

Introduction

Data for this brief were drawn from numerous data sources, including the Behavioral Risk Factor Surveillance System (BRFSS), the Washington State Birth Certificate, and the Washington State Death Certificate.

Obesity and Diabetes for Adults - BRFSS

The BRFSS is an annual random-digit dialed telephone survey of non-institutionalized adults. The survey asks respondents to brief their health status and health behaviors. The survey includes information about weight, nutrition, physical activity and chronic disease.

BRFSS data are weighted by age, gender, and the probability of being selected for the survey in order to be more representative of the Snohomish County adult population. This method assumes that survey respondents are similar to non-respondents. This is a strong assumption, so the values presented in this brief should be viewed as estimates.

For the purposes of this brief, data from multiple years of the survey were used to insure that ZIP Code area estimates had enough responses to be valid. Also, a number of ZIP Codes were combined to insure accurate results. For example, the 98087 ZIP Code was created in an area north of Lynnwood in the middle of 2005. For analyses, this ZIP Code was combined with the 98037 ZIP Code to create a combined North Lynnwood area. When ZIP Codes were aggregated, the area combinations contained geographically contiguous areas.

Obesity was defined as a body mass index (BMI) greater than or equal to 30. This is the same cut-off used by the Centers for Disease Control and Prevention (CDC). Because the heights and weights of respondents were based on self-reports, the estimated obesity prevalence is an underestimate of the true proportion of obesity within the community. Generally, men over-report their height and women under-report their weight. In both cases, this leads to an artificially smaller BMI. The number of respondents with valid BMI information ranged from 304-692 with an average of 468.

In addition to obesity information, the BRFSS was also used to estimate the prevalence of physician diagnosed diabetes. This may include both type 1 and type 2 diabetes. It is estimated that between 80-90% of diabetes in the adult population is type 2 (adult-onset diabetes), the type of diabetes most often associated with obesity.

Because only diagnosed diabetes was captured, the values presented in this brief underestimate the actual prevalence of diabetes. Many individuals may not be aware that they have diabetes. Comparing data from two national surveys, the BRFSS telephone survey and the National Health and Nutrition Examination Survey (NHANES), which uses laboratory methods to estimate diabetes, it is clear that BRFSS underestimates the prevalence of diabetes by about one-third (8.0% from BRFSS vs. 10.7% from NHANES for 2006 United States data).

The risk of obesity and diabetes changes with age. However, because of the limited sample size and the inclusion of the survey design factors, the values presented were not age-adjusted. However, the observed disparities were not explained by differences in the age distribution of ZIP Code areas.

The results of the BRFSS analysis are provided in **Table 1**.

Obesity Prior to Pregnancy - Birth Certificate

An additional source of information used in this brief was obesity prior to pregnancy ($BMI \geq 30$) from the Washington State Birth Certificate data. Data from 2003-2006 was used in the present brief for the same geographic aggregations used for the BRFSS analysis. Pre-pregnancy weight and height information on the birth certificate are obtained from the medical record. The quality of pre-pregnancy weight information is likely quite variable.

Unlike the BRFSS data, information from the birth certificate is not from a scientific survey. Instead it provides information for all births in Snohomish County. However, not all birth certificates have complete information on BMI. Approximately 17% of women had missing BMI information. The amount of missing data seems to be positively associated with the proportion of women with pre-pregnancy obesity by ZIP Code. In addition, compared with White women, non-White women were more likely to have missing BMI information. These systematic trends in missing BMI data may influence the observed disparities in pre-pregnancy obesity and may also lead to an under-estimate in the prevalence of pre-pregnancy obesity.

OBESITY IN OUR COMMUNITY

METHODS, DATA QUALITY, TECHNICAL INFORMATION, TABLES, AND MAPS

Because maternal age varies dramatically within Snohomish County and is strongly associated with pre-pregnancy BMI, the estimated proportion of women with pre-pregnancy obesity was adjusted for age using 4 age groups (10-17, 18-24, 25-34 and ≥ 35). The method for age-adjustment was direct standardization which applies a weighting to each age group. This method removes any affect of age when comparing two areas.

The results of the pre-pregnancy obesity analysis are presented in **Table 2**.

Diabetes-related Deaths - Death Certificate

To capture the distribution of long-term health consequences, Washington State Death Certificate data was used to enumerate diabetes-related deaths. Diabetes-related mortality is defined as a death with a primary or contributory cause of diabetes mellitus. In addition to diabetes mellitus, the common primary cause of death for diabetes-related deaths included acute myocardial infarction (ICD-10 I21.X), chronic ischemic heart disease (ICD-10 I25.X), and Alzheimer's disease (C49.X) as the primary cause of death. A listing of the primary causes of death for diabetes-related deaths is available in **Table 5**.

The age-adjusted rate of diabetes-related deaths was calculated for 2003-2006. The geographic aggregation used for analysis of diabetes-related death was the same as the previous analyses. The results of the diabetes-related deaths analysis are presented in **Table 2**.

Statistical Comparisons

Analysis of BRFSS data (obesity and diabetes) used a weighted X^2 (chi-squared) test to identify ZIP Code areas with significantly higher or lower prevalence of obesity or diabetes. This test compares the ZIP Code-specific prevalence to the prevalence of the entire county excluding that ZIP Code area.

Testing for pre-pregnancy obesity and diabetes-related deaths used an alternative method. The test compared the age-adjusted prevalence/rate between the ZIP Code prevalence/rate and the countywide prevalence/rate.

Regardless of the method used a p value less than 0.05 indicates that the ZIP Code area prevalence/rate differs significantly from the countywide prevalence or rate. A p value roughly corresponds to the probability that a difference between two values is due to chance. The smaller the p value the more likely that the difference between the two values is real. It is important to note that p values can be influenced by sample size and that comparing two 95% confidence intervals (CI) is an inappropriate method for identifying significant differences between values.

Contextual Data

Contextual data differ from individual-level data such as individual income because they measure area or community resources. These area-based measures have been used elsewhere to evaluate the relationship between community social and economic resources and adverse health outcomes. Contextual data was obtained from the 2000 United States Decennial Census. Because data that directly corresponds to ZIP Code areas was not readily available, block group level data was used to approximate ZIP Code level boundaries. The contextual variables evaluated included percent of households with income greater than \$75,000, percent of population living below 200% of the Federal Poverty Level (FPL), percent of population (age ≥ 25) with less than high school education, and percent of owner-occupied houses valued greater than \$250,000. The median value of owner-occupied houses in Snohomish County in 2000 was \$196,500. The associations between the contextual data and health outcomes are presented in **Table 3** and the contextual data by ZIP Code area are presented in **Table 4**.

OBESITY IN OUR COMMUNITY
METHODS, DATA QUALITY, TECHNICAL INFORMATION, TABLES, AND MAPS

Table 1. Obesity and Diabetes Prevalence for Adults by ZIP Code Area, 2003-2007

ZIP Code Area	<i>Obesity¹</i>					<i>Physician-diagnosed Diabetes¹</i>				
	n	N	Prevalence ² (%)	95% Confidence Interval (CI)	p value	n	N	Prevalence ² (%)	95% CI	p value
98012 - Mill Creek	125	563	20.6§	17.2, 24.6	0.03	44	581	5.8	4.2, 8.0	0.37
98020 - Edmonds	61	394	15.3§	11.4, 20.1	<0.001	27	411	4.7	3.0, 7.2	0.1
98026 - Edmonds	139	611	21.1§	17.6, 25.0	0.04	45	629	6.0	4.3, 8.3	0.51
98036 - Lynnwood & Brier	140	496	28.2	23.9, 33.0	0.17	34	531	4.3	3.0, 6.3	0.02
98043 - Mountlake Terrace	94	318	27.5	22.2, 33.4	0.4	32	337	7.8	5.1, 11.7	0.48
98201 - Everett	133	468	28.6	23.6, 34.2	0.17	43	488	6.6	4.7, 9.3	0.94
98203 - Everett	143	541	25.4	21.4, 29.8	0.91	49	563	7.4	5.4, 9.9	0.52
98204 - Everett	128	418	29.6†	24.7, 35.1	0.05	55	449	10.4†	7.7, 13.8	0.003
98208 - Everett	185	692	26.7	22.9, 30.7	0.43	44	733	4.5§	3.2, 6.2	0.01
98223 - Arlington	186	666	27	23.2, 31.1	0.35	71	700	8.3	6.3, 10.8	0.12
98270 - Marysville	202	619	33.8†	29.6, 38.2	<0.001	67	648	10.2†	7.8, 13.1	0.001
98271 - Tulalip / Marysville	82	304	28.5	23.0, 34.8	0.24	27	320	7.7	5.1, 11.5	0.47
98272 - Monroe	81	331	25.4	20.1, 31.6	0.93	22	358	5.7	3.5, 9.2	0.5
98275 - Mukilteo	73	322	19.0§	14.7, 24.1	0.02	23	339	6.3	3.8, 10.3	0.8
98290 - Snohomish	128	531	23.4	19.6, 27.7	0.39	37	549	6.2	4.4, 8.6	0.63
98292 - Stanwood	82	351	23.5	18.3, 29.6	0.56	24	359	4.9	3.1, 7.6	0.16
98296 - Snohomish	62	366	17.5§	13.4, 22.6	0.004	16	386	3.4§	2.0, 5.8	0.009
Bothell - Woodinville ³	81	346	21.8	17.4, 26.9	0.17	27	364	7.2	4.8, 10.7	0.73
Lake Stevens ⁴	131	535	24.1	20.1, 28.5	0.61	38	556	5.7	4.0, 8.2	0.37
North Lynnwood ⁵	165	626	25.1	21.3, 29.2	0.96	68	676	7.6	5.8, 9.9	0.33
Rural ⁶	109	338	31.7†	26.2, 37.8	0.02	33	363	8.7	5.9, 12.7	0.17
Snohomish County	2,530	9,836	25.2	24.1, 26.2		826	10,340	6.7	6.2, 7.2	

¹ Data source: BRFSS 2003-2007

² Weighted Prevalence

³ Defined as ZIP Code 98021, 98072, and 98077 (Snohomish County residents only)

⁴ Defined as ZIP Code 98205 and 98258

⁵ Defined as ZIP Code 98037 and 98087

⁶ Defined as ZIP Code 98241, 98251, 98252, and 98294

§ Significantly lower than countywide prevalence

† Significantly higher than countywide prevalence

OBESITY IN OUR COMMUNITY
METHODS, DATA QUALITY, TECHNICAL INFORMATION, TABLES, AND MAPS

Table 2. Age-adjusted Pre-pregnancy Obesity Prevalence and Diabetes-related Death Rate, 2003-2006

ZIP Code Area	Pre-pregnancy Obesity ¹					Diabetes-related Death Rate					
	n	N	Age-adjusted Prevalence (%)	95% CI	p value	n	N	Age-adjusted Rate per 100,000	95% CI	p value	Crude Rate per 100,000
98012 - Mill Creek	380	2,080	17.9§	16.1, 20.0	<0.001	53	173,000	52§	39, 69	<0.001	31
98020 - Edmonds	77	449	18.8§	14.2, 25.3	0.02	50	73,400	39§	29, 54	<0.001	68
98026 - Edmonds	253	1,148	22.1	19.4, 25.2	0.32	81	144,700	61	48, 76	0.06	56
98036 - Lynnwood & Brier	325	1,505	21.6	19.3, 24.1	0.11	60	138,700	60§	45, 78	0.05	43
98043 - Mountlake Terrace	188	791	23.6	20.3, 27.3	0.86	48	79,600	75	55, 99	0.92	60
98201 - Everett	366	1,348	28.3†	25.4, 31.5	<0.001	110	122,800	90†	73, 109	0.04	90
98203 - Everett	347	1,454	24.2	21.7, 26.9	0.43	117	131,100	88	72, 105	0.06	89
98204 - Everett	637	2,403	28.3†	25.9, 30.8	<0.001	96	135,600	111†	89, 136	<0.001	71
98208 - Everett	584	2,393	24.4	22.5, 26.5	0.22	139	195,200	106†	89, 126	<0.001	71
98223 - Arlington	409	1,707	24.2	21.9, 26.7	0.39	103	160,700	82	67, 100	0.24	64
98270 - Marysville	528	2,002	26.5†	24.3, 28.9	<0.001	106	155,800	77	63, 94	0.67	68
98271 - Tulalip / Marysville	292	1,004	30.6†	27.1, 34.4	<0.001	48	94,600	66	48, 90	0.36	51
98272 - Monroe	326	1,359	24.1	21.6, 26.9	0.5	46	103,300	66	47, 88	0.34	45
98275 - Mukilteo	91	576	15.8§	12.7, 19.6	<0.001	20	76,700	51§	31, 82	0.02	26
98290 - Snohomish	216	1,022	21.1	18.4, 24.1	0.09	86	126,000	91†	72, 113	0.03	68
98292 - Stanwood	129	626	20.6	17.2, 24.5	0.11	64	77,800	66	50, 86	0.41	82
98296 - Snohomish	177	991	18.6§	15.5, 22.4	<0.001	29	92,700	65	42, 96	0.31	31
Bothell - Woodinville ²	183	960	18.0§	15.9, 18.9	<0.001	47	104,700	57§	42, 76	0.04	37
Lake Stevens ³	417	1,718	24.2	22.0, 26.7	0.39	82	151,300	97†	77, 122	0.001	54
North Lynnwood ⁴	557	2,512	22.1	20.3, 24.1	0.15	113	186,200	75	62, 91	0.88	61
Rural ⁵	266	889	30.7†	27.1, 34.7	<0.001	59	85,800	93†	70, 120	0.04	69
Snohomish County	6,759	28,970	23.3	22.8, 23.9	reference	1,557	2,609,900	74	70, 78	reference	60

¹ Defined as Body Mass Index greater than or equal to 30 prior to pregnancy

² Defined as ZIP Code 98021, 98072, and 98077 (Snohomish County residents only)

³ Defined as ZIP Code 98205 and 98258

⁴ Defined as ZIP Code 98037 and 98087

⁵ Defined as ZIP Code 98241, 98251, 98252, and 98294

§ Significantly lower than countywide prevalence

† Significantly higher than countywide prevalence

OBESITY IN OUR COMMUNITY

METHODS, DATA QUALITY, TECHNICAL INFORMATION, TABLES, AND MAPS

Table 3. Association (r^2)¹ of Outcomes and Contextual Measures at the ZIP Code Area Level

Health Outcomes	Households with Income \geq \$75K (%)	Population Living Below 200% of the Federal Poverty Level (%)	Population (age \geq 25) With Less Than High School Education (%)	Owner-Occupied Houses Valued \geq \$250K (%)
Obesity	0.60	0.38	0.64	0.83
Physician-diagnosed Diabetes	0.38	0.20	0.26	0.34
Pre-pregnancy Obesity	0.61	0.52	0.75	0.73
Diabetes-related Deaths	0.31	0.32	0.55	0.43

¹ r^2 corresponds to the percent of variation of the health outcome that is explained by the contextual variable. An $r^2=1.0$ would indicate that 100% of the variability of the outcome is explained by the contextual variable. An $r^2=0.5$ would indicate that half of the variability in the outcome is explained by the contextual variable. The higher the r^2 value the stronger the association between two variables.

OBESITY IN OUR COMMUNITY

METHODS, DATA QUALITY, TECHNICAL INFORMATION, TABLES, AND MAPS

Table 4. Contextual Measure Values by ZIP Code Area

ZIP Code Area	Households with Income ≥ \$75K (%)	Population Living Below 200% of the Federal Poverty Level (%)	Population (age≥25) With Less Than High School Education (%)	Owner-occupied Houses Valued ≥ \$250K (%)
98012 - Mill Creek	39.0	12.2	6.5	40.9
98020 - Edmonds	35.2	11.2	5.3	52.2
98026 - Edmonds	35.1	16.7	7.1	35.2
98036 - Lynnwood & Brier	27.8	18.9	11.7	19.1
98043 - Mountlake Terrace	18.7	20.3	9.5	4.1
98201 - Everett	12.4	38.6	18.3	11.4
98203 - Everett	27.3	19.5	12.1	17.5
98204 - Everett	12.5	34.6	18.4	5.7
98208 - Everett	31.5	17.2	9.9	20.7
98223 - Arlington	24.8	18.0	14.2	21.6
98270 - Marysville	26.3	16.6	11.6	8.6
98271 - Tulalip / Marysville	26.1	21.5	12.7	12.5
98272 - Monroe	31.8	18.3	11.6	22.3
98275 - Mukilteo	43.4	11.1	3.4	60.4
98290 - Snohomish	36.3	14.9	11.5	35.3
98292 - Stanwood	27.3	17.8	9.9	23.9
98296 - Snohomish	53.1	10.9	6.1	56.8
Bothell - Woodinville ¹	41.9	9.5	6.1	43.6
Lake Stevens ²	33.0	12.8	11.0	17.9
North Lynnwood ³	24.9	19.9	10.2	22.4
Rural ⁴	19.0	21.5	16.9	8.4
Snohomish County	29.2	18.4	10.8	25.3

¹ Defined as ZIP Code 98021, 98072 and 98077 (Snohomish County residents only)

² Defined as ZIP Code 98205 and 98258

³ Defined as ZIP Code 98037 and 98087

⁴ Defined as ZIP Code 98241, 98251, 98252, and 98294

OBESITY IN OUR COMMUNITY

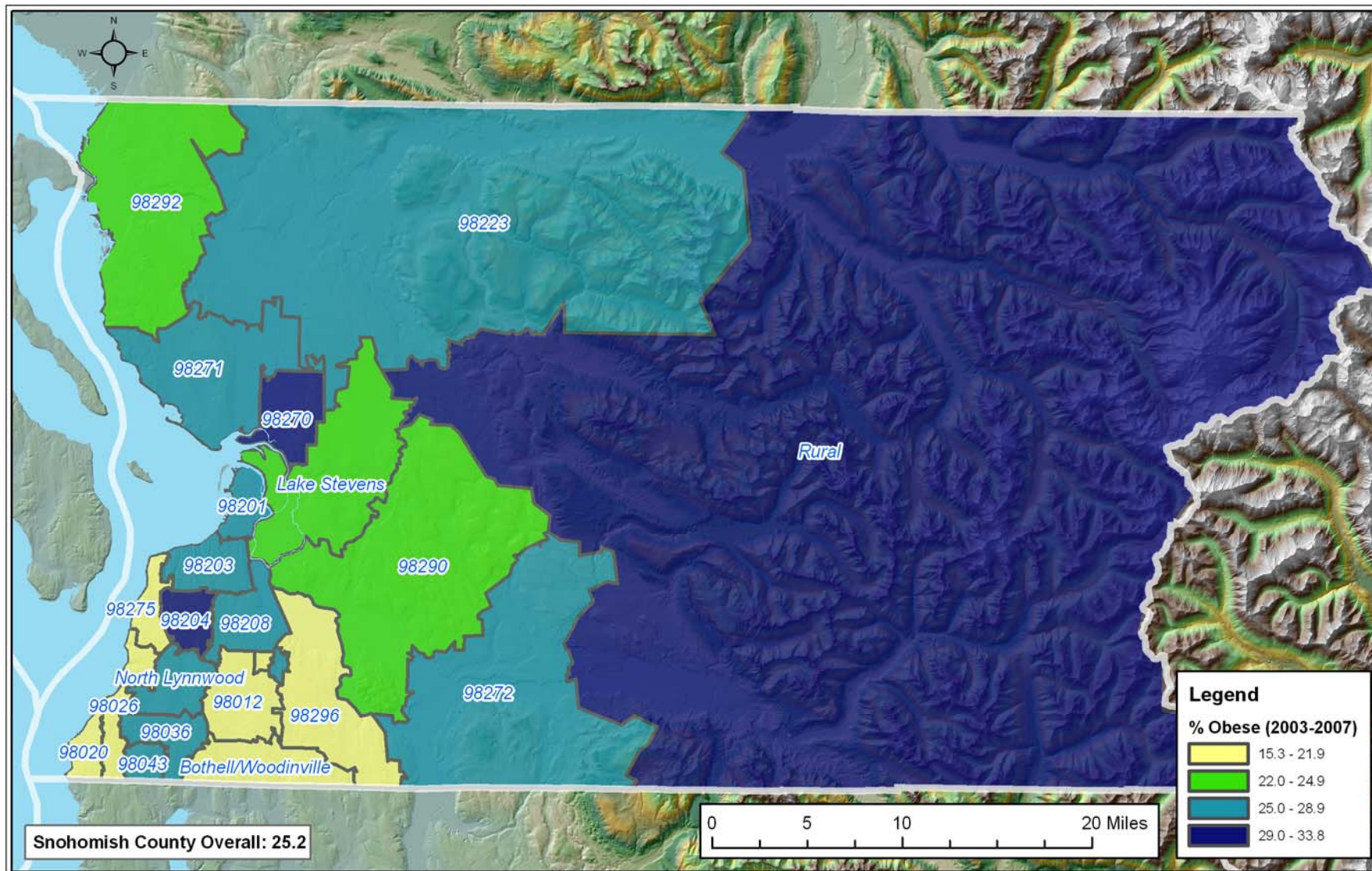
METHODS, DATA QUALITY, TECHNICAL INFORMATION, TABLES, AND MAPS

Table 5. Leading Primary Causes of Death for Diabetes-related Deaths

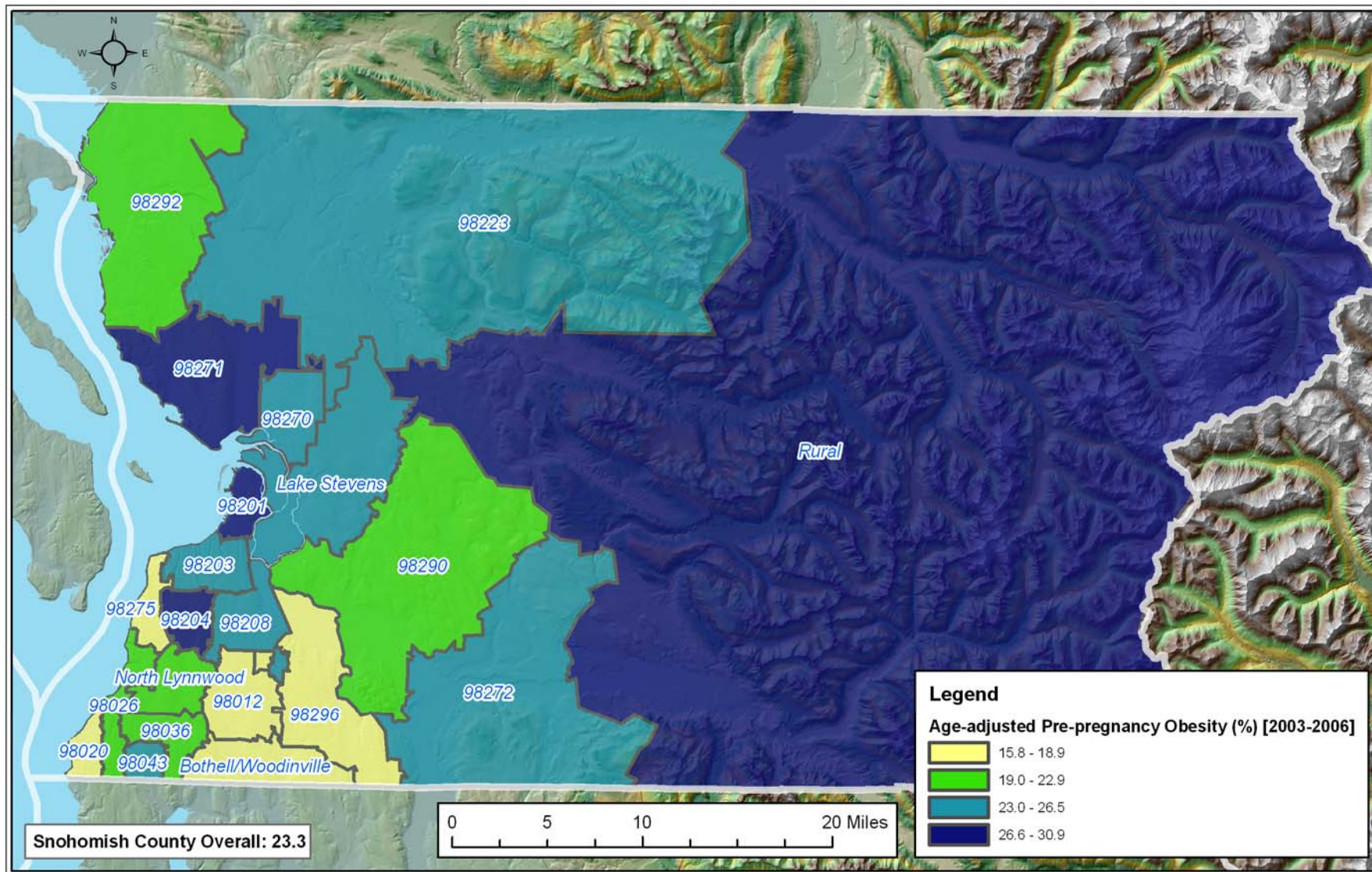
Primary Cause of Death	ICD-10 Code of Primary Cause of Death	Number of Deaths	Percent of Total (%)
Unspecified diabetes mellitus – No complications	E14.9	218	14.0
Atherosclerotic heart disease	I25.1	141	9.1
Non-insulin-dependent diabetes mellitus – No complications	E11.9	122	7.8
Atherosclerotic cardiovascular disease	I25.0	104	6.7
Acute myocardial infarction, unspecified	I21.9	86	5.5
Chronic obstructive pulmonary disease, unspecified	J44.9	57	3.7
Alzheimer’s disease, unspecified	G30.9	41	2.6
Malignant neoplasm of bronchus or lung, unspecified	C34.9	38	2.4
Stroke, not specified as hemorrhage or infarction	I64	34	2.2
All Others	-	716	46.0

OBESITY IN OUR COMMUNITY
METHODS, DATA QUALITY, TECHNICAL INFORMATION, TABLES, AND MAPS

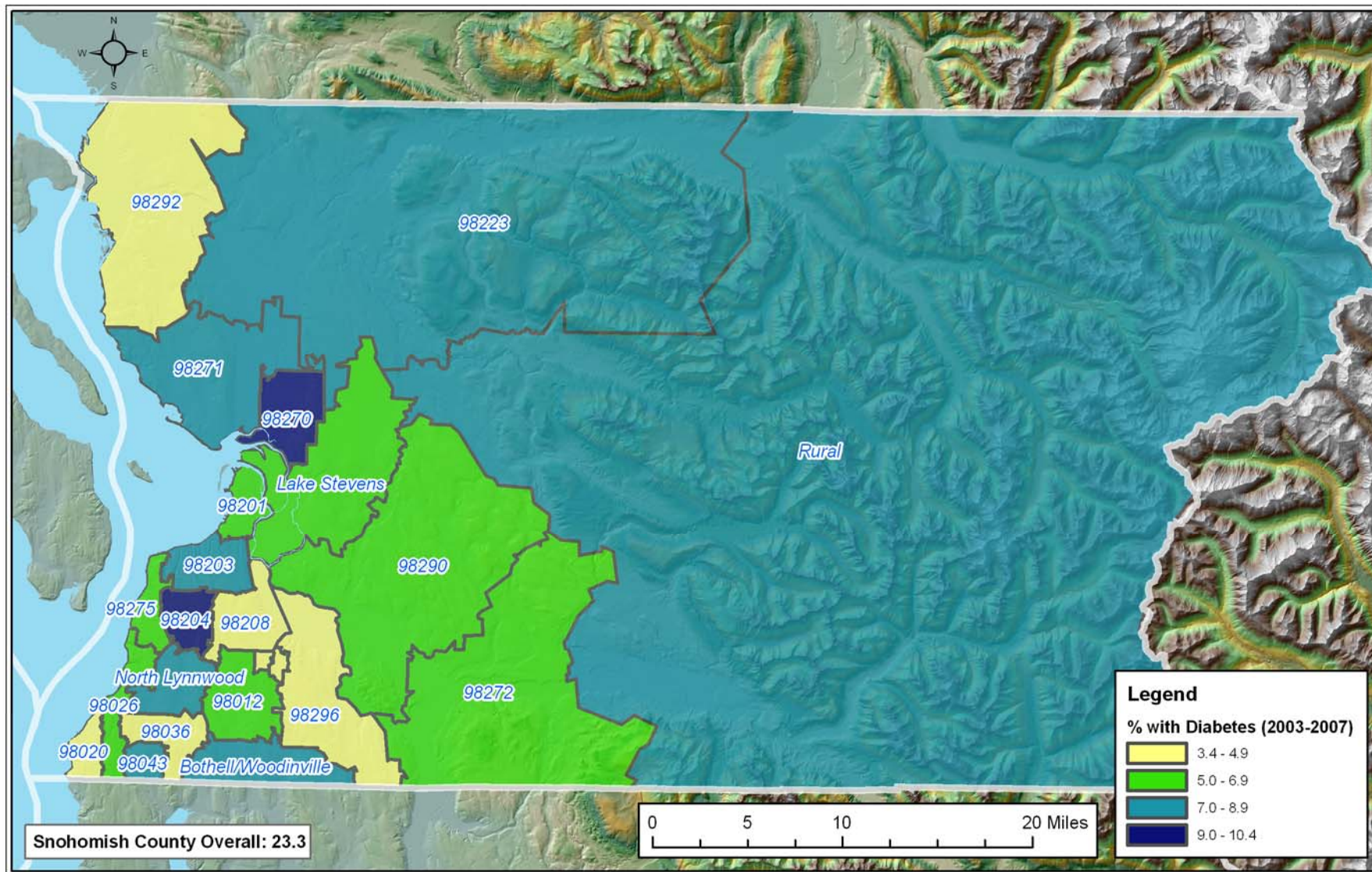
Map 1. Obesity for Adults by ZIP Code Area (2003-2007)



Map 2. Age-adjusted Obesity Prior to Pregnancy by ZIP Code Area (2003-2006)



Map 3. Diabetes for Adults by ZIP Code Area (2003-2007)



Map 4. Age-adjusted Diabetes-related Deaths by ZIP Code Area (2003-2006)

