

APPENDIX C: BATTLEMENT MESA BASELINE HEALTH PROFILE

C1 Measures of Physical Health

In order to describe the baseline of physical health for the residents of Battlement Mesa, we obtained information regarding cancer, inpatient hospital diagnoses, mortality and births. By comparing Battlement Mesa data to the same data for Colorado, we were able to provide a relative picture of health for the time period 1998-2008.

There are no databases systematically collecting information about out-patient or emergency room visits. Data regarding mental health was not available.

C1.1 Methods

Public health practitioners often compare the number of observed events (i.e. disease, death, hospitalizations) to the number of expected events. This allows practitioners to determine if a certain group of people is experiencing an increased (or decreased) amount of disease. A Standardized Incidence Ratio is one method used to measure excess or decreased amount of disease, or when mortality is examined, a Standardized Mortality Ratio (SMR). These methods were used to describe disease incidence and deaths in the Battlement Mesa/Parachute zip codes (81635, 81636).

C1.1.1 Cancer Data Methods

The Colorado Central Cancer Registry at the Colorado Department of Public Health and Environment is mandated by state statute to collect all diagnosed cancers among state residents. This registry provided the CSPH HIA team with aggregated counts of cancer for residents living within the two zip codes and age adjusted standardized incidence ratios for selected cancers diagnosed during the time period of 1998-2008.

Standardized incidence ratios were calculated using the numbers of cancers diagnosed in the Battlement Mesa/Parachute zip code compared to an expected number of cancer cases based on statewide Colorado cancer rates. Colorado rates were obtained from the Colorado Central Cancer Registry for men and women of comparable race and age and were used to calculate expected number of cancers for the Battlement Mesa/Parachute zip code. Adjusting for age, sex, and race/ethnicity assures that any difference found is not due to differences in demographics. The state of Colorado was used as a comparison to provide a large population base to generate stable, reliable rates.

Cancers studied included those based on known association between a specific type or types of cancer and the exposures of concern, common cancers, and those for which community members voiced concerns. Cancers selected for these analyses included:

- Hodgkin Lymphoma
- Non-Hodgkin Lymphomas
- Multiple Myeloma
- Leukemias
- Melanoma
- Breast cancer
- Prostate cancer
- Bladder cancer
- Colorectal cancer
- Cancer of the adrenal gland

When the number of events is less than 3 the data are not reported to preserve confidentiality, this is a policy of the Health Statistics and Vital Record Division at CDPHE. Leukemias were originally requested by type: acute lymphoblastic leukemia, acute myeloid leukemia, chronic lymphocytic leukemia, and chronic myelogenous leukemia., Because fewer than 3 cases of each type of leukemia were diagnosed over the 10 year period, the Leukemias were grouped together for the analysis.

When interpreting an standardized incidence ratio/SMR, size and stability need to be taken into consideration. Standardized incidence ratios based on greater numbers of events produce estimates that are more stable, meaning that there is greater confidence in the conclusions being drawn from the information. Because the population of Battlement Mesa/Parachute is small and the number of diseases is small, determining the *statistical significance* is extremely important. Confidence intervals (CIs) were calculated, in order to determine if the number of observed cases is significantly different from the number of expected cases or whether the difference may be due to chance alone. For these analyses, a 95% confidence interval (CI) was calculated for each standardized incidence ratio.

The following table describes how the standardized incidence ratio/SMRs are interpreted and deemed statistically significant or statistically insignificant.

Interpretation of Statistical Measures

Ratio (SIR/SMR)	Interpretation	95% Confidence Interval	Significance
< 1.00	The number of events observed is less than expected	The lower and upper limits of the interval are < 1.00	Ratio is considered statistically significant.
		The upper limit of the interval is > 1.00	Ratio is not considered statistically significant.
= 1.00	The number of events observed is equal to the number of events expected for the population.		
> 1.00	The number of events observed is greater than expected	The lower limit of the interval is < 1.00	Ratio is not considered statistically significant.
		The lower limit of the interval is > 1.00	Ratio is considered statistically significant.

C1.1.2 Inpatient Hospital Diagnoses Data Methods

Inpatient hospitalization diagnoses data from the Colorado Hospital Association were analyzed by the Health Statistics Section at the Colorado Department of Public Health and Environment and provided to the CSPH. The Colorado Department of Public Health and Environment provided aggregated inpatient hospitalization counts and standardized incidence ratios of select diagnoses using the International Classification of Diseases, ninth revision or ICD-9 codes for the time period of 1998-2008. The ICD-9 is the official system in the United States of assigning codes to diagnoses and procedures associated with hospital admissions during the 1998-2008 time period.

The Colorado Hospital Association collects discharge data for inpatient hospitalizations from participating hospitals throughout the state of Colorado. Each hospital discharge record collected can contain up to 15 diagnoses. For purposes of this analysis, the total hospitalizations were counted by including ICD-9 codes listed in any of the 15 diagnoses fields.

The Colorado Department of Public Health and Environment provided we with aggregated numbers of hospitalizations by major category as well as standardized incidence ratios computed using indirect adjustment of age based on the 2000 Census populations for the zip codes 81635 and 81636.

Major categories of ICD-9 codes included those based on known association between disease and the exposures of concern, and those for which community members voiced concerns of elevated occurrence of disease. Major diagnosis categories analyzed included:

- Depression
- Nervous system

- Ear nose and throat (ENT)
- Vascular system
- Pulmonary

Similar to the cancer analyses, a 95% CI was calculated for each standardized incidence ratio to determine statistical significance and data are suppressed when less than 3 cases were recorded for the time period.

C1.1.3 Mortality Data Methods

Mortality data were analyzed by the Health Statistics Section at the Colorado Department of Public Health and Environment and provided to the CSPH.

The Colorado Department of Public Health and Environment provided aggregated mortality counts and standardized ratios of select underlying causes using the International Classification of Disease, tenth revision or ICD-10 codes for determining diagnoses. Mortality data were provided for the time period of 1999-2008. Data for the year 1998 were not included due to a switch from ICD-9 codes in 1998 to ICD-10 codes in 1999.

Mortality data were presented as number of deaths by primary underlying cause as well as SMRs computed using indirect adjustment of age based on the 2000 Census populations for the zip codes 81635 and 81636.

Major categories of ICD-10 codes were chosen based on diseases of interest. Major mortality categories included seven major categories:

- Suicide
- Nervous system diseases
- Major cardiovascular diseases
- Chronic lower respiratory diseases
- SIDS
- Cancers
- Leukemias

Similar to the cancer and inpatient hospitalization analyses described above, a 95% CI was calculated for each SMR to determine statistical significance. Also, data are suppressed when less than 3 deaths were recorded for the time period.

C1.1.4 Birth Outcomes Data Methods

The Colorado Department of Public Health and Environment provided CSPH data from the Colorado Birth Registry for the analyses of birth outcomes.

CSPH analyzed data from 1998 to 2008 for incidences of negative birth outcomes in zip codes 81635 and 81636 based on total births. Incidences of negative birth outcomes in the remainder of Colorado were used to determine expected incidences.

Birth outcome data are presented as the number of observed and expected birth outcomes, as well as standardized incidence ratios adjusted for maternal age and race.

Two negative birth outcomes were analyzed:

- Preterm birth (Gestational age less than 37 weeks)
- Low Birth weight (Gestational age 37 weeks or greater and birth weight less than 5.51 pounds)

Birth defects were not analyzed because the birth registry may not accurately reflect the number of birth defects. Birth defects will be evaluated at the later date using data from the Colorado birth defects registry, given that more than three events exist for the recorded time period.

Similar to the cancer and inpatient hospitalization analyses, a 95% CI was calculated for each standardized incidence ratio to determine statistical significance. Data suppression was not necessary because greater than three events were recorded for the time period.

C1.2 Population/Demographics

For all analyses listed within the physical health outcomes section, the population of Battlement Mesa Planned Unit Development (PUD) was defined as the population living within one of two zip codes: 81635 and 81636. The zip code 81635 denotes physical addresses in both the Battlement Mesa PUD and the town of Parachute, which is just north of the Battlement Mesa PUD. The zip code 81636 is used for Post Office (PO) boxes and therefore the 81635 zip code was used for population counts. Because the town of Parachute shares zip codes with Battlement Mesa, we included the Parachute population in our analyses.

The 2000 U.S. census was used to obtain the most accurate population counts as well as information on age, gender, and racial composition for the Battlement Mesa/Parachute zip code. According to the 2000 U.S. census estimates, 49.3 percent of the Battlement Mesa/Parachute population was female and 50.7 percent male. The median age was 37.5 years. Twenty-six percent of the population were under 18 years of age, 7.2 percent under five years, and 19.8 percent were 65 years and older. For people reporting race in Battlement Mesa/Parachute, 98.0 percent reported a single race: 93.4 percent identified as White, 0.5 percent as Black or African American, 0.9 percent as American Indian and Alaska Native, 0.2 percent as Asian, 0.2 percent as Native Hawaiian and Other Pacific Islanders and 2.8 percent as another race. Two percent of the population reported two or more races and 9.7 percent of the population identified as Hispanic or Latino (of any race). (Table 1) The most dramatic difference between the population for the 81635 zip code and the state of Colorado as a whole is in the over 65 age group. In Colorado in 2000, 9.7 percent of the population was 65 years and over compared to 19.8 percent of the population in the Battlement Mesa/Parachute zip code. Demographic/Population information for the zip code 81635 is provided in the table below.

Demographic/Population information for the zip code 81635

Subject	Number	Percent
Total population	5,041	100
SEX		
Male	2,487	49.3
Female	2,554	50.7
AGE		
Under 5 years	361	7.2
5 to 9 years	407	8.1
10 to 14 years	347	6.9
15 to 19 years	310	6.1
20 to 24 years	252	5
25 to 34 years	661	13.1
35 to 44 years	690	13.7
45 to 54 years	510	10.1
55 to 59 years	245	4.9
60 to 64 years	258	5.1
65 to 74 years	613	12.2
75 to 84 years	333	6.6
85 years and over	54	1.1
Median age (years)	37.5	(X)
18 years and over	3,730	74
Male	1,833	36.4
Female	1,897	37.6
65 years and over	1,000	19.8
Male	479	9.5
Female	521	10.3
RACE		
One race	4,939	98
White	4,709	93.4
Black or African American	23	0.5
American Indian and Alaska Native	43	0.9
Asian	11	0.2
Asian Indian	0	0
Chinese	1	0

Subject	Number	Percent
Filipino	2	0
Japanese	8	0.2
Korean	0	0
Vietnamese	0	0
Other Asian	0	0
Native Hawaiian and Other Pacific Islander	11	0.2
Some other race	142	2.8
Two or more races	102	2
<i>Race alone or in combination with one or more other races</i>		
White	4,808	95.4
Black or African American	37	0.7
American Indian and Alaska Native	94	1.9
Asian	18	0.4
Native Hawaiian and Other Pacific Islander	13	0.3
Some other race	181	3.6
HISPANIC OR LATINO AND RACE		
Total population	5,041	100
Hispanic or Latino (of any race)	488	9.7
Mexican	372	7.4
Puerto Rican	17	0.3
Cuban	4	0.1
Other Hispanic or Latino	95	1.9
Not Hispanic or Latino	4,553	90.3
White alone	4,413	87.5

Source: U.S. Census Data, 2000.

C1.3 Vulnerable populations

It is important to note that within a population there are individuals and groups of individuals which are at increased risk or more Vulnerable to disease. Increased Vulnerability is dependent upon a number of factors that can be categorized as demographic factors, genetic factors, and acquired factors.

Demographic factors include age, sex, race and ethnicity. Age is an important factor in determining Vulnerability. As noted in the population/demographics section, the U.S. Census data for the 81635 zip code indicate that greater than 45% of the population, in the year 2000, may be considered to be more Vulnerable to certain exposures, based on age (26 % under the age of 18 and 19.8 % over the age of 65).

Acquired factors (pre-existing disease, and behaviors such as smoking history, alcohol use, pregnancy, and nutrition) and genetic factors require a more in-depth analysis of individual history, including detailed information such as lifestyle behaviors, occupation, and residential history. Although these factors can contribute significantly to a person's Vulnerability to disease, such information is not available to the HIA team.

C1.4 Cancer, Death, Birth, Hospital Inpatient Data

Data for Cancer, Inpatient Hospital Diagnoses, Mortality and Birth data are reported below.

C1.4.1 Cancer Data

The counts listed in the tables below provide a summary of disease frequency. The incidence analyses determine whether a certain number of diagnosed cancers is greater or less than expected, and whether that difference is statistically significant. The results do not allow conclusions to be made about causal relationships between exposure and any cancer.

Tables 2-4 display the number of diagnosed cancers (types) in the Battlement Mesa/Parachute zip codes, the expected number of cases based on the population of male and female residents, stratified by race and age, and the calculated standardized incidence ratios with 95% CIs.

Male/Female Cancers Combined- As displayed in Table 2, the five most common cancers diagnosed in the Battlement Mesa/Parachute zip code during the 1998-2008 time period were prostate, breast, lung, colorectal, and melanoma. (Table 2) The only statistically significant difference between the number of diagnosed cancers and the number of expected cancers was shown for prostate cancer. Over the 10-year period, 79 cases of prostate cancer were diagnosed, compared to the calculated 61.897 expected cases, which yielded a ratio of 1.28 and a confidence interval of 1.01-1.59. However, caution should be exercised when interpreting standardized incidence ratios based on a small number of cases. In this case, if 2 fewer cases of prostate cancer were diagnosed over the 10-year period, the standardized incidence ratio would not have been significant. In addition, when multiple independent tests are compared, there is a statistical chance that 5 % of the tests will be abnormal by chance alone.

Table 2- Number of Males and Females Diagnosed with Selected Cancers Compared to the Expected Number in Battlement Mesa/Parachute Zip Codes 81635 and 81636 by Cancer Site, 1998-2008

Cancer Site	Cancers Diagnosed	Cancers Expected	SIR	95% C.I.
Hodgkin Lymphoma	+	0.880	NC	NC
Non-Hodgkin Lymphoma	8	7.645	1.05	0.45-2.06
Multiple Myeloma	5	2.442	2.05	0.66-4.79
Leukemia	5	6.017	0.83	0.27-1.94
Lung	29	23.958	1.21	0.81-1.74
Melanoma	17	14.190	1.20	0.70-1.92
Prostate	79	61.897	1.28*	1.01-1.59
Bladder	13	13.200	0.99	0.52-1.68
Colorectal	20	19.954	1.00	0.61-1.55
Adrenal Gland	+	0.120	NC	NC
Hodgkin Lymphoma	+	0.880	NC	NC

+ = Data are not reported when the value for the time period is fewer than 3.

NC = Not calculated.

Note: diagnosed/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

* = ratio is statistically higher than expected

Source: Colorado Central Cancer Registry, Colorado Dept. of Public Health & Environment, July, 2010

Cancers (Male Group) – As displayed in Table 3, the five most common cancers diagnosed in **males** Battlement Mesa/Parachute zip code during the 1998-2008 time period were prostate, lung, colorectal, melanoma, and bladder. The only statistically significant difference between the number of diagnosed cancers and the number of expected cancers when adjusted for age, and race was calculated for prostate cancer.

Table 3 – Number of Males Diagnosed with Selected Cancers Compared to the Expected Number in Battlement Mesa/Parachute Zip Codes 81635 and 81636 by Cancer Site, 1998-2008

Cancer Site	Cancers Diagnosed	Cancers Expected	SIR	95% C.I.
Hodgkin Lymphoma	+	0.880	NC	NC
Non-Hodgkin Lymphoma	8	7.645	1.05	0.45-2.06
Multiple Myeloma	5	2.442	2.05	0.66-4.79
Leukemia	5	6.017	0.83	0.27-1.94
Lung	29	23.958	1.21	0.81-1.74
Melanoma	17	14.190	1.20	0.70-1.92
Prostate	79	61.897	1.28*	1.01-1.59
Bladder	13	13.200	0.99	0.52-1.68
Colorectal	20	19.954	1.00	0.61-1.55
Adrenal Gland	+	0.120	NC	NC

+ = Data are not reported when the value for the time period is fewer than 3.

NC = Not calculated.

Note: diagnosed/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

* = ratio is statistically higher than expected

Source: Colorado Central Cancer Registry, Colorado Dept. of Public Health & Environment, July, 2010

Cancers (Female Group) - As displayed in Table 4, the five most common cancers diagnosed in **females** Battlement Mesa/Parachute zip code during the 1998-2008 time period were breast, lung, colorectal, melanoma, and bladder. No statistically significant differences were observed between the number of diagnosed cancers and the number of expected cancers when adjusted for age and race.

Table 4 - Number of Females Diagnosed with Selected Cancers Compared to the Expected Number in Battlement Mesa/Parachute Zip Codes 81635 and 81636 by Cancer Site, 1998-2008

Cancer Site	Cancers Diagnosed	Cancers Expected	SIR	95% C.I.
Hodgkin Lymphoma	+	0.693	NC	NC
Non-Hodgkin Lymphoma	4	6.215	0.64	0.18-1.65
Multiple Myeloma	+	1.562	NC	NC
Leukemia	+	3.773	NC	NC
Lung	19	18.656	1.02	0.61-1.59
Melanoma	7	9.218	0.76	0.31-1.57
Breast	56	56.452	0.99	0.75-1.29
Bladder	6	3.663	1.64	0.60-3.57
Colorectal	14	16.335	0.86	0.47-1.44
Adrenal Gland	+	0.088	NC	NC

+= Data are not reported when the value for the time period is fewer than 3.

NC = Not calculated.

Note: diagnosed/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

* = ratio is statistically higher than expected

Source: Colorado Central Cancer Registry, Colorado Dept. of Public Health & Environment, July, 2010

C1.4.2 Inpatient Hospital Diagnoses Data

The counts listed in the tables below provide a summary of inpatient hospital diagnoses data. The results provide a summary of diagnoses given patients while in the hospital. The results determine whether diagnoses are greater or less than expected, and whether that difference is statistically significant. The results do not allow conclusions to be made about causal relationships between exposure and any hospital diagnoses.

Tables 5-7 display the number of diagnoses in the Battlement Mesa/Parachute zip code, the expected number of diagnoses per category based on the population of male and female

residents, stratified by race and age, and the calculated standardized incidence ratios with 95% CIs

Inpatient Hospital Diagnoses (Male/Female Group) - As displayed in Table 5, there are no inpatient ICD-9 code groups in which the standardized incidence ratio is >1.00 and statistically significant. Table 5 does show ICD-9 groups with fewer diagnoses than expected that are statistically significant, those groups include:

- Depression
- Nervous system
 - brain and CNS
 - dizziness
 - vertigo
- Ear, nose, and throat (ENT)
- Vascular (blood vessel related)
 - cardiovascular
 - cardiac dysrhythmia (abnormal heart rhythm)
 - heart failure
 - hypertension (high blood pressure)
 - stroke
- Pulmonary
 - bronchospasm-airway obstruction
 - asthma
 - other diseases with symptoms of the lung

Table 5- Inpatient Hospital Diagnoses (male/female combine group) compared to expected number in Battlement Mesa/Parachute zip codes 81635 and 81636 by sex and selected diagnoses: Colorado residents, 1998-2008.

Disease	Hospitalizations	Expected	SIR	95% CI
Depression	491	569.16	0.86	0.79-0.94
Nervous system	377	427.229	0.88	0.8-0.98
Brain and Central Nervous System (CNS)	44	60.189	0.73	0.53-0.98
Peripheral Nervous System (PNS)	99	101.571	0.97	0.79-1.19
Headaches	47	49.115	0.96	0.7-1.27
Seizure, epilepsy	167	184.211	0.91	0.77-1.05
Dizziness, vertigo	40	60.106	0.67	0.48-0.91
Ear, Nose and Throat (ENT)	224	272.762	0.82	0.72-0.94
Vascular	2,454	2,897.65	0.85	0.81-0.88
Cardiovascular disease	891	1,120.45	0.8	0.74-0.85
Cardiac dysrhythmia	669	846.962	0.79	0.73-0.85
Heart failure	539	723.47	0.75	0.68-0.81
Hypertension	1,688	1,914.51	0.88	0.84-0.92
Stroke	202	234.681	0.86	0.75-0.99
Arterial disease	90	85.952	1.05	0.84-1.29
Pulmonary	1,184	1,402.48	0.84	0.8-0.89
Bronchospasm, airway obstruction	894	1,068.22	0.84	0.78-0.89
Chronic bronchitis	172	191.802	0.9	0.77-1.04
Asthma	307	348.671	0.88	0.78-0.98
Reactions to external agents	+	0.941	NC	NC
Other diseases, symptoms of the lung	384	494.032	0.78	0.7-0.86

+= Data are not reported when the value for the time period is fewer than 3.

NC = Not calculated.

Note: Expected counts computed by applying age-and sex-specific statewide mortality rates to 2000 based study population

Note: Hospitalizations/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

Note: A single hospitalization event may be represented in more than one diagnosis category.

Source: Hospital Discharge Data, Colorado Hospital Association

Prepared by: Health Statistics Section, Colorado Dept. of Public Health & Environment, July, 2010

Inpatient Hospital Diagnoses (Male Group) - As displayed in Table 6, there are no inpatient ICD-9 code groups in which the standardized incidence ratio is >1.00 and statistically significant. Table 6 does show ICD-9 groups with fewer diagnoses than expected that are statistically significant, those groups include:

- Depression
- Vascular disease
 - cardiovascular
 - heart failure
 - hypertension (high blood pressure)
- Pulmonary
 - bronchospasm-airway obstruction
 - chronic bronchitis
 - asthma
 - other diseases with symptoms of the lung

Table 6- Inpatient Hospital Diagnoses (male) compared to expected number in Battlement Mesa/Parachute zip codes 81635 and 81636 by sex and selected diagnoses: Colorado residents, 1998-2008.

Disease	Hospitalizations	Expected	SIR	95% CI
Depression	146	199.205	0.73	0.62-0.86
Nervous system	178	192.663	0.92	0.79-1.07
Brain and CNS	19	29.116	0.65	0.39-1.02
PNS	55	48.653	1.13	0.85-1.47
Headaches	13	9.316	1.4	0.74-2.39
Seizure, epilepsy	86	95.26	0.9	0.72-1.11
Dizziness, vertigo	15	22.243	0.67	0.38-1.11
ENT	112	123.6	0.91	0.75-1.09
Vascular	1,112	1,456.82	0.76	0.72-0.81
Cardiovascular disease	531	710.133	0.75	0.69-0.81
Cardiac dysrhythmia	336	466.968	0.72	0.64-0.8
Heart failure	233	368.404	0.63	0.55-0.72
Hypertension	696	867.24	0.8	0.74-0.86
Stroke	112	118.67	0.94	0.78-1.14
Arterial disease	47	50.935	0.92	0.68-1.23
Pulmonary	527	700.505	0.75	0.69-0.82
Bronchospasm, airway obstruction	376	536.028	0.7	0.63-0.78
Chronic bronchitis	72	104.377	0.69	0.54-0.87
Asthma	97	122.566	0.79	0.64-0.97
Reactions to external agents	+	0.541	NC	NC
Other diseases, symptoms of the lung	178	247.538	0.72	0.62-0.83

+ = Data are not reported when the value for the time period is fewer than 3.

NC = Not calculated.

Note: Expected counts computed by applying age-and sex-specific statewide mortality rates to 2000 based study population

Note: Hospitalizations/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

Note: A single hospitalization event may be represented in more than one diagnosis category.

Source: Hospital Discharge Data, Colorado Hospital Association

Prepared by: Health Statistics Section, Colorado Dept. of Public Health & Environment, July, 2010

Inpatient Hospital Diagnoses (Female Group) - As displayed in Table 7, there are no inpatient ICD-9 code groups in which the standardized incidence ratio is >1.00 and statistically significant. Table 7 does show ICD-9 groups with fewer diagnoses than expected that are statistically significant, those groups include:

- Nervous system diseases
- ENT
- Vascular disease
 - cardiovascular disease
 - cardiac dysrhythmia
 - heart failure
 - stroke
- Pulmonary disease

Table 7- Inpatient Hospital Diagnoses (female) compared to expected number, in Battlement Mesa/Parachute zip codes 81635 and 81636 by sex and selected diagnoses: Colorado residents, 1998-2008.

Disease	Hospitalizations	Expected	SIR	95% CI
Depression	345	365.566	0.94	0.85-1.05
Nervous system	199	235.072	0.85	0.73-0.97
Brain and CNS	25	31.015	0.81	0.52-1.19
PNS	44	52.968	0.83	0.6-1.12
Headaches	34	40.1	0.85	0.59-1.18
Seizure, epilepsy	81	90.114	0.9	0.71-1.12
Dizziness, vertigo	25	36.953	0.68	0.44-1
Ear, Nose, and Throat (ENT)	112	149.617	0.75	0.62-0.9
Vascular	1,342	1,448.91	0.93	0.88-0.98
Cardiovascular disease	360	436.398	0.82	0.74-0.91
Cardiac dysrhythmia	333	390.491	0.85	0.76-0.95
Heart failure	306	358.627	0.85	0.76-0.95
Hypertension	992	1,033.64	0.96	0.9-1.02
Stroke	90	117.158	0.77	0.62-0.94
Arterial disease	43	36.563	1.18	0.85-1.58
Pulmonary	657	717.134	0.92	0.85-0.99
Bronchospasm, airway obstruction	518	547.509	0.95	0.87-1.03
Chronic bronchitis	100	91.099	1.1	0.89-1.34
Asthma	210	225.193	0.93	0.81-1.07
Reactions to external agents	+	0.409	NC	NC
Other diseases, symptoms of the lung	206	248.615	0.83	0.72-0.95

+ = Data are not reported when the value for the time period is fewer than 3.

NC: Not calculated.

Note: Expected counts computed by applying age-and sex-specific statewide mortality rates to 2000 based study population

Note: Hospitalizations/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

Note: A single hospitalization event may be represented in more than one diagnosis category.

Source: Hospital Discharge Data, Colorado Hospital Association

Prepared by: Health Statistics Section, Colorado Dept. of Public Health & Environment, July, 2010

C1.4.3 Mortality Data

The counts listed in the tables below provide a summary of mortality data. The results determine whether deaths categorized by underlying disease are greater or less than expected, and whether that difference is statistical significant. The results do not allow conclusions to be made about causal relationships between exposure and any cancer.

Tables 8-10 display the number of deaths by underlying disease in the Battlement Mesa/Parachute zip code, the expected number of deaths based on the population of male and female residents, stratified by race and age, and the calculated SMRs with 95% CIs.

Mortality (Male/Female group combined) - As displayed in Table 5, there are no groups of underlying cause of death in which the SMR was >1.00 and was statistically significant. However, Table 5 does show two categories of underlying disease where there were fewer deaths than expected. The following categories were less than expected (statistically significant):

- Nervous system diseases
- Major cardiovascular disease

Table 8- Deaths (Males/Females) compared to expected number in Battlement Mesa/Parachute zip codes 81635 and 81636, by sex and selected underlying causes: Colorado residents, 1999-2009.

Disease	Deaths Observed	Expected Deaths	SMR	95% CI
Total deaths	381	499.799	0.76	0.69-0.84
Suicide	11	7.81	1.41	0.7-2.52
Nervous system diseases	18	30.724	0.59	0.35-0.93
Major cardiovascular diseases	114	162.546	0.7	0.58-0.84
Chronic lower respiratory diseases	27	37.062	0.73	0.48-1.06
Sudden Infant Death Syndrome (SIDS)	+	0.501	NC	NC
Cancers				
Breast	7	7.843	0.89	0.36-1.84
Prostate	7	7.12	0.98	0.4-2.03
Lung and bronchus	30	28.094	1.07	0.72-1.52
Colon/rectum	7	11.359	0.62	0.25-1.27
Melanoma	3	1.943	1.54	0.32-4/51
Bladder	+	2.712	NC	NC
Adrenal gland	+	0.1	NC	NC
Non-Hodgkin's lymphoma	4	4.654	0.86	0.23-2.2
Hodgkin's lymphoma	+	0.255	NC	NC
Multiple myeloma	3	2.446	1.23	0.25-3.58
Leukemia	4	4.68	0.85	0.23-2.19
Acute lymphocytic leukemia	0	0.261	NC	NC
Chronic lymphocytic leukemia	3	1.024	2.93	0.6-8.56
Acute myeloid leukemia	+	1.846	0.54	0.01-3.02
Chronic myeloid leukemia	+	0.277	NC	NC

+ = Data are not reported when the value for the time period is fewer than 3.

NC = Not calculated.

Note: Expected counts computed by applying age-and sex-specific statewide mortality rates to 2000 based study population

Note: Deaths/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

ICD-10 codes used to identify selected diagnoses¹¹⁷, Table C

Source: Health Statistics Section, Colorado Dept. of Public Health & Environment, July, 2010

Mortality (Male Group) - As displayed in Table 9, there were no groups of underlying cause of death in which the SMR was >1.00 and was statistically significant. There were also no groups of underlying disease in which the SMR was <1.00 and statistically significant.

Table 9- Deaths (Males) compared to expected number in Battlement Mesa/Parachute zip codes 81635 and 81636, by sex and selected underlying causes: Colorado residents, 1999-2008

Disease	Deaths Observed	Expected Deaths	SMR	95% CI
Total deaths	223	272.783	0.82	0.71-0.93
Suicide	9	6.295	1.43	0.65-2.71
Nervous system diseases	9	14.17	0.64	0.29-1.21
Major cardiovascular diseases	71	86.902	0.82	0.64-1.03
Chronic lower respiratory diseases	13	21.324	0.61	0.32-1.04
Sudden Infant Death Syndrome (SIDS)	+	NC	NC	NC
Cancers				
Breast	+	NC	NC	NC
Prostate	7	8.377	0.84	0.34-1.72
Lung and bronchus	21	16.728	1.26	0.78-1.92
Colon/rectum	4	6.355	0.63	0.17-1.61
Melanoma	+	1.373	NC	NC
Bladder	+	2.187	NC	NC
Adrenal gland	+	0.051	NC	NC
Non-Hodgkin's lymphoma	3	2.8	1.07	0.22-3.13
Hodgkin's lymphoma	+	0.165	NC	NC
Multiple myeloma	3	1.479	2.03	0.42-5.93
Leukemia	+	2.997	NC	NC
Acute lymphocytic leukemia	+	0.159	NC	NC
Chronic lymphocytic leukemia	+	NC	1.47	NC
Acute myeloid leukemia	+	NC	0.87	NC
Chronic myeloid leukemia	+	0.173	NC	NC

+ = Data are not reported when the value for the time period is fewer than 3.

NC = Not calculated.

Note: Expected counts computed by applying age-and sex-specific statewide mortality rates to 2000 based study population

Note: Deaths/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

ICD-10 codes used to identify selected diagnoses¹¹⁷, Table C

Source: Health Statistics Section, Colorado Dept. of Public Health & Environment, July, 2010

Mortality (Female Group) - As displayed in Table 10, there are no groups of underlying cause of death in which the SMR was >1.00 and was statistically significant. Table 10 shows that there were fewer total deaths and deaths due to cardiovascular disease than expected and this was statistically significant.

Table 10- Deaths (Female) compared to expected number in Battlement Mesa/Parachute zip codes 81635 and 81636, by sex and selected underlying causes: Colorado residents, 1999-2008

Disease	Deaths Observed	Expected Deaths	SMR	95% CI
Total deaths	158	231.569	0.68	0.58-0.8
Suicide	+	1.642	NC	NC
Nervous system diseases	9	16.36	0.55	0.25-1.04
Major cardiovascular diseases	43	76.496	0.56	0.41-0.76
Chronic lower respiratory diseases	14	16.667	0.84	0.46-1.41
Sudden Infant Death Syndrome (SIDS)	+	0.189	NC	NC
Cancers				
Breast	7	7.329	0.96	0.38-1.97
Prostate	+	0	NC	NC
Lung and bronchus	9	12.083	0.74	0.34-1.41
Colon/rectum	3	5.139	0.58	0.12-1.71
Melanoma	+	0.636	NC	NC
Bladder	+	0.73	NC	NC
Adrenal gland	+	0.049	NC	NC
Non-Hodgkin's lymphoma	+	1.97	NC	NC
Hodgkin's lymphoma	+	0.096	NC	NC
Multiple myeloma	+	1.03	NC	NC
Leukemia	+	1.857	NC	NC
Acute lymphocytic leukemia	+	0.113	NC	NC
Chronic lymphocytic leukemia	+	0.38	NC	NC
Acute myeloid leukemia	+	0.759	NC	NC
Chronic myeloid leukemia	+	0.112	NC	NC

+ = Data are not reported when the value for the time period is fewer than 3.

NC = Not calculated.

Note: Expected counts computed by applying age-and sex-specific statewide mortality rates to 2000 based study population

Note: Deaths/expected ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

ICD-10 codes used to identify selected diagnoses¹¹⁷, Table C

Source: Health Statistics Section, Colorado Dept. of Public Health & Environment, July, 2010

C1.1.4 Birth Outcome Data

The counts listed in the tables below provide a summary of birth outcome data. The results determine whether birth outcomes are greater or less than expected, and whether that difference is statistically significant. The results do not allow conclusions to be made about causal relationships between exposure and any birth outcome.

Table 11 presents a comparison of maternal age and race between the Battlement Mesa/Parachute zip code and the rest of Colorado.

Table 11- Maternal demographics in Battlement Mesa/Parachute zip codes 81635 and 81636 compared to Colorado, 1998-2008.

Race	Battlement Mesa/Parachute	Colorado
Hispanic	240 (23.98)	213842 (28.84)
White	727 (72.63)	455285 (61.41)
Other Race	34 (3.4)	72245 (9.74)
< 20 years	154 (15.38)	77679 (10.48)
20-40 years	833 (83.22)	643619 (86.81)
> 40 years	14 (1.4)	20074 (2.71)

Table 12 displays the number of a particular birth outcome observed in the Battlement Mesa/Parachute zip code, the expected number of birth outcomes, based on the number of total births in the Battlement Mesa/Parachute zip code, stratified by maternal race and age, and the calculated standardized incidence ratios with 95% CIs

As displayed in Table 12, there are no birth outcomes for which the standardized incidence ratio is >1.00 or <1.00 and statistically significant. There is no statistical difference between the number of negative birth outcomes observed and the number expected.

Table 12- Negative birth outcomes compared to expected number in Battlement Mesa/Parachute zip codes 81635 and 81636 to Colorado residents, 1998-2008.

Outcome	Observed	Expected	SIR	95% CI
Preterm Birth	92	93	0.99	0.68 – 1.4
Low Birth Weight	30	34	0.88	0.43-1.6

Note: Expected counts computed by applying age-and race-specific statewide incidence rates to births in zip codes 81635 and 81636 between 1998 and 2008

Note: standardized incidence ratios that have a 95% confidence interval that brackets the value 1.00 are not considered statistically high or low.

Source: Data from Colorado Birth Registry provided by: Health Statistics Section, Colorado Dept. of Public Health & Environment, July, 2010

C.1.5 Health Data Gaps/Limitations

In determining baseline health for the Battlement Mesa/parachute area, it was not possible to obtain some important information regarding physical health. This missing information is referred to as *Data Gaps*.

Some medical conditions are routinely treated on an outpatient basis, with rare hospital admissions. Asthma, hypertension, diabetes, mental health disorders and other conditions are such examples. While we made several attempts to obtain outpatient and emergency department information, it was not possible to do so in the time frame of this report. Therefore, this information is not included in the baseline health assessment. In addition, we was unable to include injury information in the baseline health assessment. Injury information is best found in emergency room data, outpatient and occupational health clinics.

All data sets have important limitations. It is important to understand the limitations of the data that was used for this baseline health assessment. Understanding the limitations helps researchers and readers interpret the data correctly.

C1.5.1 Cancer data

Cancers may sometimes be associated with residential history, lifestyle behaviors, occupation, or genetics. Cancers are typically diseases of long latency, often years to decades, therefore current incidence is not necessarily indicative of current exposure. We did not have information regarding individual residential history, lifestyle behaviors, occupation, or genetics.

C1.5.2 Inpatient hospitalization data

Hospital discharge records do not capture information about personal risk factors, such as weight, smoking, family medical history, which are all important in considerations when assessing health. Hospital discharge records often contain detailed information for each patient discharge record, such as demographic information, however, we did not have access to hospital discharge records, and therefore no demographic information was obtained.

Some diseases may take years to be actively reflected hospital diagnoses numbers. As mentioned above these diseases may be treated primarily on an outpatient basis and are therefore not captured by hospital diagnoses. In addition, like cancer, some diseases have long latency and are not captured in hospital discharge records until years after pertinent exposures.

Medical practice patterns and payment mechanisms may affect decisions by healthcare providers to hospitalize patients, to correctly diagnose disease, and/or to list the condition as a discharge diagnoses.

The ICD-9 codes abstracted from the discharge records include all diagnoses made during that particular hospital stay. As a consequence of this method, the sum of the diagnoses across a series of diagnosis subcategories (i.e. stroke, cardiovascular disease) may be greater than the total count for a parent category (i.e. vascular disease) because a single hospitalization record may have provided more than one subcategory when containing multiple diagnoses. It should also be noted, that it is possible that a patient was admitted more than once during our time frame and therefore the diagnoses associated with that patient would have been counted more than once. Diagnoses, therefore, may be higher than prevalence of disease.

C1.5.3 Mortality Data

Mortality data provide information on fatal illness only, not on current rate of disease. In addition, there are often multiple causes that act synergistically to cause death, or the cause of death is not clear. For this analysis, only the primary cause of death was considered.

C1.5.4 Birth Data

Birth data provide information from birth certificate, which may not have been verified and are not always consistently recorded. They do reflect the current rate of disease. In addition, there are often multiple causes that act synergistically to cause negative birth outcome.

C1.6 Conclusions for Physical Health

In order to provide the residents of Battlement Mesa with a baseline picture of physical health, the CSPH obtained analyzed data from state and hospital databases, as well as birth outcomes data, from CDPHE.

For the time period of 1998-2008 the Battlement Mesa/Parachute residents were found to be in better health than people of similar age, race and gender elsewhere in the state of Colorado. The slightly higher than expected rate of prostate cancer is felt to be a chance occurrence. The residents of Battlement Mesa had the same number or fewer as expected of other common cancers and leukemia; the same number or fewer than expected hospital discharge diagnoses related to depression, nervous system conditions, ear/nose/throat conditions, vascular conditions, and pulmonary conditions. These residents also had the same as expected or fewer than expected total deaths and deaths related to suicide, nervous system diseases, cardiovascular diseases, chronic lower respiratory diseases, and sudden infant death syndrome, as well as common cancers. Finally, the negative birth outcomes preterm birth, low birth weight, and congenital malformations all occurred at rates no higher or lower than those elsewhere in Colorado.

Data gaps and limitations make this baseline profile incomplete. Future investigations should focus on establishing data sharing agreements with local hospitals to obtain emergency room and outpatient data. Furthermore, collection of primary data, through surveys, medical record review and reanalysis of existing databases would also yield a more complete picture of physical health in Battlement Mesa.

C2 Measures of Community Health

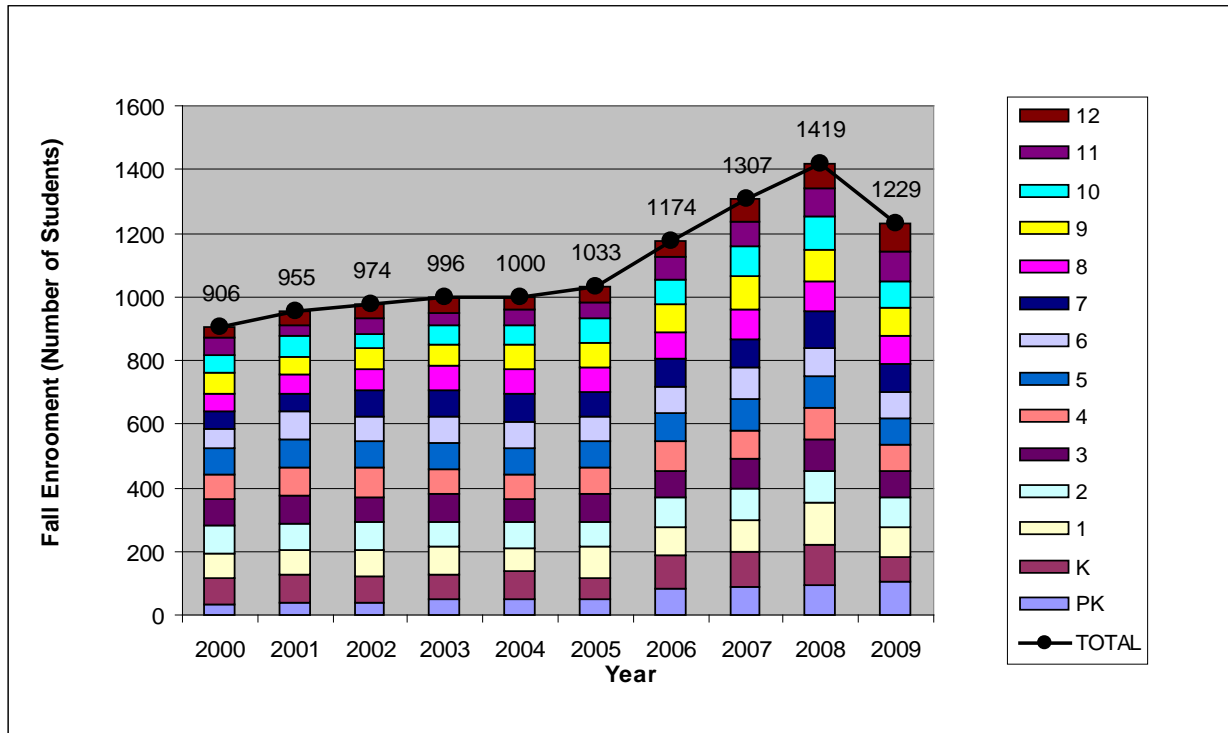
The following sections summarize key data evaluations conducted as part of the Community Wellness Assessment.

C2.1 Education/School Enrollment

Education for children in the towns of Battlement Mesa and Parachute is provided by Garfield County School District 16. Currently, the district is comprised of four schools, Grand Valley High School (9th-12th), Grand Valley Middle School (6th-8th), St. John Elementary School (4th-5th), and Bea Underwood Elementary School (1st-3rd). Additionally, the Grand Valley Center for Family Learning hosts the districts Head Start, Pre-Kindergarten and Kindergarten programs¹¹⁸.

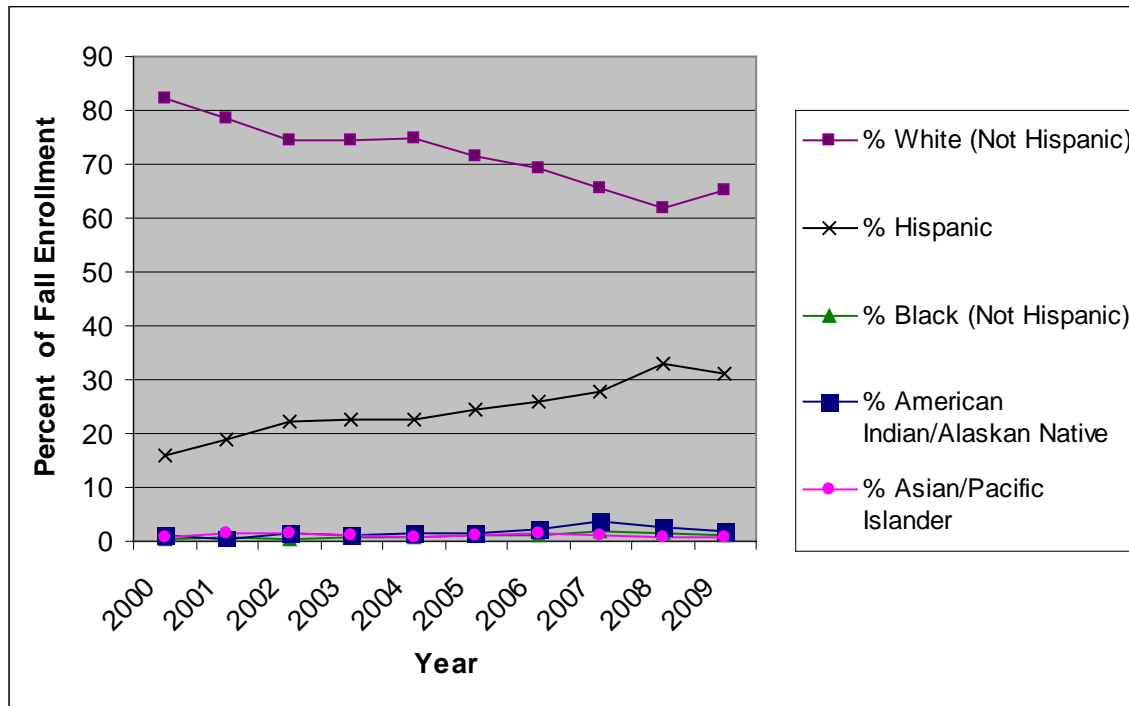
Data on school enrollment was collected from the Colorado Department of Education (http://www.cde.state.co.us/index_stats.htm). In 2009, there were 1,229 students enrolled in the district, an increase of 19.0% since 2005 and 35.7% since 2000. Figure 1 displays annual district enrollment stratified by grade. While total enrollment has increased significantly, with an increase of nearly 400 students during the period 2005-2008, proportional enrollment by grade appears to have remained relatively stable.

Figure 1: Garfield County District 16, School Enrollment by Grade 2000-2009



Since 2000, there has been a change in the racial and ethnic profile of students enrolled in the district schools (Figure 2). The percentage of Hispanic children has doubled from approximately 15% in 2000 to 30% in 2009. At the same time, the percentage of White children has decreased from 82% to 65%. Proportions of African American, American Indian, and Asian children have remained relatively stable.

Figure 2: Garfield County School District 16, Enrollment by Race/Ethnicity 2000-2009



C2.2 Crime

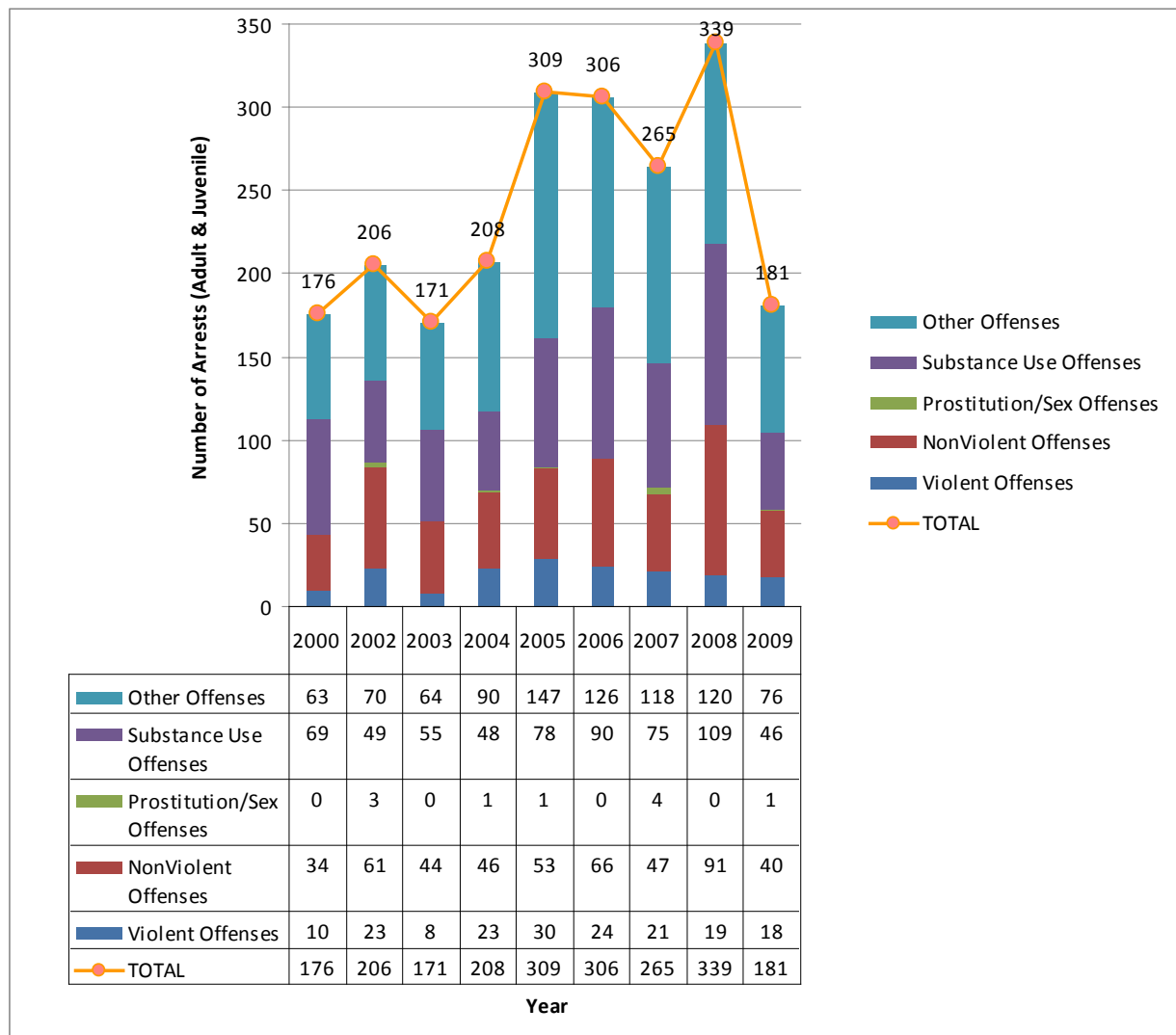
Data on criminal activity is publically available through the Colorado Bureau of Investigation (CBI) in the annual Crime in Colorado report. All Colorado law enforcement agencies are required to submit crime and arrest data to the CBI through the federally mandated Uniform Crime Reporting (UCR) Program. Incident data follow the national UCR Summary Hierarchy Rules and the National Incident-Based Reporting System (NIBRS) reporting and counting guidelines, broadly interpreted to mean the arrest for the most serious charge is counted¹¹⁹.

Due to its unincorporated status and lack of a designated police force, criminal investigation for events in the Battlement Mesa PUD is under the jurisdiction of the Garfield County Sheriff's Office (GCSO). Statistics for crimes occurring in Battlement Mesa are reported to CBI by the GCSO and thus become part of the larger pool of data reported to the NIBRS database by that agency. For this HIA report, the GCSO was contacted and agreed to attempt retrieval of crime statistics specific to Battlement Mesa. These attempts were not successful due to recent changes in their internal electronic systems and also restrictions on mechanisms for agencies to retrieve data from the NIBRS system. The neighboring town of Parachute, which shares a zip-code with Battlement Mesa, operates a stand-alone police department and maintains NIBRS reporting separate from the GCSO. Due to its close proximity and similar community composition, CBI data from the Parachute PD was analyzed as a surrogate for criminal activity in Battlement Mesa. These data may also include crime occurring in Battlement Mesa which the Parachute Police force responded to and resolved. Adult and juvenile arrests were included.

In Figure 3 below, violent arrests consisted of crimes such as assault and forcible rape, nonviolent arrests included crimes like burglary, theft and vandalism, substance use offenses

included DUI and drug violations. The category of other arrests was not well-characterized in the source data, but includes various and numerous other crimes such as weapons offenses, fraud and forgery. There is no consistent trend apparent across the entire period of 2000-2009; however crime rates appear somewhat elevated during the period 2005-2008, then decreased to baseline frequency in 2009. This includes clear increases in the categories of substance abuse and other offences. While these data are not sufficient to establish a causal relationship between the boom of drilling activity in 2003 and crime rates, the higher crime numbers over the 2005-2008 period suggest additional monitoring in this area is warranted during times of high industry activity and in-migration of workers and other population shifts. Though not possible to do with publically available data, evaluation of crime rates by season or month may facilitate better understanding of whether criminal activity is correlated with increased drilling activity and workforce numbers.

Figure 3: Arrests Recorded by the Parachute Police Department, 2000-2009*



*2001 data not available

C2.3 Mental Health, Substance Abuse and Suicide:

Significant efforts were made to obtain data on mental health, substance abuse and suicide specific to residents of Battlement Mesa. We identified the Colorado West Regional Mental Health, Inc. as a potential source of this information due to their wide-reach in the region with numerous local outpatient clinics, including Rifle and Glenwood Springs¹²⁰. Outpatient services offered by Colorado West include key treatment approaches for mental health such as, emergency and critical incident consultation, counseling for families, children & adults, psychiatric evaluation and medication management, as well as being a major provider of Employee Assistance Programs. While data on clinical usage and outpatient visits is maintained centrally across all clinics in the Colorado West system, they were unable to provide data for analysis requested for this project due to recent changes in their electronic system rendering retrospective data inaccessible in the time-frame required for this report. Colorado West and the authors of this report are also aware of the highly sensitive nature of data on mental health measures, and were prepared to implement information sharing agreements as necessary to safeguard any identifying protected health information.

As primary data from Colorado West was not available, nor does Colorado West track visit data specific to substance abuse, Community Health Initiative (CHI) was identified as a potential source of baseline data on this topic¹²¹. CHI is a public service organization with locations in Glenwood Springs and Carbondale. Working with partners from area agencies and organizations, such as Garfield County's Public Health Department and School District, its primary mission involves reducing substance abuse by sponsoring workplace and community prevention programs and providing outpatient treatment services for youth. While primary data were not available from CHI, several reports are publically available which detail recent projects in community prevention and provide summary statistics for measures pertaining to these issues.

One of these reports is the Garfield County Public Health Department's 2006 assessment on community needs⁸¹. Through their Health and Quality of Life Survey, conducted during the period of September-October 2005, the GCPH identified four types of health/quality-of-life problems most common to survey respondents. One of these common issues was the challenge associated with mental health and substance abuse. This topic was identified to be widespread across households of Garfield County, affecting a greater number of households than issues pertaining to medical/dental service access or environmental risk. Further, the survey found that when respondents reported mental health problems (defined as experiencing depression or stress), they also reported issues with substance abuse in the home and difficulties/restrictions to engaging in physical activity. Within the mental health and substance abuse domains, depression, anxiety and stress along with tobacco smoking and alcohol abuse were the top indicators of the burden of these conditions (Table 13).

Table 13: Data from the Garfield County Public Health Department 2006 Community Needs Survey

Health/Quality of Life Domain Assessed	Three Most Prevalent Conditions Reported	% All Respondents (n=740)
Household with member(s) affected by mental health issues	a) Depression/anxiety	17.2%
	b) Stress	15.4%
	c) Eating disorders	3.0%
Household with member(s) affected by substances abuse issues	a) Smoking using tobacco	10.4%
	b) Alcohol abuse	6.9%
	c) Drug abuse	1.5%

It is important to note that the survey respondents were self-selected through survey distribution at libraries, city halls, community centers, health clinics, and mailings to some randomly selected homes. Thus, the respondents did not represent a statistically chosen sample of Garfield County, however the authors noted that response came from a wide-range of individuals and were probably the “most valid information available on residents’ health and quality-of-life experiences.”

Another study available through CHI provides an analysis of discharge data from four Garfield County regional hospitals during the period 2003-2005 for persons whose diagnoses included either alcohol/drug abuse or suicidal behavior⁸². This study showed that of the 275 persons attributed to these discharge diagnoses during this period, 47 (17.1%) had an alcohol/drug abuse diagnosis and 228 (82.9%) had a diagnosis of suicidal behavior. (Table 14) This study only looked at count data of hospital admissions, so we cannot assess trends or compare rates of these conditions to expected rates or rates of other discharge diagnoses. While these data cannot be attributed directly to residents of Battlement Mesa, they suggest that substance abuse and suicidal ideation exist in the surrounding community. As such, they should be monitored and prevention measures should be implemented where possible.

Table 14: Data from the Garfield County Colorado Prevention Partners 2006 Local Needs Assessment Report on Alcohol./Drug Abuse and Suicidal Behavior

Hospital	Diagnostic Group		Total
	Alcohol/Drug Abuse	Suicidal Behavior	
Aspen Valley Hospital	12	32	44
Grand River Medical Center	0	8	8
Vail Valley Medical Center	17	133	150
Valley View Hospital	18	55	73
Total	47 (17.1%)	228 (82.9%)	275

Further analysis in this report showed fewer admissions for alcohol/substance abuse and suicidal behavior treatment during the summer months, with the highest numbers occurring in December and the late winter months. Also seen in this data were that significantly more men were treated for substance abuse and significantly more women for suicidal behavior; the mean ages of the two diagnoses groups were 41 and 39 respectively.

C2.4 Sexually Transmitted Infections

In Colorado, several sexually transmitted infections (STIs) are reportable to the state health department, including Chlamydia, Gonorrhea, Syphilis and HIV. De-identified sexually transmitted infection data were available by request from the Colorado Department of Public Health and Environment (CDPHE). Incident sexually transmitted infection cases were obtained for the years 2005-2009 for all zip codes in Garfield County.

Table 15 displays frequency of cases for the two sexually transmitted infection's of greatest prevalence in Battlement Mesa and Garfield County. Due to small numbers, it is difficult to draw conclusions about proportion or distribution of cases among Battlement Mesa residents, or make valid comparisons to a larger cohort such as Garfield County. However, these data show that Chlamydia is more prevalent in the female population, with between 70-85% of the Garfield County cases and 60-100% of the Battlement Mesa cases occurring in females. During the period 2005-2007, between 46-60% of Gonorrhea case occurred in Garfield County females, yet that proportion has decreased to around 20% in recent years. A similar assessment of Battlement Mesa cases cannot be made due to low numbers.

Table 15: Chlamydia and Gonorrhea Cases by Gender, Garfield County and Battlement Mesa, 2005-2009

sexually transmitted infection	Year	Garfield County N (% of Total)			Battlement Mesa N (% of Total)		
		Male	Female	Total N	Male	Female	Total N
Chlamydia	2005	13 (25.0)	39 (75.0)	52	2 (33.3)	4 (66.7)	6
	2006	12 (16.7)	60 (83.3)	72	0 (0.0)	6 (100.0)	6
	2007	25 (28.1)	64 (71.9)	89	7 (36.8)	12 (63.2)	19
	2008	27 (22.5)	93 (77.5)	120	0 (0.0)	10 (100.0)	10
	2009	21 (29.2)	51 (70.8)	72	1 (10.0)	9 (90.0)	10
Gonorrhea	2005	2 (50.0)	2 (50.0)	4	1 (100)	0 (0)	1
	2006	4 (40.0)	6 (60.0)	10	0 (0)	1 (100)	1
	2007	7 (53.9)	6 (46.1)	13	0 (n/a)	0 (n/a)	0
	2008	4 (80.0)	1 (20.0)	5	0 (n/a)	0 (n/a)	0
	2009	3 (75.0)	1 (25.0)	4	1 (100)	0 (0)	1

Using epidemiologic methods described below, we calculated rates of sexually transmitted infection for Battlement Mesa residents (defined as zip codes 81635 and 81636) as well rates for all residents of Garfield County combined.

Rather than assess only a count of the number of cases, evaluating a rate provides perspective on the measure of the frequency with which a disease occurs in a population over a specified period of time. Population incidence rates can be calculated using the number of new cases observed in the numerator and the mid-year population as the denominator. Using this method, sexually transmitted infection rates for Garfield County were calculated using population estimates from the U.S. Census Bureau, which produces annual mid-year estimates of total population for states, counties and other sub-county units (Table 16)¹¹⁶. For the period 2005-2009, these population estimates were derived from 2000 U.S. Census base data.

Within the Garfield County sexually transmitted infection dataset, Battlement Mesas cases were defined as occurring for residents of zip codes 81635 and 81636. Zip code 81635 denotes physical addresses in both the Battlement Mesa and the town of Parachute, while 81636 is used solely for Post Office (PO) boxes. Because the town of Parachute shares a zip code with Battlement Mesa, we were not able to exclude the population from these analyses. Because U.S. Census Bureau mid-year population estimates are not available for unincorporated places, such as the Battlement Mesa PUD, the population for 2005-2009 was calculated using the equivalent percentage changes as provided for Garfield County, described above and in Table 16.

Table 4: Population Estimates for Garfield County and the Battlement Mesa PUD, 2005-2009

	2000 U.S. Census Population Estimate	2005	2006	2007	2008	2009
Garfield County Population Est. Provided by the US Census	43,791	49,177	51,111	52,965	54,838	56,298
Percent Change in Garfield County Population, Calculated & Applied to Battlement Mesa	(Baseline)	12.3 %	3.93 %	3.63 %	3.54 %	2.66 %
Battlement Mesa PUD Population Est.	5,041	5,661	5,884	6,097	6,313	6,481

Because the oil & gas industry boom occurred in 2003, in-migrant populations who have since remained in Garfield County and Battlement Mesas were not counted in the 2000 Census data. As such, these mid-year population estimates may be underestimate of the true population levels and may potentially inflate the observed the rates. Additionally, these population estimates for are not age adjusted. Never-the-less, this method represents the most accurate estimate available to assess trends in sexually transmitted infection incidence rates over time.

Garfield County experienced a steady increase in Chlamydia rates for the period 2005-2008, yet there was a noticeable decline in incidence in 2009. (Figure 4) In comparison, Battlement Mesa residents experienced stable rates of Chlamydia in 2005-06, yet saw a sharp increase in the case rate in 2007, which then decreased and remained stable in 2008-09. (Figure 5) In tandem with the increase of Chlamydia, rates of new Gonorrhea also increased significantly in Garfield County from 8 cases/100,00 population in 2005 to 25 cases/100,000 population in 2007, but declined and have remained stable since 2008. (Figure 4) The Gonorrhea case rate for Battlement Mesa did not experience the same trend, and has not increased over 18 cases per 100,000 population since 2005, the equivalent of < 1 case per 5,000 people. (Figure 5) It is worth noting that the numbers of cases for Battlement Mesa are very small, making it difficult to assess population trends and comparison with the larger cohort of Garfield County. Rates of Syphilis and HIV are extremely low for both Garfield County and Battlement Mesa. In fact, there were no cases of either recorded for residents of Battlement Mesa during this evaluation period.

Figure 4: Rates of Sexually Transmitted Infection, Garfield County, 2005-2009

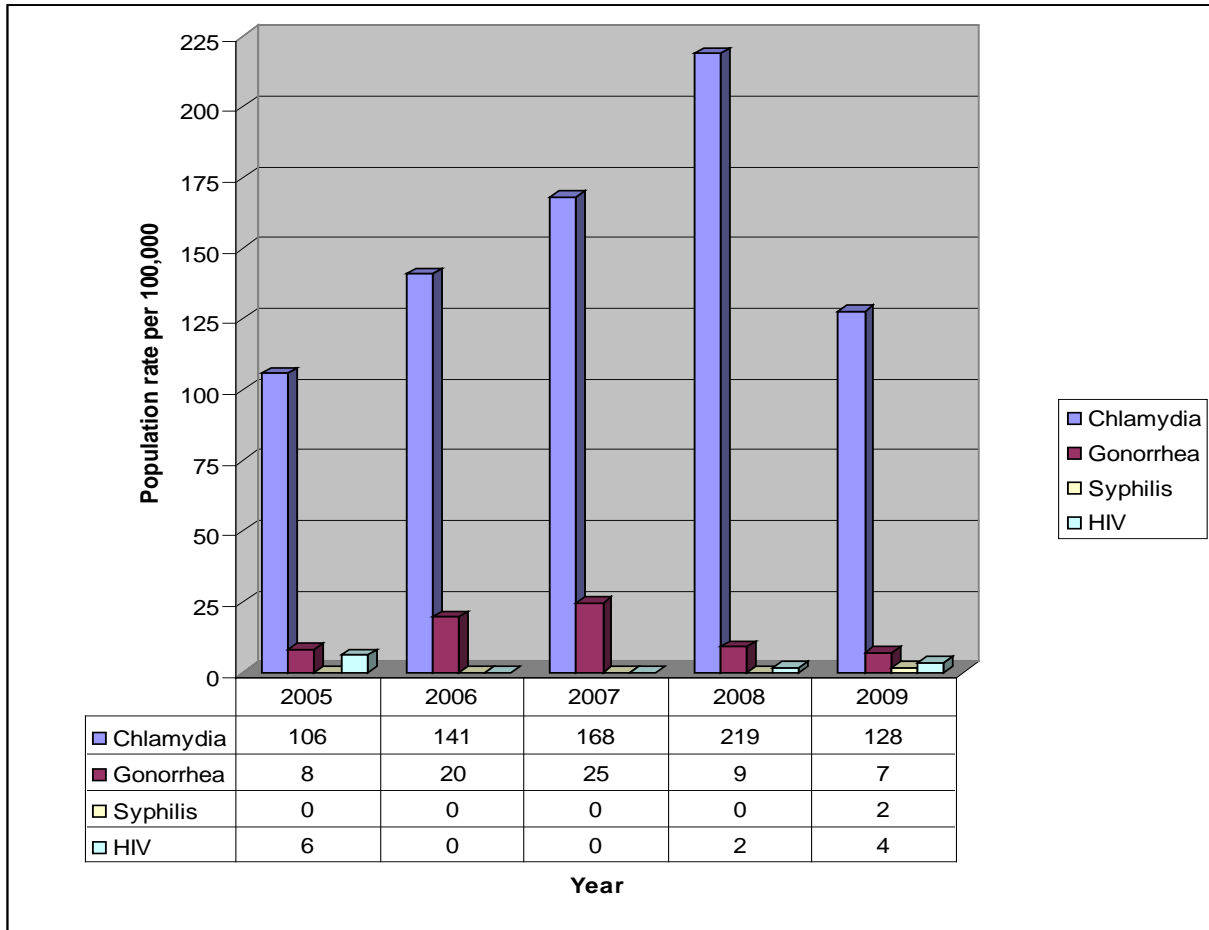
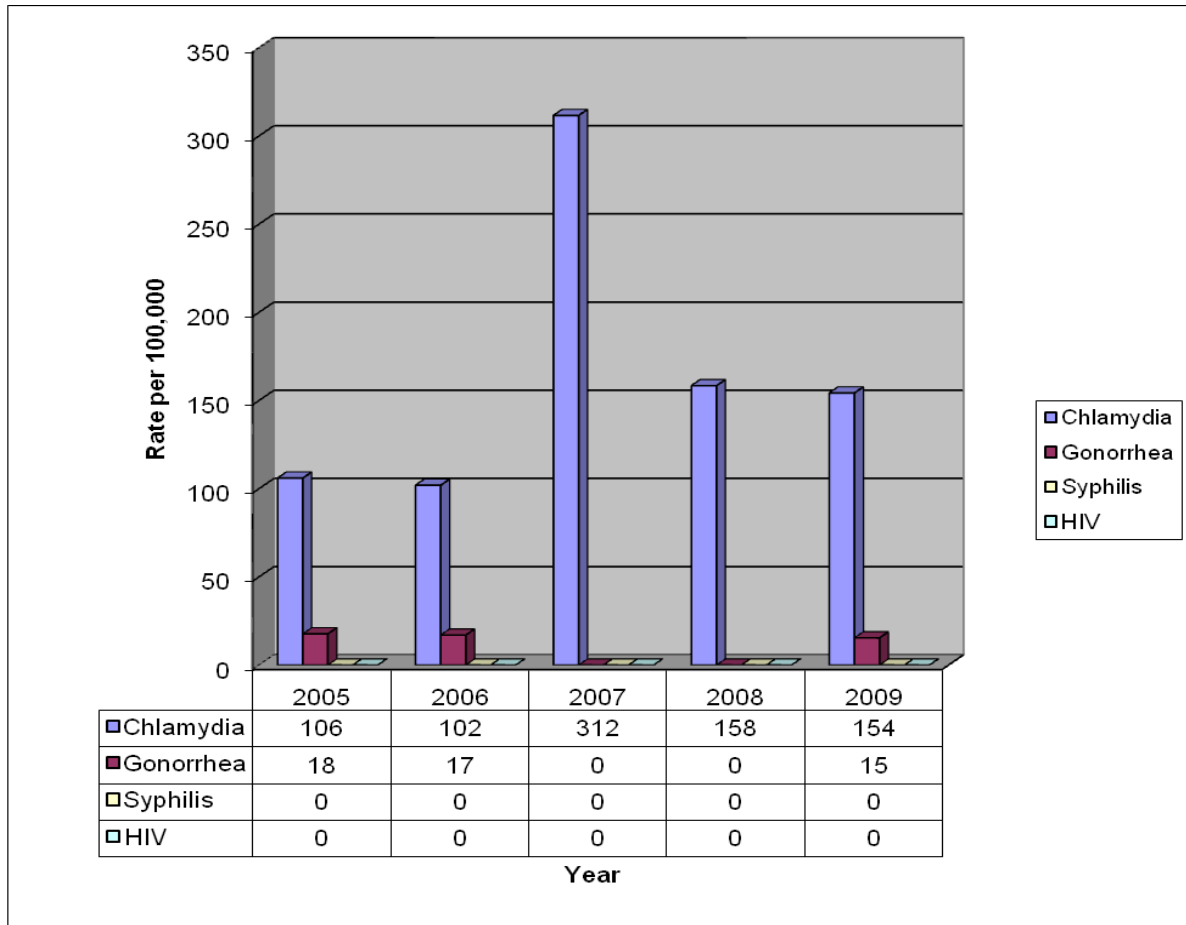


Figure 5: Rates of Sexually Transmitted Infection, Battlement Mesa Zip Codes 81635 & 81636, 2005-2009



C2.5 Limitations of Social Determinants of Health

Data on measures of community well-being are rife with limitations, with the repeating theme being lack of primary data available for systematic review and analysis, especially at the level of a small community such as Battlement Mesa. For many key-indicators of community health, aggregate data may very well be available at the county, state or national level, yet these may not be representative of the local community due to local customs, culture and social structure in place in microcosms of a bigger community. In this case report, data sources were mostly limited to Garfield County and we were unable to locate data specific to the residents and the localized area of the Battlement Mesa PUD. Some additional limitations are as follows:

- U.S. Census and other types of nationally compiled statistics are not available to the level of unincorporated areas, such as the Battlement Mesa PUD. Incorporating the Battlement Mesa PUD may increase access to health statistics collected and disseminated by the federal government.

- Data on student-teacher ratios for the local school district are not publically available beyond 2004, and so are not included as part of this baseline assessment. This information is crucial in order to fully characterize impact of the project on the local education system.
- While crime statistics from the Parachute Police Department represent a reasonable surrogate for the Battlement Mesa PUD, it is not possible to assess data only on crimes specifically occurring in Battlement Mesa. With publically available data, it is also not possible to evaluate criminal conduct on the basis of residence location or length of residence.
- Community level data on outpatient treatment for mental health, substance abuse and suicide are not readily available for public access. Analysis of hospital discharge data (in-patient) may provide additional perspective on the burden of these conditions.
- While local data on sexually transmitted infections was available, incidence rates were calculated using population estimates, which may not accurately reflect the true population at any given time. It is also difficult to assess statistical significance of the sexually transmitted infection data due to very low numbers.

C2.6 Summary and Conclusions for Social Determinants of Health

Systematic collection of measures of community health, cohesion and well-being in Battlement Mesa being are not being conducted. Of all the potential indicators of community health, only certain data were publically available and readily accessible in the time frame of this project to evaluate the health of residents in the Battlement Mesa PUD. As such, we were able to analyze data on education, criminal activity and sexually transmitted infections, obtained through web-based reports or by request of local agencies. The years 2005-2008 appear to be a period of increase for all three of these indicators, with apparent rises in local school enrollment as well as criminal activity. Incidence rates of sexually transmitted infection in Garfield County (Chlamydia and Gonorrhea) also increased during this period, accompanied by a noteworthy increase in the rate of Chlamydia observed in the Battlement Mesa population in 2007. Numbers in all categories appear to decrease in 2009. The mechanisms for obtaining and reviewing the community health indicators of education, crime and sexually transmitted infection are adequate for timely and prospective monitoring. Comparative review of these data should continue in a similar fashion to evaluate any changes and trends. Future analysis should focus on potential causal associations correlated with shifts in population or community environment that may be brought about by nearby industrial development.

Longitudinal source data for mental health, substance abuse and suicide were not available for analysis, however the 2006 survey data indicates upwards of 17% of residents were burdened by one of these conditions. Additional efforts to evaluate these issues should focus on pursuit of a relevant data source for outpatient visits or investigation of another source for surrogate data that are representative of these measures.