

# DEPARTMENT OF HEALTH

## **Tamaqua Area Cancer Incidence Study; 1996 through 2002**

Bureau of Epidemiology  
Pennsylvania Department of Health

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Cancer incidence was examined by looking at the distribution of cases by type for Carbon, Luzerne and Schuylkill Counties. Cases diagnosed between 1996 and 2002 were sorted and the distributions expressed as percentages of total cases [Table1]. These were compared to the distribution for Pennsylvania. Also, cancer rates were examined for each county, as well as for each of the 80 zip code areas; each was compared to the respective Pennsylvania rate, for the 1996-2002 period. This provided a measure of risk for each study population. In response to the community, the numbers of cases occurring in the Counties' municipalities was inspected. These counts were identified from the PADOH Bureau of Health Statistics and Research web site. Additionally, cancer death rates for the United States, Pennsylvania and the study counties were retrieved from the National Cancer Institute's web site and compared.

#### Study Populations

The study populations were defined as residents of the 80 zip codes which make-up Carbon (10), Luzerne (32), and Schuylkill (38) Counties [Figure 1]. Zip codes rather than municipalities were used for the analyses because frequently the name of the municipality shown on the medical record is in error. The municipality indicated often designates the location of the post office and/or a neighboring city or borough, not where the case actually resided. Because every case has a zip code and they are considered to be correct, zip codes were used to locate cases and identify study populations. The U.S. 2000 Census provided the basic population data; however, because census data does not contain the most *up-to-date* zip code area population estimates, the PADOH utilized a commercial data source, Claritas, Inc.

#### Identification of Study Cases

Cases were identified from the files of the Pennsylvania Cancer Registry (PCR). They were tabulated in accordance with the World Health Organization's (WHO) International Classification of Diseases for Oncology (ICD-O, Third Edition) site-coding definitions, used by the PADOH Bureau of Health Statistics and Research. These are consistent with other Pennsylvania Department of Health data summaries and reports. Cases are *primary* cancers only, and do not include metastatic cancers that had a point of origin elsewhere in body. A case was defined as a person diagnosed with cancer during the seven-year period between 1996 and 2002 that resided in one of the three counties at the time of diagnosis. With the WHO classifying polycythemia vera in 2000 from a neoplasm with a morphology code of *uncertain* behavior (M-9950/1) to one with *malignant* behavior (M-9950/3), the PADOH made polycythemia vera reportable to the PCR starting in January 2001; therefore, statistics presented are based on 2001 and 2002 cases only.

#### Identification of Deaths

To compare cancer death rates for Pennsylvania counties to the U.S., statistics maintained and published by the National Cancer Institute (NCI) were used. These were accessed from the NCI *State Cancer Profiles* on their web site through [cancer.gov](http://cancer.gov). These covered the 1997 to 2001 period and were all age-adjusted.

### Rates

Incidence rates were evaluated for the three counties and each of the 80 zip codes by calculating a statistic called the standardized morbidity ratio [SMR], which provides a measure of a cancer incidence rate relative to the state rate. The observed number of cases in each zip code area or county was compared to the number that would be expected [SMR= obs. cases/exp cases] if the study population had experienced the same incidence rate as Pennsylvania. Expected cases were determined by multiplying an area's population by the statewide incidence rate for the 1996-2002 period. This was performed separately for ten individual age groups (0-4, 5-14, 15-24,.....75-84,85+), and summed, to yield the total number of cancer cases *expected*. This was carried-out for males, females, and the total population. In addition, the actual statewide rate, as well as the age-adjusted rate, and crude rate (unadjusted) for each population were calculated and are expressed as the number of new cases diagnosed in the population per 100,000 residents in a year. The ratio of the age-adjusted rate for a county or zip code to the state rate also yields the SMR. The statistical significance of a higher or lower rate was determined and is noted by the *z* score, where a value of 1.96 or larger indicates that the difference between an area's rate (county or zip code) and the state is statistically significant.

### **Results**

Between 1996 and 2002 a total of 24,867 new cancer cases were diagnosed among residents of the three counties. The distribution of these cases by types are summarized and presented in Table 1. SMRs, and age-adjusted rates for the counties are presented in Tables 2 through 4. A total of 5,644 site, sex, and zip code-specific incidence rates were evaluated, and compared to site and sex-specific statewide Pennsylvania rates, for the same time period. These are described in the ten color-coded maps for Total Cancer, eight major types, and polycythemia vera. The complete set of 5,644 site, sex and zip code specific SMRs and rates are available but are not included in this publication.

#### **Distribution by Cancer Type**

Twenty-three (23) types plus polycythemia vera represented 23,020 cases or 92.6 percent of all cancers diagnosed between 1996 through 2002, among residents of the three counties [Table 1]. This included totals of 2,710, 15,003, and 7,154 cases from Carbon, Luzerne, and Schuylkill Counties,

respectively. An additional 1,847 cases or 7.4 percent were of other types, including cases with “unknown” primary site. During the 7-year period, 1996 to 2002, there were 492,952 new cases among citizens of the Commonwealth. The percentages shown in Table 1 are based on these respective totals. The four most common types, colon-rectum, lung, breast, and prostate cancer, accounted for over half (55.4 percent) of all new cases in the three county study area. Statewide they accounted for 278,317 or 56.5 percent of total cases. Overall, the percentages are remarkably similar when they are compared by cancer type. The differences between the state and the study counties were all 1.0 percent or less, with the exceptions of colon-rectum, breast, and prostate cancers. For colon-rectum cancers the proportions were for Pennsylvania and the counties, 12.8 percent compared to 13.4, 14.9, and 15.4, for Carbon, Luzerne, and Schuylkill Counties, respectively. For breast cancer the proportions were 14.2, compared to 13.0, 13.8, and 13.0 percent, and for prostate cancer the proportions were for Pennsylvania and the counties, 15.2 percent compared to 14.0, 11.8, and 12.6 percent for Carbon, Luzerne and Schuylkill Counties, respectively.

### **Incidence Rates**

Cancer incidence rates were calculated both for counties and for zip codes. County rates are described in Tables 2 through 4. Each table shows the county population, numbers of cancer cases diagnosed and expected between 1996 and 2002, and the SMR or ratio between the two. In addition, are the statewide rate (PA RATE), the (UNADJUSTED) rate for the county, and the age-adjusted rate for the county (AGE-ADJ RATE), all expressed as new cases per 100,000 residents per year. Zip code analyses are described in the maps that are color-coded to indicate if the rate is higher or lower than the state, and its statistical significance. Incidence rates for ten cancer sites were evaluated in relation to their geographic distribution using populations defined by zip code boundaries. Each zip code was examined in Carbon, Luzerne, and Schuylkill Counties. These are described in the accompanying ten maps.

#### Incidence Rates by County

Table 2 shows that the incidence rate (age-adjusted) for “All Sites” (total cancers) in Carbon County is essentially the same as the state 579.2 compared to 573.4 per 100,000 [SMR=2,710 obs/2682.7 exp =1.01]. While the County’s rates were not identical to the state, differences were not statistically significant with the exception of malignant melanoma of the skin with a rate 41 percent higher than the state [SMR= 99 obs/ 70.3 exp =1.41]. In Luzerne County the incidence rates for *All Sites* combined was not different from the state [SMR=1.01], but cancers of the stomach, colon-rectum, larynx, uterus, thyroid, leukemias, and polycythemia vera were each statistically higher than the respective Pennsylvania rate [Table 3], while cancers of the lung and prostate were significantly lower than the state rate. In Schuylkill County cancers of the oral cavity, colon-rectum, uterine cervix, and uterus were higher than the state and

statistically significant, and cancers of the liver, pancreas, lung in women, prostate, and Hodgkin's lymphoma were lower than the respective state rate and statistically significant [Table 4].

#### Incidence Rates by Zip Codes

##### *All Sites Combined*

Among the eighty zip codes examined, a pattern of elevated rates for *Total Cancer* (All Cancer Sites) was grouped in northeastern Luzerne County [Map 1]. Statistically significant areas included zip codes 18612, 18621, 18640, 18424 and 18702 corresponding to Hunlock, Dallas, Wilkes-Barre, Pittston and adjacent Moosic in Lackawanna County. The rates for zip code areas 18660 and 18201 were also elevated and statistically significant. These correspond to Nanticoke and Hazleton. In addition, eleven (11) zip codes in Luzerne County had rates statistically lower than the state. Four in Luzerne County were contiguous with several other zip codes in Schuylkill and Carbon Counties, also with lower rates. Together, these include zip codes; 18246, 18249, 18202, 18248, 17985, 18237, 18216.

##### *Colon-Rectum Cancers*

Incidence rates for invasive cases of colon-rectum cancer were higher for males and the total population in Luzerne County, and males and females in Schuylkill County compared to Pennsylvania. These reached statistical significance. Almost three-fourths (57) of the 80 zip code areas showed incidence rates higher than expected. Several were statistically significant; 18612, 18651, 18702, and 18201 in Luzerne County corresponding to Dallas, Plymouth, Wilkes-Barre and Hazleton; and in Schuylkill County zip codes 17941 and 17963 [Map 2].

##### *Lung Cancer*

Rates were significantly lower in Luzerne and Schuylkill Counties. Zip codes with elevated rates were seen in the Cities of Hazleton (zip code 18201), and Wilkes-Barre (zip code 18702) [Map 3]. At the same time, significantly lower rates were seen in zip codes 18706, 18707, 18708, 18635, 18246 and 18202 in Luzerne County, and in three zip codes in Carbon County, and one in Schuylkill County, corresponding to 18216, 18235, and 18058, and 17959 Schuylkill County.

##### *Breast Cancer*

The breast cancer incidence rate for women in Carbon County was about the same as women across the state (SMR=0.95 or nearly 1.00). This was true for Luzerne County (SMR=0.98), and Schuylkill County (SMR=0.96). There were no unique patterns by zip codes, though statistically significant rates were seen in zip code 18660 (higher), and in 18706, 18246, 18202, 17985, 18250, 18235, 18245, 17925, and 17963, all lower [Map 4].

### *Prostate Cancer*

A pattern of statistically significant lower rates for zip code areas was observed running through Luzerne and Schuylkill Counties, contributing to each county's overall lower incidence rate. The rates were 161.2 per 100,000 for Carbon County, 142.5 for Luzerne County, and 149.4 per 100,000 for Schuylkill County, compared to the state rate of 180.0 per 100,000 [Map 5].

### *Brain Cancer*

Zip code rates for males and females were unremarkable. This is reflected by the incidence rates in for each of the counties, all were within the ranges expected [Map 6].

### *Non-Hodgkins lymphoma*

There was no pattern to the distribution of higher and lower rates for zip codes within the three counties, however the two zip codes with statistically significant higher rates were in Luzerne County (18612 and 18201). Four zip codes had statistically significant lower rates compared to Pennsylvania; 18706, 18655, 18617, and 18202, while two were significantly higher than Pennsylvania's rate - 18612 and 18201 [Map 7].

### *Hodgkin's lymphoma*

Schuylkill County showed a rate significantly lower than the state (SMR=0.63). There was no pattern to the distribution of higher and lower rates for zip codes within the three counties [Map 8].

### *Leukemia*

All zip codes with rates significantly different from the state were located in Luzerne County [Map 9]. Three zip codes had significantly higher rates; 18201, 18621 and 18702, while zip code area 18202 and 18701 demonstrated a statistically significant lower leukemia incidence rate compared to Pennsylvania.

### *Polycythemia vera*

When viewed on a zip code specific basis, there were no areas that demonstrated statistically significant higher or lower rates [Map 10]. Countywide, only Luzerne County showed a statistically significant higher incidence rate, both for males and the total population, with the rate three times the state rate {SMR= 32 obs / 10.6 exp=3.01}.

Tables displaying the numbers of new cases, by type of cancer, for each of the 166 municipalities, within the three county-area are available from the Bureau of Health Statistics and Research in the Department of Health. Twenty-three types plus total cancers are shown for each of the municipalities. These 3,984 separate frequencies can be accessed from the Department of Health, Bureau of Health Statistics and Research, EpiQMS website; <http://app2.health.state.pa.us/epiqms/>. The number of cases varies greatly between municipalities; these are largely determined by the population size of each municipality.

#### Mortality Rates by Counties

The U.S. average-annual age-adjusted cancer death rates for the 1997 to 2001 time-period were compared to age-adjusted rates for Pennsylvania, and Carbon, Luzerne, and Schuylkill Counties. Fourteen different cancers, plus *All Cancers* were reviewed [Table 5]. Stomach cancer mortality was significantly higher in Luzerne County, while all three counties had colon-rectum cancer mortality rates higher than the U.S. Uterine cancer mortality was elevated in Luzerne and Schuylkill Counties, and statewide.

### **Discussion**

#### **Distribution by Cancer Type**

The types of cancer diagnosed, their relative frequencies, as well as the incidence rates for the counties and subdivisions have been described. In each county the distribution of cancer types relative to total cases mimics the state [Table1]. The differences between Pennsylvania and the three-county population were remarkably small - within one percent of each other. The exceptions were colon-rectum, breast, and prostate cancers. The number of cases identified in each county largely depends on the size of each population. Cancer screening rates can have a substantial impact on the numbers. This is particularly true for prostate cancer, where the number of cases reported to the PCR quickly grew following the introduction of the PSA test over a decade ago. In the three counties the proportions of prostate cases were smaller than the state as a whole, for Luzerne 11.8 percent, Schuylkill 12.6, and Carbon 14.0 percent, compared to Pennsylvania at 15.2 percent. This is most likely from differential screening rates.

#### **County Incidence Rates**

When *Carbon County's* rates were compared to Pennsylvania there were no differences that stood out; the SMRs [ratio of the county rate to the state rate] were all close to 1.00 [Table 2], the exception was malignant melanoma of the skin. The rate was 41 percent higher than the state [SMR=1.41] and statistically significant.

#### *Malignant Melanoma*

Principal risk factors are skin pigmentation, fair versus dark, history of freckles, presence of nevi and moles, and a history of sun exposure. All three probably contribute to the rate in this area. Malignant melanoma arises from pre-malignant lesions. Sun exposure and hormonal factors contribute to its development. Intermittent sun exposure with burning conveys the largest risk. There is a fair amount of evidence to indicate hormones play a role. Estrogen alone, and in combination with progesterone, stimulates the division of melanocytes. This is presumably the reason why hyper-pigmentation occurs in women taking oral contraceptives. Several studies confirm a gradient of risk among long-term users of birth control pills. Immune factors are probably important as transplant patients show higher risks.

In *Luzerne County* the incidence rate for *All Cancer Sites* was identical to the state [SMR=1.01], however there were several types with incidence rates that were higher and statistically significant. These included stomach cancer, 27 percent higher [SMR=1.27], colon-rectum cancer, 13 percent higher [SMR=1.13], larynx cancer, 23 percent [SMR=1.23], cancer of the uterus, 20 percent [SMR=1.20], thyroid cancer, 45 percent [SMR=1.45], leukemia, 19 percent higher [SMR=1.19], and polycythemia vera 201 percent higher [SMR=3.01], compared to Pennsylvania.

The following are established risk factors for these cancers:

#### *Stomach cancer*

Rates for Luzerne County and Pennsylvania follow a pattern seen throughout the world. It has long been recognized that geographic areas with coal mining as a major activity show elevated stomach cancer incidence and mortality rates. The reasons are complex, but involve the following risk factors, diet and nutritional factors, occupational exposure to particulates, and chronic infection with the *Helicobacter pylori* bacterium, as well as other host factors. Other than occupation, there are no environmental pollutants linked to this cancer. Current theories suggest that N-nitroso compounds found in foods are an agent. Low consumption of vitamin C and antioxidants contributes to the activity of these compounds. Infection with *H. pylori* leads to inflammation and chronic gastritis. Historically, mortality rates published by the National Cancer Institute show Luzerne County has had statistically higher rates compared to the



United States throughout the decades of the 1950's, 1960's and 1970's. Current cancer mortality data again show the county has statistically elevated stomach cancer rates compared to Pennsylvania [Table 5].

#### *Colon-rectum*

Colorectum cancer rates also have been elevated in Luzerne County, as well as neighboring Lackawanna County. Etiological factors are not very well known. Diets high in fat and/or low in fiber content are associated. Other high-risk conditions include history of adenomatous polyps, familial polyposis syndrome, and inflammatory bowel disease. Environmental carcinogens have been explored primarily in relation to food consumption. Animal and experimental studies show that heterocyclic aromatic amines (HAA) serve as mutagens and are the result of both the type of foods consumed and how they are prepared. Sources include heating of fats, as well as meats and fish that are smoked, barbecued or cured. However, these food sources alone do not seem to account for the higher rates that we see in this area. Other important factors include calcium consumption (preventative), vitamin D consumption (preventative), as well as alcohol consumption (promotion), and obesity (promotion).

#### *Larynx*

Larynx cancer represents about 14.5 percent of all cancers diagnosed each year in Pennsylvania. The causes of larynx cancer are well understood. Tobacco smoke is responsible for 85 percent of all cases. If larynx cases were either current or former cigarette smokers, one can be fairly certain that this practice was responsible for their disease.

#### *Uterus*

The reasons for the higher rate in Luzerne County are not clear. Risk factors are similar to breast cancer and are largely determined by a woman's exposure to estrogens. The more years of exposure the larger is the risk. There are many situations that result in greater exposure. Age monthly reproductive cycles begin and end, or total number of ovarian cycles and exposure to estrogens. The more full-term pregnancies, the lower the risk, since monthly ovulation cycles cease with each pregnancy. The older the mother's age at time of her first full term pregnancy, the greater the risk. In addition, breast-feeding suppresses estrogen and reduces the risk. Obesity is a risk factor in older women, because fat tissue converts certain postmenopausal hormones to estrogen. In addition, artificial estrogens increase risk as well.

Based on medical and epidemiological research there are no known ambient or environmental factors shown to cause uterine or breast cancer including air pollution, electromagnetic radiation, and radon from all ambient sources. Herbicides and pesticides do have chemical structures similar to

estrogen. When absorbed, these are stored in fat, where they are modified into forms with estrogenic activity. This estrogenic activity however, appears insignificant compared to a woman's endogenous estrogens, and do not appear to increase risk.

### *Thyroid*

Thyroid cancers represent a very small percent of all new cancers diagnosed each year, about 1.6 percent. Yet, they command our attention because they most often appear as part of a thyroid nodule, and these are not rare. About 4.0 percent of the population has thyroid nodules or about 480,000 people living in Pennsylvania, or over 20,000 in the three county areas. Consequently, the public may believe that the prevalence of thyroid cancer is much larger than it actually is. In addition, thyroid cancer has a very good cure rate consequently the prevalent pool of persons living with thyroid cancer is considerably larger than the number of new cases occurring. This increases public awareness and the chances of knowing someone who has ever been diagnosed with the disease.

Risk factors include a history of x-radiation to the neck. The greater the exposure, greater is the chances of developing cancer. Important sources between 1940 and 1960 were dental, and treatment of skin diseases, tonsillitis and thyroid conditions. Both iodine deficiency and iodine excess can cause thyroid cancer. Cruciferous vegetables appear to be protective, while seafood may increase risk. There also appears to be an association with breast cancer risk. Like breast cancer the influence of estrogens and other hormones can affect risk. Benign thyroid nodules appear to be associated with the risk of thyroid cancer, and some types of nodules may precede cancer development. Additionally, certain diseases/conditions are closely associated with thyroid cancer, including Gardner's syndrome, and Crowden's disease.

### *Leukemia*

There are several established agents for the leukemias, however they account for a small proportion of total cases. The cause(s) of most leukemia cases remain largely unknown. The role of viruses in animals has been established for a long time. More recently, the human T-cell lymphotropic virus (HTLV-1), the AIDS virus, and the Epstein-Barr virus have been shown to cause some adult T-cell leukemias. In addition therapeutic agents such as chemotherapy (alkylating agents) can cause leukemia. Several sources of x-radiation have been shown to cause the disease however, doses must be relatively large; diagnostic x-rays if not controlled, and workers with long-term exposures to high levels. For non-ionizing radiation, there are no proven excesses from electromagnetic fields. Cigarette smoking does support an elevated risk of leukemia, but alcohol consumption data is conflicting. In addition some genetic syndromes increase lifetime risk, such as children with Down's Syndrome who have 10-fold chance of developing leukemia.

In *Schuylkill County* the incidence rate for *All Cancer Sites* combined was the same as the state [SMR=1.01]. There were several cancers that stood out as being higher or lower than Pennsylvania and statistically significant. These include buccal cavity [SMR=1.24], colon and rectum [SMR=1.17], cervix [SMR=1.51], uterus [SMR=1.32], prostate [SMR=0.83], and Hodgkin's lymphoma [SMR=0.63].

Risk factors for these additional cancers include:

#### *Buccal Cavity – Mouth*

Excessive use of alcohol in combination with tobacco consumption, particularly smokeless tobacco is the major causes of this disease.

#### *Cervix*

Cervical cancer is caused by the Human Papilloma virus, through person-to-person contact. There are no other environmental agents known to cause this cancer, though cigarette smoking contributes to the risk. The period from exposure to the development of a detectable lesion can span five to ten years.

#### *Prostate*

In the three counties there was a total of 3,046 cases identified or about 435 each year. This is the most common cancer type in men. Approximately 10,000 new cases are diagnosed annually in the Pennsylvania. The cause of prostate cancer is not known, though the role of endocrine factors may be important. Normal growth and function of the prostate comes under the control of testosterone. It is also known that estrogen and antagonists will control the growth of prostate cancer. Factors affecting the action of testosterone include the pituitary gland - controlling lutenizing hormone, testosterone production, levels of hormone in the blood, and the binding of the hormone to cells in the prostate gland regulated by a gene on chromosome X. Other factors that have been considered are fat consumption, obesity, vitamin D deficiency, vitamin A, venereal disease and vasectomy.

At this time, there is no known environmental cause(s) of prostate cancer in fact such etiological factors are simply not known. Some believe, this cancer may simply be a consequence of the aging process, where progression from normal epithelial tissue to neoplasia occurs as a result of impaired control mechanisms of cell differentiation and proliferation. There have been some studies of cadmium exposure and prostate cancer. Since zinc is essential for the health of normal prostate epithelial cell growth, and cadmium is a zinc antagonist, the accumulation of cadmium in the tissues might result in abnormal cell growth. A few studies support this hypothesis. Just the same, given the very small proportion of the population who receive a significant cadmium exposure, cadmium would account for very few prostate cancers in the general population.

### *Hodgkin's lymphoma*

Risk factors for Hodgkin's lymphoma are largely unknown. There is no established association with tobacco use, diet, or alcohol, though hormones may play a role. An infectious origin has been suggested, particularly the role of the DNA Epstein-Barr virus.

### *Ovary*

Ovarian cancer has epidemiological features similar to breast cancer. Age at full-term pregnancy is related to eventual risk. The younger a woman is when her first child is born, the lower her lifetime risk. Again the role of endogenous hormone levels is important. However, factors influencing these levels are not understood. Both genetic factors and diet are probably important.

## **Zip Code Area Incidence Rates**

The first public reports of a cancer problem were related to areas adjacent to Ben Titus Road in Schuylkill County and its extension Quakake Road in Carbon County. To assess the rates in that region the PADOH performed small-area analyses based on place of residence as defined by zip codes. The Department had determined that using zip codes was superior to either municipalities or U.S. Census groupings. Municipalities shown in the medical records of cases are often in error. They frequently represent a larger neighboring municipality such as borough or city, or the location of the post office. Small area analyses using U.S. Census blocks or tracts are less useful as cases can not be assigned to census tracts without geo-coding which is not always possible if the address is a PO Box or uses a rural route (RR) number.

The zip codes serving this part of Schuylkill and Carbon Counties include 18237, 18245, 18255 and 18240. To the north of Quakake Road is zip code 18216. For zip code 18255 the rate for *All Cancer Sites* combined and for major cancers were neither significantly elevated nor unusually low compared to Pennsylvania. In zip code 18240, again no rates were significantly high or low. This was also true for the area that extended into Schuylkill County. In zip code 18245 rates for individual types were not elevated and statistically significant, however the rate for *All Cancer Sites* combined was low and statistically significant, and the total numbers of cases observed in both zip codes 18237 and 18216 were fewer than expected and statistically significant.

For other areas of Carbon, Luzerne, and Schuylkill Counties there were patterns of significantly higher and lower rates, particularly in Luzerne County. Statistically significant was *All Cancer Sites* combined, elevated in zip codes 18424, 18612, 18621, 18640, 18702 and 18201. These represent urban

communities of Hazleton, as well as those between Nanticoke, Wilkes-Barre, and Pittston. Elevated but not statistically significant rates were also seen in several neighboring zip code areas. This is consistent with a pattern of higher rates for total cancer reported for other urban areas.

Colorectal cancer rates were significantly elevated in zip codes 18201, 18612, 18651, and 18702, and another thirteen zip codes showed rates higher than the state, though not statistically significant. These elevations contributed to the higher incidence overall rate for the entire county. Lung cancer rates were significantly elevated in the urban areas of Wilkes-Barre and Hazleton. Again this pattern would be consistent with higher smoking rates typically seen in similar areas. Breast cancer rates showed no particular pattern. However, prostate cancer rates were almost universally low compared to the state throughout the three counties, with a band of statistically significant lower rates running through the center of Schuylkill and Luzerne Counties. The reason for lower rates is not clear, but incidence is markedly linked to the intensity of screening behavior. Because the prevalence of the disease is typically between 15 and 30 percent in men over age 50, lower screening rates in the area, compared to the entire state will result in fewer cases detected and lower incidence rates.

Brain, Non-Hodgkin's lymphomas and Hodgkin's lymphoma demonstrated no noteworthy patterns. Leukemia rates were statistically significant in zip codes 18702, 18621 and 18201, all higher than the state, while the rate for zip code 18202 was lower and statistically significant. Little is understood about the causes that would help explain these rates.

Historically, urban areas have had elevated rates for *All Cancer Sites* combined and certain cancers associated with socioeconomic factors. Associated with lower socioeconomic indicators are the smoking related cancers; mouth, esophagus, larynx, lung, kidney and bladder, as well as stomach cancer, liver cancer and cervical cancer. On the other hand, the risk of cancer of the breast, uterus, ovary, Hodgkin's lymphoma, and testes are associated with indicators of higher socioeconomic status. Colon-rectum and prostate cancers, and leukemia do not show these associations. The patterns of higher rates for *All Cancer Sites* combined and lung cancer in areas of Hazleton, Wilkes-Barre and Pittston are consistent with studies done of other urban areas.

### **Polycythemia vera**

An important objective of this study was to describe the incidence rate of polycythemia vera as completely as possible, though the Department's ability to do this was limited by a lack of historical data. Reporting of this condition to the PCR began with 2001 cases consequently there were only two years of observation (2001-2002) available. This severely limited the Department's ability to accurately measure the rates, and precluded making any inferences about risk in the local areas of interest. Though no zip

codes in Luzerne County were found to be high, the rate was found to be elevated for the County as a whole. More cases will need to be accessioned before the incidence rates in this region will be completely understood.

While the pathological characteristics of the disease are well documented, the causes of this cancer are unknown. It generally begins in middle life, and there is a slight male dominance. It is relatively uncommon in Blacks and occurs with increased frequency in Jews of European ancestry. There are rare cases in monozygotic twins and a minimal increased risk in first-degree relatives of affected members suggesting a genetic role. There does not appear to be a link with radiation exposure and the role of viruses has not been established though there is a model in mice.

### **Summary**

This study was conducted for the purpose of determining the cancer burden among residents in proximity to the former McAdoo Super Fund Site, and throughout the three county region. The types of cancer and relative frequencies, and incidence rates or risks were ascertained. The analyses show that the types of cancer occurring and the relative numbers of cases are the same in each of the three counties and the state. Clearly the burden of cancer extends across the entire Commonwealth. When incidence rates were examined, cancer types showing significant elevations were malignant melanoma in Carbon County, stomach, colon-rectum, larynx, uterus, thyroid, and leukemia in Luzerne County, and buccal cavity, colon-rectum, cervix, and uterine cancers in Schuylkill County. At the same time the incidence rate for several cancers were lower than expected. These included prostate cancer across the region, lung cancer in Luzerne County, and liver cancer, prostate cancer and Hodgkin's lymphoma in Schuylkill County. And when rates were examined for zip code areas near the former Super Fund site, there were no elevations.

Modifiable risk factors are considered responsible for a large number of the cancers in the region, and have affected incidence, leading to many high and low rates. These include smoking, alcohol, obesity, diet, hormone replacement therapy, sun exposure, pathogenic organisms, and iatrogenic agents (x-rays, pharmaceuticals). Another factor that can affect incidence are screening practices or actively identifying lesions. This applies to colon-rectum, breast, prostate, skin, uterine, and cervical cancers.

Health departments have the responsibility of performing disease surveillance, identifying health problems in communities, and intervening based on this knowledge. Examples include food-borne outbreaks and certain communicable disease epidemics, and cancer clusters. Generally, the agents that cause these problems are known, and it is possible to intervene and stop the epidemic.

Even if the cause of a cancer is understood, frequently the factor is not modifiable. For breast cancer, as an example, age at first full-term pregnancy is an important determinant but not modifiable. In addition, if effective interventions do exist, the latency period between exposure and cancer can be at least 15 years; therefore any interventions implemented now would not result in a measurable change in the near future. Unfortunately, there are many cancers where the cause(s) are not known, meaning the PADOH cannot make recommendations that could modify the risk in the community. This is true for many of the cancers occurring in the study area.

The Department of Health is sensitive to the communities' concerns about their environment, and the numbers of residents diagnosed with cancer that have resided near the former McAdoo Superfund Site and throughout the three-county area. In an effort to provide the most current assessment of the cancer burden and risk in these communities, the types of cancer, the relative frequencies and the incidence rates for counties and zip codes were examined through the year 2002 – the most current data available.

This study provides an objective measure of the cancer risks relative to all Pennsylvanians. Based on the findings, the types and frequencies of cancers when compared to the state are identical. The rates seen within these populations vary but are not unexpected. In addition, based on our current knowledge of the causes of the different types of cancer there isn't an indication that the ambient environment is contributing to the rates.

It is of interest that the rate for polycythemia vera and leukemia were elevated in Luzerne County. Unfortunately, little is known about the cause of polycythemia vera and the different types leukemia. To better understand the distribution of these will require addition years of data and for leukemia a description by subtypes. Therefore, the Department of Health feels it is worthwhile to further examine these rates as more cancer cases are obtained by the Pennsylvania Cancer Registry.





**Table 1**  
**Distribution of Cancers by Type for Tamaqua Study Counties and Pennsylvania**  
**1996 - 2002**

CANCER	Carbon Co.		Luzerne Co.		Schuylkill Co.		Pennsylvania	
	Percent	Cases	Percent	Cases	Percent	Cases	Percent	Cases
ALL CANCERS	100.0	2,710	100.0	15,003	100.0	7,154	100.0	492,952
MOUTH	1.7	46	2.0	301	2.3	167	1.9	9,569
ESOPHAGUS	0.7	19	1.1	165	0.9	63	1.1	5,195
STOMACH	1.7	45	2.1	313	1.8	126	1.6	7,983
COLON-RECTUM	13.4	363	14.9	2,229	15.4	1,099	12.8	62,895
LIVER	1.0	25	0.7	111	0.6	45	0.9	4,469
PANCREAS	2.0	53	2.4	366	1.7	125	2.2	11,077
LARYNX	0.8	21	1.1	168	1.1	82	0.9	4,637
LUNG	14.5	392	13.6	2,034	14.2	1,015	14.3	70,651
MELANOMA	3.7	99	2.4	361	2.9	207	2.7	13,322
BREAST	13.0	351	13.8	2,077	13.0	932	14.2	70,039
UTERUS	3.7	101	3.8	576	3.0	292	3.2	15,868
CERVIX	1.0	20	1.0	132	1.2	83	0.9	4,381
OVARY	1.9	52	1.9	278	1.7	120	1.8	8,855
PROSTATE	14.0	379	11.8	1,764	12.6	903	15.2	74,732
TESTICULAR	0.5	14	0.5	68	0.4	31	0.5	2,433
URINARY BLADDER	5.7	154	5.4	807	5.5	394	5.2	25,214
KIDNEY	2.6	71	2.5	373	2.5	178	2.3	12,761
BRAIN/NERVOUS	1.2	32	1.3	191	1.1	78	1.3	6,273
THYROID	1.4	37	2.1	315	1.6	111	1.6	8,062
N.H. LYMPHOMAS	4.2	115	4.0	607	3.9	277	4.0	19,525
HODGKIN LYMPHOMA	0.5	14	0.6	88	0.3	23	0.6	2,888
MULTIPLE MYELOMA	1.2	33	1.0	149	1.0	68	1.1	5,357
LEUKEMIA	2.5	69	2.8	417	2.5	180	2.4	11,716
POLYCYTHEMIA VERA **	0.1	1	0.7	32	0.6	12	0.2	354

\*\* Based on 2001-2002 PV and total cases.

**TABLE 2**  
**CANCER INCIDENCE RATES for CARBON COUNTY COMPARED to PENNSYLVANIA**  
**STANDARDIZED MORBIDITY RATIOS and AGE-ADJUSTED RATES, 1996-2002 CASES**

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>ALL CANCER SITES</b>								
MALE	28633	1446	1415.09	1.02	610.85	721.45	624.19	.70
FEMALE	30169	1264	1267.57	1.00	538.44	598.53	536.92	.09
TOTAL	58802	2710	2682.67	1.01	573.40	658.38	579.24	.46
<b>ORAL CAVITY/PHARYNX</b>								
MALE	28633	33	35.11	.94	15.53	16.46	14.60	.33
FEMALE	30169	13	16.49	.79	7.02	6.16	5.54	.87
TOTAL	58802	46	51.60	.89	11.13	11.18	9.92	.73
<b>ESOPHAGUS</b>								
MALE	28633	17	22.23	.76	9.60	8.48	7.34	1.10
FEMALE	30169	2	6.53	.31	2.72	.95	.83	2.82
TOTAL	58802	19	28.75	.66	6.04	4.62	3.99	1.94
<b>STOMACH</b>								
MALE	28633	31	27.43	1.13	11.81	15.47	13.3	.55
FEMALE	30169	14	16.24	.86	6.78	6.63	5.84	.53
TOTAL	58802	45	43.67	1.03	9.20	10.93	9.49	.17
<b>COLON AND RECTUM</b>								
MALE	28633	201	175.05	1.15	75.13	100.28	86.26	1.57
FEMALE	30169	162	171.00	.95	71.33	76.71	67.57	.62
TOTAL	58802	363	346.06	1.05	73.16	88.19	76.74	.77
<b>LIVER/INTRAHEPATIC BILE DUCT</b>								
MALE	28633	19	16.72	1.14	7.31	9.48	8.31	.46
FEMALE	30169	6	7.71	.78	3.23	2.84	2.51	.62
TOTAL	58802	25	24.43	1.02	5.20	6.07	5.32	.10

TABLE 2 - continued

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>PANCREAS</b>								
MALE	28633	28	30.41	.92	13.07	13.97	12.04	.39
FEMALE	30169	25	30.55	.82	12.71	11.84	10.40	.98
TOTAL	58802	53	60.96	.87	12.89	12.88	11.20	.95
<b>LARYNX</b>								
MALE	28633	17	20.34	.84	8.81	8.48	7.36	.70
FEMALE	30169	4	5.25	.76	2.21	1.89	1.68	.55
TOTAL	58802	21	25.59	.82	5.39	5.10	4.43	.87
<b>BRONCHUS AND LUNG</b>								
MALE	28633	240	229.20	1.05	97.79	119.74	102.40	.60
FEMALE	30169	152	163.09	.93	67.61	71.98	63.02	.79
TOTAL	58802	392	392.29	1.00	82.18	95.23	82.12	.01
<b>MELANOMA OF THE SKIN</b>								
MALE	28633	57	40.96	1.39	18.22	28.44	25.35	1.89
FEMALE	30169	42	29.32	1.43	12.96	19.89	18.56	1.83
TOTAL	58802	99	70.27	<u>1.41</u>	15.50	24.05	21.83	2.62 **
<b>BREAST</b>								
MALE	28633	2	3.75	.53	1.63	1.00	.87	1.08
FEMALE	30169	349	364.49	.96	156.01	165.26	149.38	.75
TOTAL	58802	351	368.24	.95	81.47	85.27	77.66	.84
<b>CERVIX UTERI</b>								
FEMALE	30169	20	21.87	.91	9.85	9.47	9.01	.40
<b>CORPUS/UTERUS, NOS</b>								
FEMALE	30169	101	83.88	1.20	35.69	47.83	42.97	1.53
<b>OVARY</b>								
FEMALE	30169	52	46.21	1.13	19.92	24.62	22.41	.73

**PROSTATE**

MALE 28633 379 423.36 .90 180.04 189.09 161.18 1.94

**TABLE 2 - continued**

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>TESTIS</b>								
MALE	28633	14	11.56	1.21	5.86	6.98	7.10	.66
<b>URINARY BLADDER</b>								
MALE	28633	115	103.59	1.11	44.33	57.38	49.21	.91
FEMALE	30169	39	36.78	1.06	15.33	18.47	16.25	.31
TOTAL	58802	154	140.37	1.10	29.33	37.41	32.18	.94
<b>KIDNEY AND RENAL PELVIS</b>								
MALE	28633	46	42.49	1.08	18.56	22.95	20.09	.45
FEMALE	30169	25	26.98	.93	11.38	11.84	10.54	.35
TOTAL	58802	71	69.47	1.02	14.84	17.25	15.17	.16
<b>BRAIN/OTHER NERVOUS SYSTEM</b>								
MALE	28633	19	17.82	1.07	8.16	9.48	8.70	.25
FEMALE	30169	13	14.83	.88	6.49	6.16	5.69	.47
TOTAL	58802	32	32.65	.98	7.30	7.77	7.15	.11
<b>THYROID</b>								
MALE	28633	13	10.03	1.30	4.61	6.49	5.98	.76
FEMALE	30169	24	30.20	.79	13.83	11.36	10.99	1.22
TOTAL	58802	37	40.23	.92	9.38	8.99	8.63	.51
<b>NON-HODGKIN'S LYMPHOMA</b>								
MALE	28633	56	55.26	1.01	24.31	27.94	24.63	.09
FEMALE	30169	59	50.30	1.17	21.22	27.94	24.89	1.01
TOTAL	58802	115	105.56	1.09	22.71	27.94	24.74	.78
<b>HODGKIN'S LYMPHOMA</b>								
MALE	28633	8	7.81	1.02	3.81	3.99	3.90	.07
FEMALE	30169	6	6.22	.96	2.94	2.84	2.84	.09
TOTAL	58802	14	14.03	1.00	3.36	3.40	3.35	.01

TABLE 2 - continued

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED	AGE-ADJ	Z-SCORE
<b>MULTIPLE MYELOMA</b>								
MALE	28633	14	15.28	.92	6.56	6.98	6.01	.29
FEMALE	30169	19	14.26	1.33	5.92	9.00	7.89	.95
TOTAL	58802	33	29.54	1.12	6.23	8.02	6.96	.52
<b>LEUKEMIAS</b>								
MALE	28633	42	35.38	1.19	15.72	20.95	18.67	.91
FEMALE	30169	27	27.18	.99	11.67	12.79	11.59	.03
TOTAL	58802	69	62.56	1.10	13.63	16.76	15.03	.69
<b>Polycythemia vera</b>								
MALE	28633	1	1.15	.87	1.80	1.75	1.56	.14
FEMALE	30169	0	.74	.00	1.11	.00	.00	.82
TOTAL	58802	1	1.89	.53	1.44	.85	.76	.80

\*\* Statistically significant indicated by z-score greater or equal to 1.96; difference between the county and PA rates is expected to occur 5 percent of the time or less due to chance.

VARIABLE CODES:

- POP = 2000 Census Population.
- CASES = Number of newly diagnosed cases during the reporting period.
- EXPECTED = Number of expected cases if study area had experienced average PA state rates during reporting period.
- SMR = Standard Morbidity Ratio (observed/expected cases).
- PA RATE = Average annual state rate per 100,000 population during reporting period.
- UNADJUST RATE = Average annual crude rate per 100,000 population for study area during reporting period.
- AGE-ADJ RATE = Average annual rate per 100,000 population for study area during reporting period based on PA 1996-2002 rates.
- Z-SCORE = Statistical significance of study area compared to state during reporting period (a z-score of 1.96 equates to a 95 % level of statistical significance or a 1 in 20 chance

that the results are due to random variation).

**TABLE 3**  
**CANCER INCIDENCE RATES for LUZERNE COUNTY COMPARED to PENNSYLVANIA**  
**STANDARDIZED MORBIDITY RATIOS and AGE-ADJUSTED RATES, 1996-2002 CASES**

CANCER	POP	CASES	EXPECTED	SMR	PARATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>All CANCER SITES</b>								
MALE	153795	7449	7496.17	.99	610.85	691.92	607.00	.48
FEMALE	165455	7554	7420.07	1.02	538.44	652.23	548.16	1.30
TOTAL	319250	15003	14916.24	1.01	573.40	671.35	576.74	.61
<b>BUCCAL CAVITY AND PHARYNX</b>								
MALE	153795	213	185.82	1.15	15.53	19.79	17.80	1.68
FEMALE	165455	88	96.19	.91	7.02	7.60	6.43	.74
TOTAL	319250	301	282.01	1.07	11.13	13.47	11.88	.97
<b>ESOPHAGUS</b>								
MALE	153795	136	117.58	1.16	9.60	12.63	11.10	1.39
FEMALE	165455	29	39.36	.74	2.72	2.50	2.01	1.54
TOTAL	319250	165	156.94	1.05	6.04	7.38	6.35	.54
<b>STOMACH</b>								
MALE	153795	182	146.21	<u>1.24</u>	11.81	16.91	14.69	2.31 **
FEMALE	165455	131	100.72	<u>1.30</u>	6.78	11.31	8.81	2.06 **
TOTAL	319250	313	246.93	<u>1.27</u>	9.20	14.01	11.67	3.11 **
<b>COLON AND RECTUM</b>								
MALE	153795	1113	931.24	<u>1.20</u>	75.13	103.38	89.79	4.73 **
FEMALE	165455	1116	1041.56	1.07	71.33	96.36	76.42	1.77
TOTAL	319250	2229	1972.80	<u>1.13</u>	73.16	99.74	82.66	4.50 **
<b>LIVER/INTRAHEPATIC BILE DUCT</b>								
MALE	153795	75	88.44	.85	7.31	6.97	6.20	1.38
FEMALE	165455	36	46.40	.78	3.23	3.11	2.50	1.40
TOTAL	319250	111	134.84	.82	5.20	4.97	4.28	1.95

TABLE 3 - continued

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>PANCREAS</b>								
MALE	153795	156	161.51	.97	13.07	14.49	12.63	.38
FEMALE	165455	210	185.35	1.13	12.71	18.13	14.40	1.35
TOTAL	319250	366	346.86	1.06	12.89	16.38	13.60	.83
<b>LARYNX</b>								
MALE	153795	137	107.28	<u>1.28</u>	8.81	12.73	11.25	2.24 **
FEMALE	165455	31	29.86	1.04	2.21	2.68	2.29	.18
TOTAL	319250	168	137.14	<u>1.23</u>	5.39	7.52	6.61	2.09 **
<b>BRONCHUS AND LUNG</b>								
MALE	153795	1254	1210.20	1.04	97.79	116.48	101.33	1.08
FEMALE	165455	780	956.19	<u>.82</u>	67.61	67.35	55.16	5.17 **
TOTAL	319250	2034	2166.39	<u>.94</u>	82.18	91.02	77.16	2.49 **
<b>MELANOMA OF THE SKIN</b>								
MALE	153795	207	217.66	.95	18.22	19.23	17.33	.67
FEMALE	165455	154	165.36	.93	12.96	13.30	12.07	.83
TOTAL	319250	361	383.01	.94	15.50	16.15	14.61	1.05
<b>BREAST</b>								
MALE	153795	23	19.96	1.15	1.63	2.14	1.88	.56
FEMALE	165455	2054	2094.53	.98	156.01	177.35	152.99	.77
TOTAL	319250	2077	2114.49	.98	81.47	92.94	80.03	.71
<b>CERVIX UTERI</b>								
FEMALE	165455	132	119.91	1.10	9.85	11.40	10.85	1.00
<b>CORPUS/UTERUS, NOS</b>								
FEMALE	165455	576	478.93	<u>1.20</u>	35.69	49.73	42.92	3.49 **
<b>OVARY</b>								
FEMALE	165455	278	265.40	1.05	19.92	24.00	20.86	.66

**PROSTATE**  
MALE

153795 1764 2229.52 .79 180.04 163.85 142.45 9.64 \*\*

**TABLE 3 - continued**

**CANCER** POP **CASES** **EXPECTED** **SMR** **PA RATE** **UNADJUSTED RATE** **AGE-ADJ RATE** **Z-SCORE**

**TESTIS**

MALE 153795 68 62.76 1.08 5.86 6.32 6.35 .64

**URINARY BLADDER**

MALE 153795 587 551.38 1.06 44.33 54.53 47.19 1.27  
 FEMALE 165455 220 221.95 .99 15.33 19.00 15.19 .11  
 TOTAL 319250 807 773.33 1.04 29.33 36.11 30.61 1.00

**KIDNEY AND RENAL PELVIS**

MALE 153795 226 224.69 1.01 18.56 20.99 18.66 .08  
 FEMALE 165455 147 157.35 .93 11.38 12.69 10.63 .72  
 TOTAL 319250 373 382.04 .98 14.84 16.69 14.49 .41

**BRAIN/OTHER NERVOUS SYSTEM**

MALE 153795 114 94.63 1.20 8.16 10.59 9.83 1.68  
 FEMALE 165455 77 84.45 .91 6.49 6.65 5.92 .76  
 TOTAL 319250 191 179.08 1.07 7.30 8.55 7.78 .79

**THYROID**

MALE 153795 54 53.23 1.01 4.61 5.02 4.68 .10  
 FEMALE 165455 261 164.52 1.59 13.83 22.54 21.93 5.81 \*\*  
 TOTAL 319250 315 217.74 1.45 9.38 14.10 13.57 5.27 \*\*

**NON-HODGKIN'S LYMPHOMA**

MALE 153795 290 293.92 .99 24.31 26.94 23.98 .20  
 FEMALE 165455 317 298.14 1.06 21.22 27.37 22.57 .87  
 TOTAL 319250 607 592.06 1.03 22.71 27.16 23.29 .52

**HODGKIN'S LYMPHOMA**

MALE 153795 49 42.17 1.16 3.81 4.55 4.42 .95  
 FEMALE 165455 39 34.85 1.12 2.94 3.37 3.29 .65  
 TOTAL 319250 88 77.02 1.14 3.36 3.94 3.84 1.14



TABLE 3 - continued

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>MULTIPLE MYELOMA</b>								
MALE	153795	78	81.17	.96	6.56	7.25	6.30	.31
FEMALE	165455	71	85.75	.83	5.92	6.13	4.91	1.40
TOTAL	319250	149	166.92	.89	6.23	6.67	5.56	1.22
<b>LEUKEMIAS</b>								
MALE	153795	222	188.91	<u>1.18</u>	15.72	20.62	18.48	1.99 **
FEMALE	165455	195	161.38	<u>1.21</u>	11.67	16.84	14.10	2.02 **
TOTAL	319250	417	350.29	<u>1.19</u>	13.63	18.66	16.22	2.84 **
<b>Polycythemia vera</b>								
MALE	153795	20	6.14	<u>3.26</u>	1.80	6.50	5.85	2.79 **
FEMALE	165455	12	4.48	<u>2.68</u>	1.11	3.63	2.98	1.78
TOTAL	319250	32	10.62	<u>3.01</u>	1.44	5.01	4.34	3.28 **

\*\* Statistically significant indicated by z-score greater or equal to 1.96; difference between the county and PA rates is expected to occur 5 percent of the time or less due to chance.

VARIABLE CODES:

- POP = 2000 Census Population.
- CASES = Number of newly diagnosed cases during the reporting period.
- EXPECTED = Number of expected cases if study area had experienced average PA state rates during reporting period.
- SMR = Standard Morbidity Ratio (observed/expected cases).
- PA RATE = Average annual state rate per 100,000 population during reporting period.
- UNADJUST RATE = Average annual crude rate per 100,000 population for study area during reporting period.
- AGE-ADJ RATE = Average annual rate per 100,000 population for study area during reporting period based on PA 1996-2002 rates.
- Z-SCORE = Statistical significance of study area compared to state during reporting period (a z-score of 1.96 equates to a 95 % level of statistical significance or a 1 in 20 chance

that the results are due to random variation).

**TABLE 4**  
**CANCER INCIDENCE RATES for SCHUYLKILL COUNTY COMPARED to PENNSYLVANIA**  
**STANDARDIZED MORBIDITY RATIOS and AGE-ADJUSTED RATES, 1996-2002 CASES**

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>ALL CANCER SITES</b>								
MALE	74818	3632	3665.07	.99	610.85	693.49	605.33	.48
FEMALE	75518	3522	3418.15	1.03	538.44	666.26	554.80	1.46
TOTAL	150336	7154	7083.22	1.01	573.40	679.81	579.13	.71
<b>BUCCAL CAVITY AND PHARYNX</b>								
MALE	74818	117	90.37	<u>1.29</u>	15.53	22.34	20.11	2.22 **
FEMALE	75518	50	44.28	1.13	7.02	9.46	7.93	.68
TOTAL	150336	167	134.65	<u>1.24</u>	11.13	15.87	13.81	2.18 **
<b>ESOPHAGUS</b>								
MALE	74818	48	57.37	.84	9.60	9.17	8.03	1.18
FEMALE	75518	15	18.13	.83	2.72	2.84	2.25	.64
TOTAL	150336	63	75.49	.83	6.04	5.99	5.04	1.33
<b>STOMACH</b>								
MALE	74818	75	71.58	1.05	11.81	14.32	12.37	.34
FEMALE	75518	51	46.33	1.10	6.78	9.65	7.46	.51
TOTAL	150336	126	117.91	1.07	9.20	11.97	9.84	.59
<b>COLON AND RECTUM</b>								
MALE	74818	561	456.04	<u>1.23</u>	75.13	107.12	92.42	3.82 **
FEMALE	75518	538	479.69	<u>1.12</u>	71.33	101.77	80.00	1.98 **
TOTAL	150336	1099	935.74	<u>1.17</u>	73.16	104.43	85.93	4.05 **
<b>LIVER/INTRAHEPATIC BILE DUCT</b>								
MALE	74818	34	43.19	.79	7.31	6.49	5.75	1.40
FEMALE	75518	11	21.39	.51	3.23	2.08	1.66	2.50
TOTAL	150336	45	64.58	<u>.70</u>	5.20	4.28	3.62	2.47 **

TABLE 4 - continued

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>PANCREAS</b>								
MALE	74818	65	78.97	.82	13.07	12.41	10.76	1.50
FEMALE	75518	60	85.37	<u>.70</u>	12.71	11.35	8.93	2.58 **
TOTAL	150336	125	164.34	<u>.76</u>	12.89	11.88	9.80	2.90 **
<b>LARYNX</b>								
MALE	74818	65	52.15	1.25	8.81	12.41	10.98	1.41
FEMALE	75518	17	13.78	1.23	2.21	3.22	2.72	.66
TOTAL	150336	82	65.93	1.24	5.39	7.79	6.71	1.53
<b>BRONCHUS AND LUNG</b>								
MALE	74818	648	591.75	1.10	97.79	123.73	107.08	1.91
FEMALE	75518	367	441.95	<u>.83</u>	67.61	69.43	56.15	3.16 **
TOTAL	150336	1015	1033.70	.98	82.18	96.45	80.70	.49
<b>MELANOMA OF THE SKIN</b>								
MALE	74818	112	106.60	1.05	18.22	21.39	19.14	.46
FEMALE	75518	95	75.97	1.25	12.96	17.97	16.20	1.76
TOTAL	150336	207	182.57	1.13	15.50	19.67	17.57	1.52
<b>BREAST</b>								
MALE	74818	11	9.75	1.13	1.63	2.10	1.84	.33
FEMALE	75518	921	965.01	.95	156.01	174.23	148.90	1.24
TOTAL	150336	932	974.76	.96	81.47	88.56	77.90	1.23
<b>CERVIX UTERI</b>								
FEMALE	75518	83	55.11	<u>1.51</u>	9.85	15.70	14.84	2.89 **
<b>CORPUS/UTERUS, NOS</b>								
FEMALE	75518	292	220.61	<u>1.32</u>	35.69	55.24	47.24	3.57 **
<b>OVARY</b>								
FEMALE	75518	120	122.14	.98	19.92	22.70	19.57	.17
<b>PROSTATE</b>								
MALE	74818	903	1087.94	<u>.83</u>	180.04	172.42	149.44	5.33 **

TABLE 4 - continued

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>TESTIS</b>								
MALE	74818	31	31.59	.98	5.86	5.92	5.75	.10
<b>URINARY BLADDER</b>								
MALE	74818	276	270.06	1.02	44.33	52.70	45.30	.31
FEMALE	75518	118	102.29	1.15	15.33	22.32	17.68	1.15
TOTAL	150336	394	372.35	1.06	29.33	37.44	31.03	.90
<b>KIDNEY AND RENAL PELVIS</b>								
MALE	74818	100	109.57	.91	18.56	19.09	16.93	.85
FEMALE	75518	78	72.60	1.07	11.38	14.76	12.23	.51
TOTAL	150336	178	182.17	.98	14.84	16.91	14.50	.27
<b>BRAIN/OTHER NERVOUS SYSTEM</b>								
MALE	74818	39	46.21	.84	8.16	7.45	6.88	1.07
FEMALE	75518	39	38.90	1.00	6.49	7.38	6.51	.01
TOTAL	150336	78	85.11	.92	7.30	7.41	6.69	.73
<b>THYROID</b>								
MALE	74818	28	26.13	1.07	4.61	5.35	4.94	.33
FEMALE	75518	83	75.39	1.10	13.83	15.70	15.22	.81
TOTAL	150336	111	101.51	1.09	9.38	10.55	10.25	.88
<b>NON-HODGKIN'S LYMPHOMA</b>								
MALE	74818	144	144.01	1.00	24.31	27.50	24.30	.00
FEMALE	75518	133	137.37	.97	21.22	25.16	20.55	.31
TOTAL	150336	277	281.38	.98	22.71	26.32	22.36	.22
<b>HODGKIN'S LYMPHOMA</b>								
MALE	74818	16	20.81	.77	3.81	3.06	2.93	1.15
FEMALE	75518	7	15.79	.44	2.94	1.32	1.30	3.27
TOTAL	150336	23	36.60	<u>.63</u>	3.36	2.19	2.11	2.74 **

TABLE 4 - continued

CANCER	POP	CASES	EXPECTED	SMR	PA RATE	UNADJUSTED RATE	AGE-ADJ RATE	Z-SCORE
<b>MULTIPLE MYELOMA</b>								
MALE	74818	37	39.73	.93	6.56	7.06	6.11	.39
FEMALE	75518	31	39.55	.78	5.92	5.86	4.64	1.22
TOTAL	150336	68	79.28	.86	6.23	6.46	5.34	1.13
<b>LEUKEMIAS</b>								
MALE	74818	103	92.28	1.12	15.72	19.67	17.55	.94
FEMALE	75518	77	74.27	1.04	11.67	14.57	12.10	.26
TOTAL	150336	180	166.55	1.08	13.63	17.10	14.73	.86
<b>Polycythemia vera</b>								
MALE	74818	9	3.00	3.00	1.80	6.01	5.39	1.79
FEMALE	75518	3	2.06	1.46	1.11	1.99	1.62	.44
TOTAL	150336	12	5.06	2.37	1.44	3.99	3.42	1.72

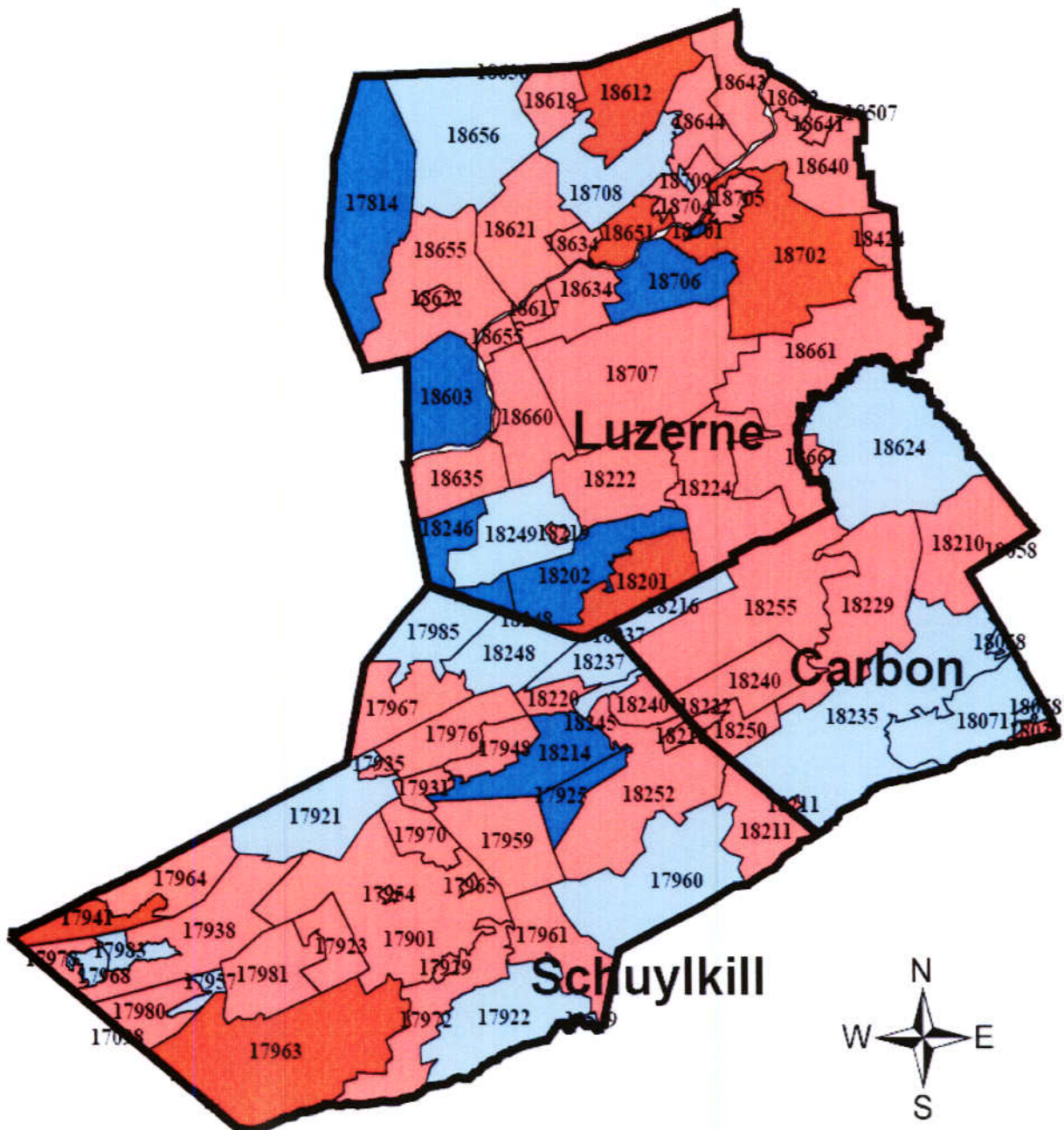
\*\* Statistically significant indicated by z-score greater or equal to 1.96; difference between the county and PA rates is expected to occur 5 percent of the time or less due to chance.

VARIABLE CODES:

- POP = 2000 Census Population.
- CASES = Number of newly diagnosed cases during the reporting period.
- EXPECTED = Number of expected cases if study area had experienced average PA state rates during reporting period.
- SMR = Standard Morbidity Ratio (observed/expected cases).
- PA RATE = Average annual state rate per 100,000 population during reporting period.
- UNADJUST RATE = Average annual crude rate per 100,000 population for study area during reporting period.
- AGE-ADJ RATE = Average annual rate per 100,000 population for study area during reporting period based on PA 1996-2002 rates.
- Z-SCORE = Statistical significance of study area compared to state during reporting period (a z-score of 1.96 equates to a 95 % level of statistical significance or a 1 in 20 chance that the results are due to random variation).



**MAP 2**  
**Tamaqua Health Study**  
**Colorectal Cancer Incidence Rates Compared to State-wide Rates**  
**Pennsylvania ZIP Code Areas, 1996-2002**



**Legend: Ranking of ZIP Code Areas**

- Sig. Low
- Lower
- Higher
- Sig. High



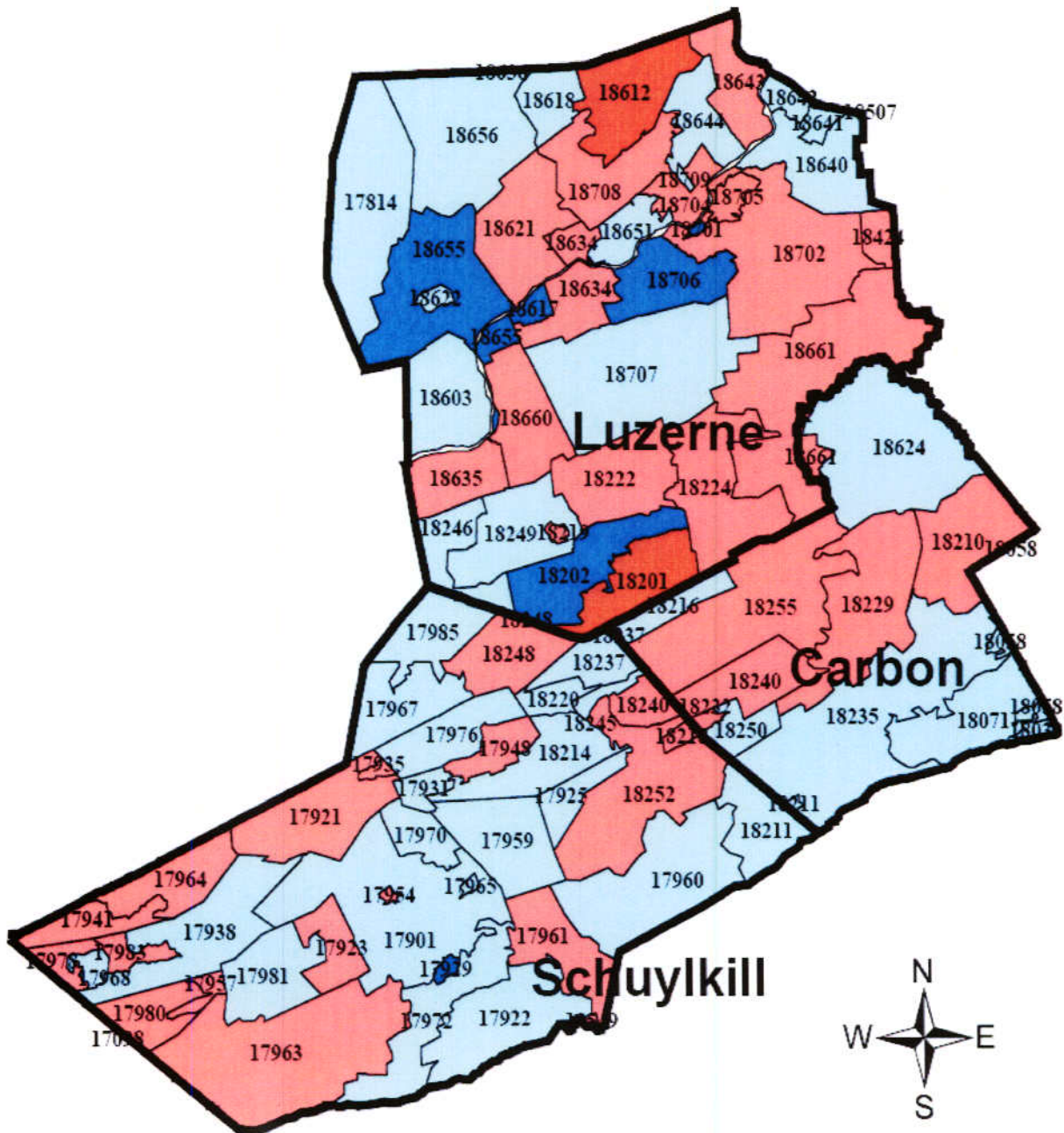








**MAP 7**  
**Tamaqua Health Study**  
**Non-Hodgkin Lymphoma Incidence Rates Compared to State-wide Rates**  
**Pennsylvania ZIP Code Areas, 1996-2002**



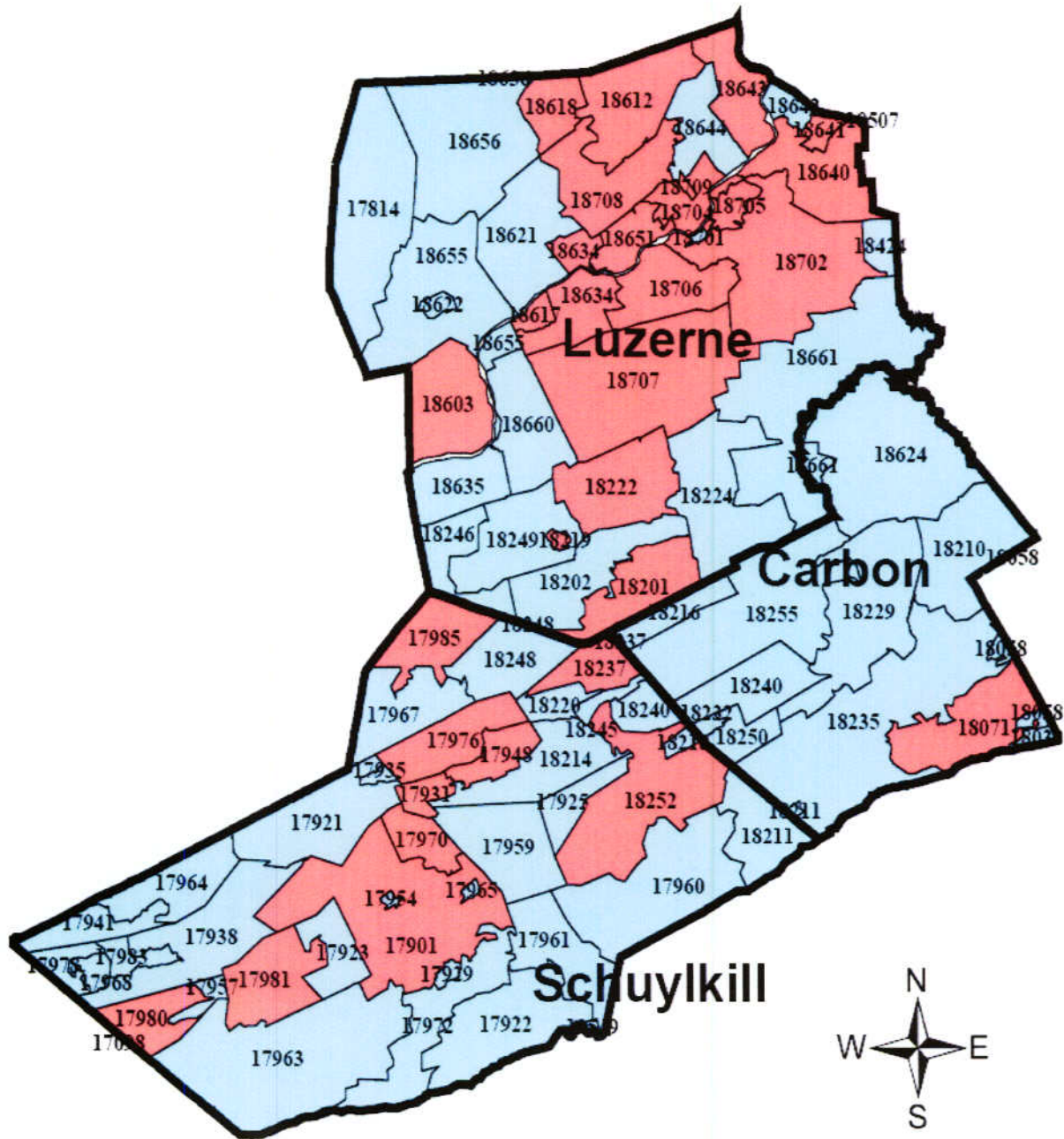
**Legend: Ranking of ZIP Code Areas**

- Sig. Low
- Lower
- Higher
- Sig. High





**MAP 10**  
**Tamaqua Health Study**  
**Polycythemia Incidence Rates Compared to State-wide Rates**  
**Pennsylvania ZIP Code Areas, 2001-2002**



**Legend: Ranking of ZIP Code Areas**

- Sig. Low
- Lower
- Higher
- Sig. High



Table 5

**Cancer Mortality Rates for the U.S., Pennsylvania, Carbon, Luzerne, Schuylkill Counties  
Age-Adjusted Death Rates Per 100,000 Residents, 1997 to 2002**

	U.S.	Pennsylvania	Carbon Co.	Luzerne Co.	Schuylkill Co.
<b>CANCER</b>					
ALL CANCERS	199.8	207.1	221.7 *	210.6	212.4
STOMACH	4.7	4.6	5.0 *	6.0 *	4.5
COLON-RECTUM	20.8	23.4	26.7 *	26.9 *	24.7 *
PANCREAS	10.5	10.6	10.6	10.8	8.9
LUNG	56.2	55.7	60.1	52.3 *	58.3
BREAST	27	28.8	33.5	28.5	24.9
UTERUS	4.1	4.7 *	---	5.4 *	7.3 *
PROSTATE	31.5	31.8	29.4	29.6	28.4
KIDNEY	4.2	4.3	4.3	4.5	4.4
URINARY BLADDER	4.4	4.7 *	5.8	4.3	5.0
THYROID	0.5	0.5	---	---	---
BRAIN/NERVOUS	4.6	4.4	---	4.5	4.0
N.H. LYMPHOMAS	8.4	8.9 *	8.3	9.0	8.6
HODGKIN's disease	--	---	---	---	---
LEUKEMIA	7.6	7.8	6.7	8.2	9.2

\* Statistically significant compared to the U.S. rate.

Source; National Cancer Institute -State Cancer Profiles; <http://statecancerprofiles.cancer.gov/>