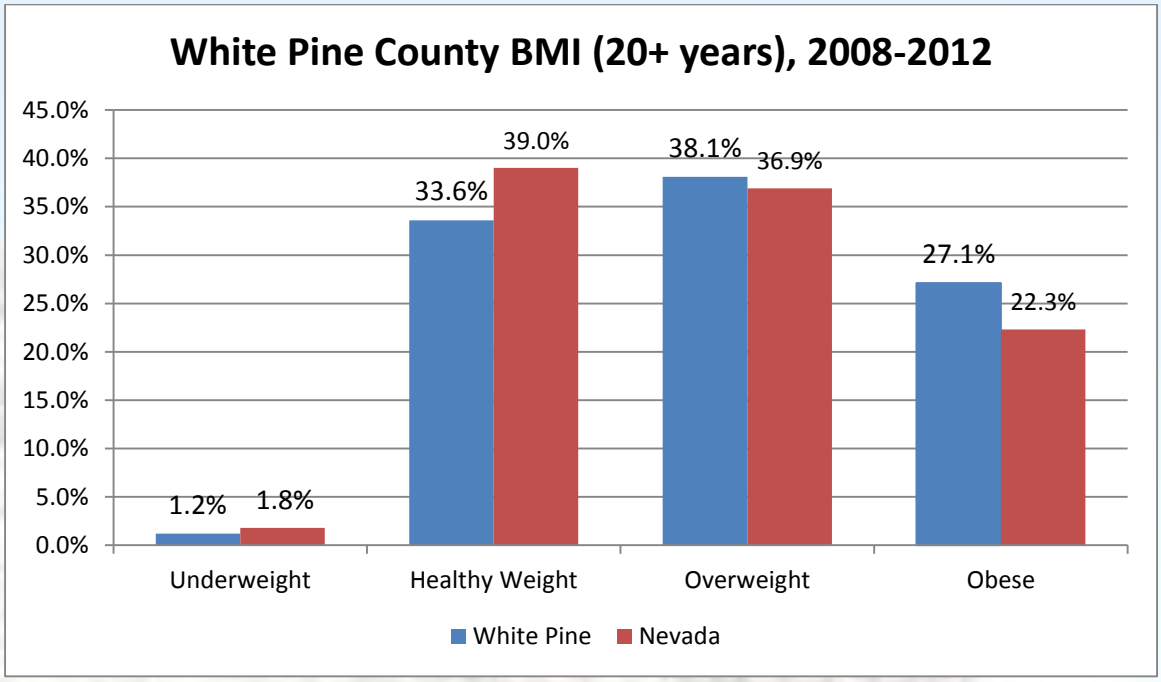
Figure 70: Washoe County Male and Female BMI-for-Age



White Pine County

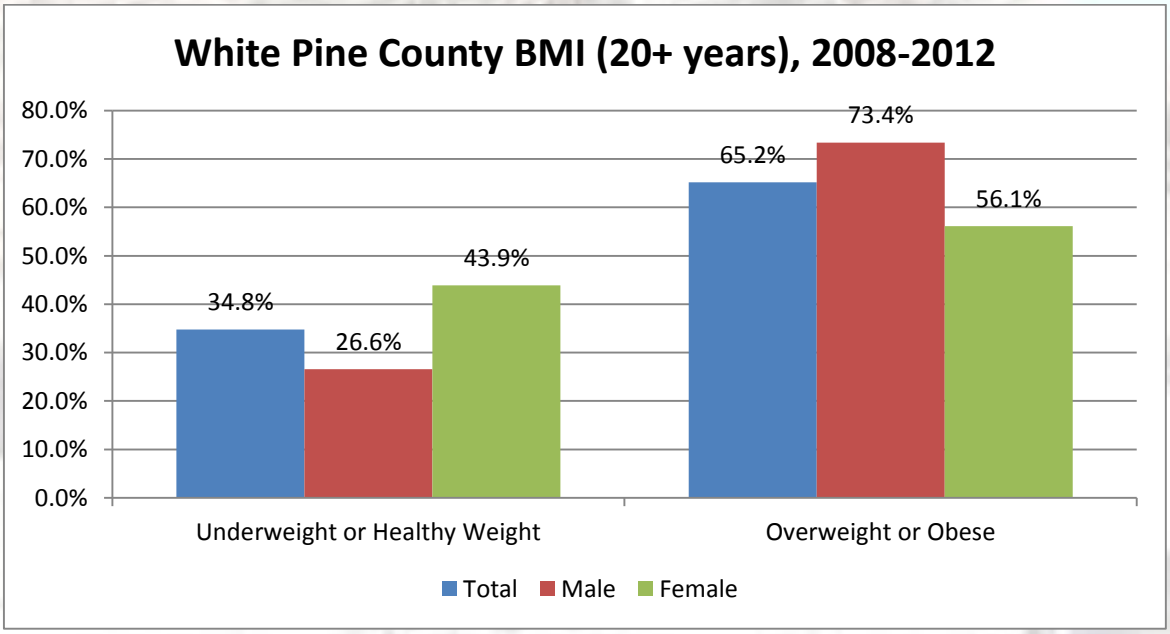
The rates of White Pine County adults (20+ years) collectively who are overweight and obese are 38.1% and 27.1% respectively compared to statewide averages of 36.9% and 22.3%.

Figure 71: White Pine County Adult BMI



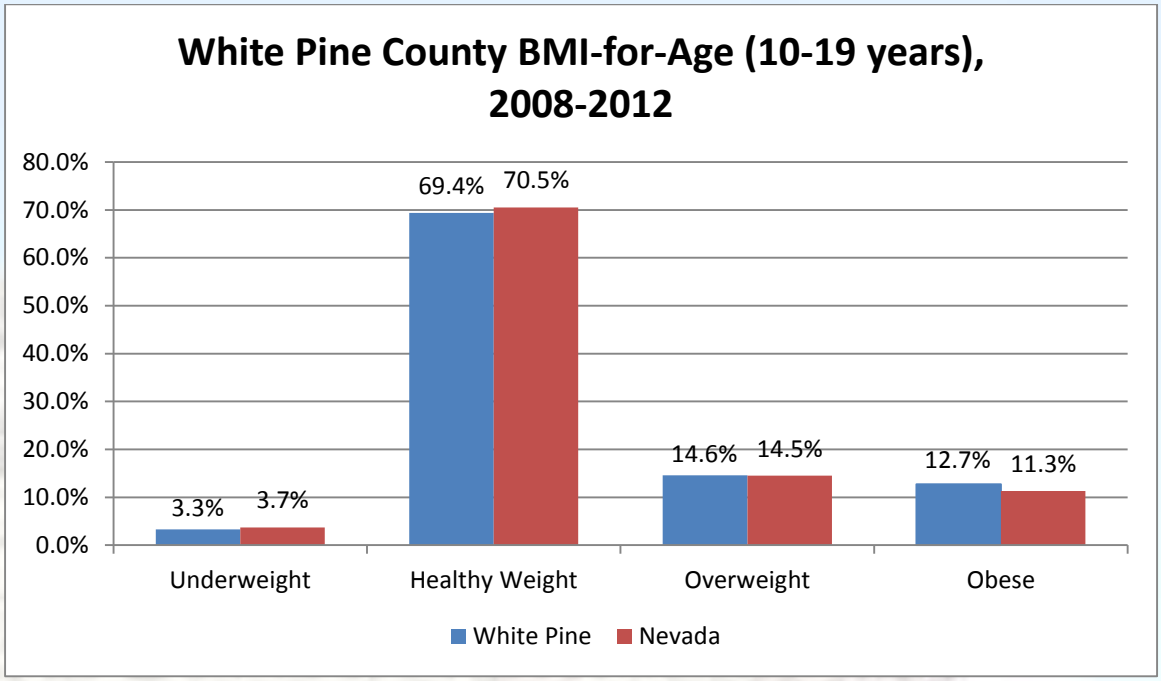
Data indicate that more male adults (20+ years) in White Pine County are overweight or obese when compared to females (20+ years).

Figure 72: White Pine County Adult Male and Female BMI



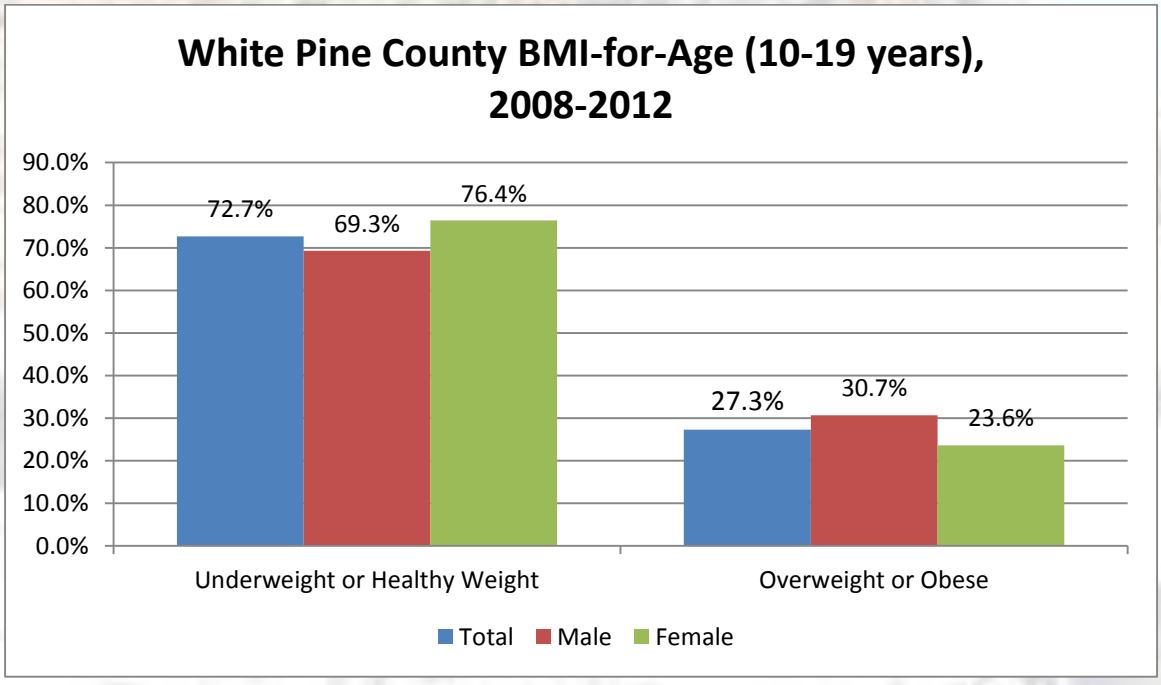
The rates of White Pine County youth (10-19 years) collectively who are overweight and obese are 14.6% and 12.7% respectively compared to statewide averages of 14.5% and 11.3%.

Figure 73: White Pine County BMI-for-Age



Data indicate that more male youth (10-19 years) in White Pine are overweight or obese when compared to females (10-19 years).

Figure 74: White Pine County Male and Female BMI-for-Age



Comparisons between DMV and BRFSS

The CDC's BRFSS obesity rate calculations for Nevada from 2008 to 2012 were compared to DMV data obesity rate calculations. Overall, the percentage decrease from BRFSS obesity values to DMV obesity values is 11.4% (Table 1).

Table 1. Comparison of BRFSS and DMV Obesity Rates, 2008-2012

Year	BRFSS	DMV
2008	25.6	22.3
2009	26.4	
2010	23.1	
2011	24.5	
2012	26.2	
Average	25.2	22.3

Percentage Decrease= (BRFSS-DMV)/BRFSS *100= 11.4%

The obesity rate from 2008 through 2012 in Nevada was then stratified by sex and compared with DMV data. The magnitude of estimates in DMV data was 7% and 16% lower than that of BRFSS for men and women, respectively (Table 2).

Table 2. Comparison between BRFSS and DMV 2008-2012 by Sex

Year	BRFSS (Male)	BRFSS (Female)	DMV (Male)	DMV (Female)
2008	27.7	23.4	25.2	19.3
2009	29.4	23.2		
2010	26.5	19.4		
2011	25.5	23.4		
2012	26.5	25.8		
Average	27.1	23.0	25.2	19.3

Comparison with the Overall Health Outcomes by County

When comparing the obesity status in Nevada with the overall Health Outcomes encompassing Mortality, Morbidity and Health at County Health Rankings & Roadmaps Factors (Rankings for State of Nevada, 2013), the counties that ranked better in health outcomes also ranked lower in obesity. In other words, overall health outcomes are negatively correlated with obesity.

Table 3. Obesity Status and Overall Health Outcomes by County

County	*†Ranking in Health Outcomes	**†Rank in Obesity	**Obese aged 20+ years (%)
Storey	1	17	14.3
Lincoln	2	11	25.2
Douglas	3	16	17.6
Elko	4	8	27.3
Eureka	5	7	27.4
Washoe	6	15	20.0
Lyon	7	6	27.7
Carson City	8	13	22.3
Clark	9	14	22.2
Pershing	10	1	31.2
Humboldt	11	4	29.2
Churchill	12	9	27.1
White Pine	13	9	27.1
Lander	14	2	31.0
Mineral	15	3	30.9
Nye	16	5	28.3
Esmeralda	No Report	12	25.0

*: from County Health Rankings & Roadmaps

**: from 2008 to 2012 Nevada Body Mass Index Report

†: The rankings are ordered from highest (1) to lowest (17).

Discussion

Caution should be taken in interpreting these numbers by the CDC's BRFSS program, as they are based on self-report surveys which asked individuals (or, in case of children and adolescents, their parents) to self-report their height and weight. Height is commonly over-reported and weight underreported, sometimes resulting in significantly lower estimates. One study estimated the magnitude of bias between actual and self-reported obesity as 7% among males and 13% among females as of 2002, with the tendency to report a lower weight (Majid Ezzati et al., 2006).

A study published in the Journal of Obesity in 2013 measured the height and weight of individuals from the nine census regions. The long running study, REGARDS, found the West North Central region (North Dakota, South Dakota, Minnesota, Missouri, Nebraska, and Iowa), and East North Central region (Illinois, Ohio, Wisconsin, Michigan, and Indiana) had the highest obesity rates in the nation (Le A. et al., 2013).

Consistent with previous studies (Le Marchand L, Yoshizawa CN, Nomura AM, 1988; Ossiander EM, Emanuel I, O'brien W, et al., 2004), this study found DMV data to underestimate mean BMI. The effect is more pronounced among women (16% in women and 7% in men), due to greater differences in reported weights. Because of this bias, it may be best to analyze trends for men and women separately. Whatever the reason, the bias creates obesity prevalence estimates that are very different from established state-level estimates. As a result, it is recommend using BRFSS estimates rather than DMV records to estimate obesity prevalence. Data quality could be improved by putting rulers and scales in the DMV offices, and requiring updated height and weight information for all renewals.

An advantage of DMV data for obesity prevalence compared with BRFSS data is the larger sample size. BRFSS samples sizes from some rural areas or underrepresented groups such as Blacks, Asians, etc., were too small to ensure reliability. On the other hand, DMV data provides adequate counts for analysis in all Nevada counties.

The current findings are based on Nevada DMV data and may not be applicable to other states. However, in any study interpreting the obesity prevalence based on self-reported data should use caution. Like other self-report surveys, the weight and height in the DMV data are reported by individuals so the weight may be under-reported and height may be over-reported. Another limitation for using the DMV data to estimate obesity rate is those without a driver license or ID card are absent from the data. Additionally, when people die or move out of state, older records in the DMV database may become less representative of the population at the time of the license issue. Therefore, it may be prudent to use only records issued in recent years for future analysis.

Conclusion

Several key findings were identified from this study:

1) From 2008 to 2012, 22.3% of Nevada's adults, age 20 and older, were obese. The prevalence of obesity in each county ranged from 14.3 to 31.2%). The prevalence of obesity was higher among males (25.2%) than females (19.3%). The range in Nevada was 14.3 to 31.2%.

2) From 2008 to 2012, 11.3% of Nevada's youth, ages 10-19 years old, were obese. The prevalence of obesity was higher among males (14.5%) than females (8.1%)

3) The five counties identified as having the highest prevalence of obesity were Pershing (31.2%), Lander (31.0%), Mineral (30.9%), Humboldt (29.2%), and Nye (28.3%) counties.

4) When comparing obesity prevalence with overall health outcomes (as identified in County Health Rankings & Roadmaps) in Nevada, we found overall health outcomes are negatively correlated with obesity.

5) Overall, BRFSS and DMV BMI estimates are similar. The BMI estimates in DMV data are 7% and 16% lower than that of BRFSS estimates for men and women, respectively.

Even though height and weight information on a driver license or ID card may be predictably biased, DMV data may still be useful for population-based monitoring of obesity. It is strongly encouraged that public health agencies continue to explore DMV records for obesity tracking, particularly in Nevada's rural areas where the baseline estimates are often not easy to identify.

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Appendix

Appendix A: 2008-2012 Nevada Department of Motor Vehicles (DMV) Body Mass Index Data (20+ years)

County/Gender		BMI Category								Total
		Underweight		Healthy Weight		Overweight		Obese		
		n	Row Percent	n	Row Percent	n	Row Percent	n	Row Percent	N
County	Gender									
Carson City	Male	122	0.5%	6,344	28.4%	10,430	46.7%	5,445	24.4%	22,341
	Female	497	2.2%	10,786	48.0%	6,644	29.6%	4,528	20.2%	22,455
	Total	619	1.4%	17,130	38.2%	17,074	38.1%	9,973	22.3%	44,796
Churchill	Gender									
	Male	47	0.5%	2,133	24.0%	4,086	45.9%	2,632	29.6%	8,898
	Female	190	2.1%	3,675	41.5%	2,808	31.7%	2,181	24.6%	8,854
	Total	237	1.3%	5,808	32.7%	6,894	38.8%	4,813	27.1%	17,752
Clark	Gender									
	Male	3,893	0.6%	186,880	28.4%	301,212	45.8%	165,487	25.2%	657,472
	Female	21,509	3.3%	325,098	50.2%	176,827	27.3%	124,391	19.2%	647,825
	Total	25,402	1.9%	511,978	39.2%	478,039	36.6%	289,878	22.2%	1,305,297
Douglas	Gender									
	Male	59	0.3%	5,052	29.1%	8,599	49.5%	3,656	21.1%	17,366
	Female	432	2.6%	9,272	55.9%	4,576	27.6%	2,313	13.9%	16,593
	Total	491	1.4%	14,324	42.2%	13,175	38.8%	5,969	17.6%	33,959
Elko	Gender									
	Male	81	0.5%	3,882	22.8%	7,776	45.7%	5,270	31.0%	17,009
	Female	307	2.0%	6,735	44.1%	4,682	30.7%	3,548	23.2%	15,272
	Total	388	1.2%	10,617	32.9%	12,458	38.6%	8,818	27.3%	32,281
Esmeralda	Gender									
	Male	3	0.8%	113	29.4%	170	44.2%	99	25.7%	385
	Female	11	3.8%	116	40.6%	90	31.5%	69	24.1%	286
	Total	14	2.1%	229	34.1%	260	38.7%	168	25.0%	671
Eureka	Gender									
	Male	1	0.2%	175	26.3%	276	41.5%	213	32.0%	665
	Female	14	2.5%	245	43.7%	179	31.9%	123	21.9%	561
	Total	15	1.2%	420	34.3%	455	37.1%	336	27.4%	1,226
Humboldt	Gender									
	Male	27	0.4%	1,570	23.4%	2,982	44.5%	2,123	31.7%	6,702
	Female	111	1.9%	2,424	41.5%	1,764	30.2%	1,536	26.3%	5,835

	Total	138	1.1%	3,994	31.9%	4,746	37.9%	3,659	29.2%	12,537
Lander	Gender									
	Male	9	0.4%	454	21.2%	955	44.6%	722	33.7%	2,140
	Female	21	1.1%	726	39.1%	594	32.0%	516	27.8%	1,857
	Total	30	0.8%	1,180	29.5%	1,549	38.8%	1,238	31.0%	3,997
Lincoln	Gender									
	Male	10	0.6%	421	25.5%	756	45.8%	465	28.1%	1,652
	Female	24	1.6%	675	45.2%	468	31.3%	326	21.8%	1,493
	Total	34	1.1%	1,096	34.8%	1,224	38.9%	791	25.2%	3,145
Lyon	Gender									
	Male	99	0.5%	5,120	24.4%	9,405	44.8%	6,365	30.3%	20,989
	Female	424	2.2%	8,222	41.9%	6,119	31.1%	4,879	24.8%	19,644
	Total	523	1.3%	13,342	32.8%	15,524	38.2%	11,244	27.7%	40,633
Mineral	Gender									
	Male	14	0.7%	433	23.2%	804	43.0%	618	33.1%	1,869
	Female	38	2.0%	706	37.8%	586	31.4%	537	28.8%	1,867
	Total	52	1.4%	1,139	30.5%	1,390	37.2%	1,155	30.9%	3,736
Nye	Gender									
	Male	115	0.6%	4,662	24.1%	8,474	43.9%	6,064	31.4%	19,315
	Female	443	2.5%	7,372	41.8%	5,414	30.7%	4,409	25.0%	17,638
	Total	558	1.5%	12,034	32.6%	13,888	37.6%	10,473	28.3%	36,953
Pershing	Gender									
	Male	8	0.6%	297	22.5%	586	44.4%	428	32.4%	1,319
	Female	19	1.6%	445	37.1%	379	31.6%	358	29.8%	1,201
	Total	27	1.1%	742	29.4%	965	38.3%	786	31.2%	2,520
Storey	Gender									
	Male	5	1.0%	149	29.7%	254	50.7%	93	18.6%	501
	Female	19	4.3%	251	56.2%	134	30.0%	43	9.6%	447
	Total	24	2.5%	400	42.2%	388	40.9%	136	14.3%	948
Washoe	Gender									
	Male	784	0.5%	45,078	30.0%	70,278	46.8%	33,875	22.6%	150,015
	Female	4,013	2.7%	77,129	52.6%	40,039	27.3%	25,549	17.4%	146,730
	Total	4,797	1.6%	122,207	41.2%	110,317	37.2%	59,424	20.0%	296,745
White Pine	Gender									
	Male	12	0.3%	913	26.2%	1,540	44.3%	1,015	29.2%	3,480
	Female	66	2.1%	1,305	41.8%	977	31.3%	777	24.9%	3,125
	Total	78	1.2%	2,218	33.6%	2,517	38.1%	1,792	27.1%	6,605
Total	Gender									
	Male	5,289	0.6%	263,676	28.3%	428,583	46.0%	234,570	25.2%	932,118

	Female	28,138	3.1%	455,182	49.9%	252,280	27.7%	176,083	19.3%	911,683
	Total	33,427	1.8%	718,858	39.0%	680,863	36.9%	410,653	22.3%	1,843,801

Appendix B: 2008-2012 Nevada Department of Motor Vehicles (DMV) Body Mass Index Data (10-19 years)

County/Gender		BMI-for-Age Category								
		Underweight		Healthy Weight		Overweight		Obese		Total
		n	Row Percent	n	Row Percent	n	Row Percent	n	Row Percent	N
County	Gender									
Carson City	Male	79	4.0%	1,326	66.5%	300	15.0%	290	14.5%	1,995
	Female	40	2.1%	1,412	74.3%	291	15.3%	157	8.3%	1,900
	Total	119	3.1%	2,738	70.3%	591	15.2%	447	11.5%	3,895
Churchill	Gender									
	Male	35	4.3%	545	66.5%	120	14.6%	120	14.6%	820
	Female	19	2.2%	615	71.9%	133	15.6%	88	10.3%	855
	Total	54	3.2%	1,160	69.3%	253	15.1%	208	12.4%	1,675
Clark	Gender									
	Male	2,509	4.4%	37,340	65.9%	8,350	14.7%	8,471	14.9%	56,670
	Female	1,936	3.5%	40,786	73.6%	8,115	14.7%	4,548	8.2%	55,385
	Total	4,445	4.0%	78,126	69.7%	16,465	14.7%	13,019	11.6%	112,055
Douglas	Gender									
	Male	42	3.4%	918	73.6%	173	13.9%	114	9.1%	1,247
	Female	32	2.6%	1,026	82.7%	137	11.0%	45	3.6%	1,240
	Total	74	3.0%	1,944	78.2%	310	12.5%	159	6.4%	2,487
Elko	Gender									
	Male	62	3.1%	1,304	65.7%	303	15.3%	315	15.9%	1,984
	Female	42	2.2%	1,357	72.2%	307	16.3%	173	9.2%	1,879
	Total	104	2.7%	2,661	68.9%	610	15.8%	488	12.6%	3,863
Esmeralda	Gender									
	Male	1	4.2%	12	50.0%	8	33.3%	3	12.5%	24
	Female	0	0	6	66.7%	1	11.1%	2	22.2%	9
	Total	1	3.0%	18	54.5%	9	27.3%	5	15.2%	33
Eureka	Gender									
	Male	1	1.5%	39	59.1%	13	19.7%	13	19.7%	66
	Female	0	0	53	82.8%	7	10.9%	4	6.3%	64

County/Gender		BMI-for-Age Category								Total
		Underweight		Healthy Weight		Overweight		Obese		
		n	Row Percent	n	Row Percent	n	Row Percent	n	Row Percent	N
	Total	1	0.8%	92	70.8%	20	15.4%	17	13.1%	130
Humboldt	Gender									
	Male	22	3.1%	455	63.2%	112	15.6%	131	18.2%	720
	Female	10	1.4%	503	72.2%	111	15.9%	73	10.5%	697
	Total	32	2.3%	958	67.6%	223	15.7%	204	14.4%	1,417
Lander	Gender									
	Male	11	4.7%	146	62.4%	34	14.5%	43	18.4%	234
	Female	2	0.9%	161	68.5%	40	17.0%	32	13.6%	235
	Total	13	2.8%	307	65.5%	74	15.8%	75	16.0%	469
Lincoln	Gender									
	Male	10	6.5%	110	71.0%	21	13.5%	14	9.0%	155
	Female	4	2.6%	118	76.6%	19	12.3%	13	8.4%	154
	Total	14	4.5%	228	73.8%	40	12.9%	27	8.7%	309
Lyon	Gender									
	Male	58	3.5%	1,118	67.2%	238	14.3%	250	15.0%	1,664
	Female	26	1.6%	1,173	73.2%	243	15.2%	160	10.0%	1,602
	Total	84	2.6%	2,291	70.1%	481	14.7%	410	12.6%	3,266
Mineral	Gender									
	Male	7	5.3%	71	54.2%	27	20.6%	26	19.8%	131
	Female	3	2.2%	91	67.9%	19	14.2%	21	15.7%	134
	Total	10	3.8%	162	61.1%	46	17.4%	47	17.7%	265
Nye	Gender									
	Male	56	4.3%	883	67.4%	173	13.2%	199	15.2%	1,311
	Female	26	2.1%	905	74.6%	172	14.2%	110	9.1%	1,213
	Total	82	3.2%	1,788	70.8%	345	13.7%	309	12.2%	2,524
Pershing	Gender									
	Male	6	4.3%	92	66.2%	16	11.5%	25	18.0%	139
	Female	2	1.6%	80	64.0%	27	21.6%	16	12.8%	125
	Total	8	3.0%	172	65.2%	43	16.3%	41	15.5%	264
Storey	Gender									
	Male	3	9.1%	24	72.7%	4	12.1%	2	6.1%	33
	Female	0	0	21	84.0%	2	8.0%	2	8.0%	25

County/Gender		BMI-for-Age Category								Total
		Underweight		Healthy Weight		Overweight		Obese		
		n	Row Percent	n	Row Percent	n	Row Percent	n	Row Percent	N
	Total	3	5.2%	45	77.6%	6	10.3%	4	6.9%	58
Washoe	Gender									
	Male	552	4.2%	9,091	69.5%	1,811	13.8%	1,626	12.4%	13,080
	Female	332	2.6%	9,905	77.8%	1,634	12.8%	857	6.7%	12,728
	Total	884	3.4%	18,996	73.6%	3,445	13.3%	2,483	9.6%	25,808
White Pine	Gender									
	Male	18	5.3%	219	64.0%	46	13.5%	59	17.3%	342
	Female	4	1.2%	242	75.2%	51	15.8%	25	7.8%	322
	Total	22	3.3%	461	69.4%	97	14.6%	84	12.7%	664
Total	Gender									
	Male	3,472	4.3%	53,693	66.6%	11,749	14.6%	11,701	14.5%	80,615
	Female	2,478	3.2%	58,454	74.4%	11,309	14.4%	6,326	8.1%	78,567
	Total	5,950	3.7%	112,147	70.5%	23,058	14.5%	18,027	11.3%	159,182

Further information may be addressed to:

Department of Health and Human Services
Division of Public and Behavioral Health
Chronic Disease Prevention and Health Promotion Section

4150 Technology Way Suite 210
Carson City NV 89706
(775) 684-4285

This report is available on the Nevada Division of Public and Behavioral Health website at:
http://dpbh.nv.gov/Programs/Obesity/Obesity_Prevention_and_Control_-_Home/

Contact information:

Jessica Lamb
Obesity Prevention Program Coordinator
Chronic Disease Prevention & Health Promotion
Bureau of Child, Family, & Community Wellness
Division of Public and Behavioral Health
Office: 775-684-4261
Email: jalamb@health.nv.gov

Suggested citation:

Chronic Disease Prevention and Health Promotion. Nevada Division of Public and Behavioral Health. *Nevada Body Mass Index Report 2008-2012 Department of Motor Vehicles Data.* Carson City, Nevada. August 2015.