

INTRODUCTION

In the Spring of 2004, the Pennsylvania Department of Health (PADOH) was contacted by State Representative David Argall requesting assistance in determining the cancer risk for communities in the vicinity of the former U.S. Environmental Protection Agency (EPA) McAdoo Associates Superfund site, bordering Carbon and Schuylkill Counties. Residents and local area physicians expressed concern that the incidence of cancer was elevated and that environmental contamination from industries and waste disposal sites in the area may be responsible for increasing numbers of cases.

An initial examination of cancer rates for persons residing in eight zip code areas surrounding the landfill was completed by the PADOH and presented at a community meeting held October 6, 2004 in Quakake, Pennsylvania. At that meeting, citizens expressed their concern that the cancer “problem” was growing, and that the appearance of the very rare myeloproliferative hematological cancer – *polycythemia vera* - was linked to environmental pollution. The decision to conduct the current study, based on 80 zip codes spanning Carbon, Luzerne and Schuylkill Counties, was based on that meeting.

The present study was developed to answer the following question: *What is the burden and geographic distribution of cancers in Carbon, Luzerne and Schuylkill Counties?* The Tamaqua Area Cancer Incidence Study was designed to answer this question through a comprehensive evaluation of cancer incidence rates for the counties, including small area analyses for eighty zip codes comprising the three counties. In addition, some members of the medical community advocated for further investigation of a rare disorder, polycythemia vera. The investigation was a descriptive epidemiological study only, and was conducted to examine the types of cancer, assess incidence rates in communities both around the McAdoo Site and in contiguous communities, and to examine county cancer incidence and mortality rates. The study was not designed to be an etiological investigation of cause and effect relationships.

METHOD

The study design was a retrospective descriptive study, and the purpose was to determine the burden and location of disease. The study describes the incidence rate of cancers by specific location.

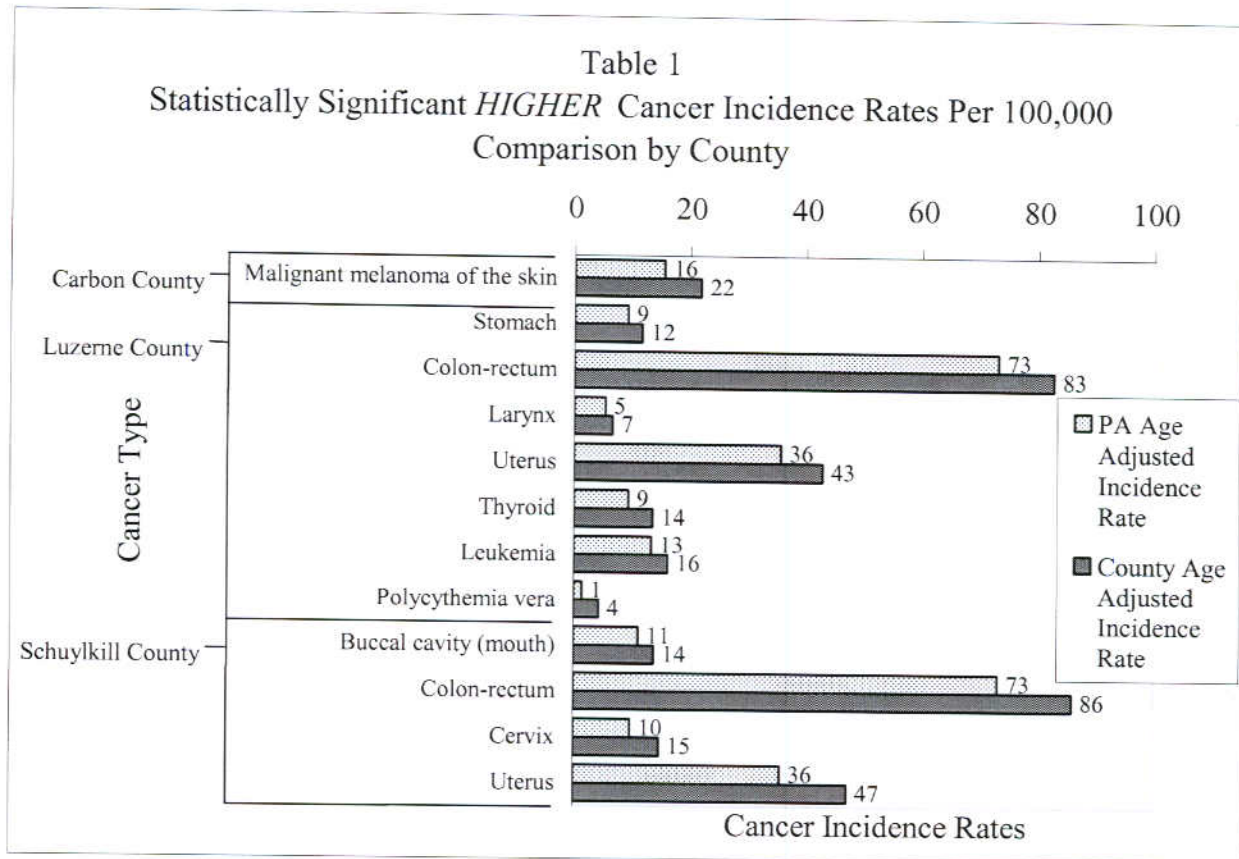
Study populations were defined as residents of the 80 zip codes that make up Carbon (10), Luzerne (32) and Schuylkill (38) Counties. Study cases were defined as all cancers diagnosed between 1996 and 2002 among residents of the three counties, at the time of diagnosis. Cases were primary cancers only, and did not include metastatic cancers that had a point of origin elsewhere in the body. Cases of polycythemia vera were available for the years 2001 and 2002 only; therefore, these statistics are based on two years worth of data.

First, cases were sorted by cancer type and the distribution for each county was compared to Pennsylvania for the same period of time. Second, incidence rates were calculated for each county and for each zip code. For each study area (county or zip code) the age-adjusted incidence rate for each cancer type was compared to the corresponding statewide rate. In addition, the ratio was calculated between the numbers of cancers that actually occurred in a study area to the number expected, based on statewide rates. Tests were performed to determine the statistical significance of each result. Zip code specific analyses were mapped for all cancers combined, and nine types individually, including polycythemia vera.

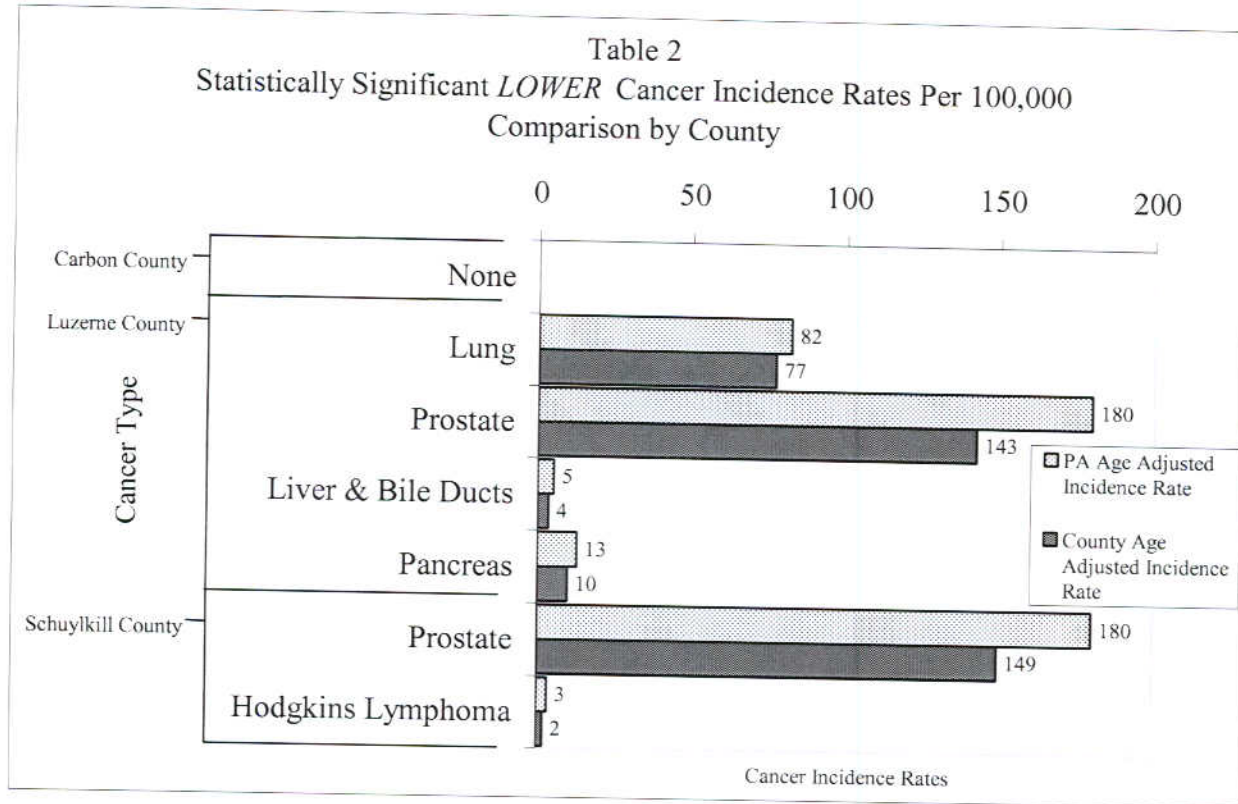
RESULTS

Between 1996 and 2002, a total of 24,867 new cancer cases were diagnosed among residents of the three counties, 45 of which were polycythemia vera. The four most common types; prostate, breast, colon-rectum, and lung; accounted for 55.4 percent of cases. This compared to 56.5 percent for Pennsylvania as a whole.

Research has shown that the rate for total cancers, as well as for lung cancer, generally tend to be higher in more urbanized areas. Rates in the three counties followed this pattern, having slightly higher levels in those counties and those zip codes that were more heavily urbanized. Thus, Luzerne County showed the highest incidence, followed by Schuylkill County and then Carbon County, corresponding to the declining urban nature of the counties respectively. This trend is also found in Pennsylvania as a whole, where the more heavily urbanized areas have elevated rates. This study found that some types of cancer had statistically significant higher or lower incidences in the three counties. These are identified in Tables 1 and 2 below, which provide comparisons of the state and county incidence rates. The incidence for polycythemia vera was significantly elevated in Luzerne County, but rates for the individual zip codes were not significantly higher, indicating that no single area was at greater risk.



In addition to the elevated cancers identified above, PADOH found the rates of several types of cancer were lower than the Commonwealth as a whole, and statistically significant. These cancers are identified in Table 2.



In order to determine what risk factors may be associated with the specific cancer types found in the three counties, a literature review was conducted. The table below identifies some of the major risk factors associated with the each of the cancers identified in Tables 1 and 2.

Known Risk Factors by Cancer Type

| Type of Cancer | Risk Factors | Comments |
|------------------------------|---|---|
| Buccal cavity (mouth) | Excessive use of alcohol | Tobacco and alcohol together account for approximately 60 percent of all cases |
| | Excessive use of tobacco (particularly smokeless tobacco) | |
| Cervix | Human Papilloma virus through person-to-person contact | Tobacco accounts for approx. 10 percent of cases |
| | No environmental agents known to be risk factors | |
| | Cigarette smoking contributes to risk | |
| Colon-rectum | Diets high in fat and/or low in fiber content | Since the 1950's, colon-rectum cancer rates have been elevated in counties in northeastern Pennsylvania |
| | History of adenomatous polyps | |
| | Familial polyposis syndrome | |

**Tamaqua Area Cancer Incidence Study
Report Summary**

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|---------------------------------------|--|--|
| | Inflammatory bowel disease | |
| | Alcohol consumption | |
| | Obesity | |
| Hodgkins Lymphoma | Possible viral etiology | |
| Lung | Tobacco smoke | Accounts for 90 percent of all cases |
| Larynx | Tobacco smoke | Together alcohol and tobacco account for more than 85 percent of all cases |
| | Alcohol consumption | |
| Leukemia | Human T-cell lymphotropic virus | Cause(s) of most types are unknown |
| | AIDS virus | |
| | Epstein-Barr virus | |
| | Therapeutic agents such as chemotherapy | |
| Liver & Bile Ducts | Hepatitis B and C infections | |
| | Alcohol | |
| | Exposure to aflatoxins | |
| Malignant melanoma of the skin | Skin pigmentation | Rates among African Americans are very low |
| | History of freckles | |
| | Presence of moles | |
| | History of sun exposure (particularly with burning) | |
| | X-radiation | |
| | Down's Syndrome | |
| Pancreas | Cigarette smoking | Accounts for approx. 28 percent of all cases |
| Polycythemia vera | Unknown | |
| | No known link with radiation exposure | |
| Prostate | Endocrine factors (testosterone) may be related | Number of cases or the incidence rate can be greatly affected by prostate cancer screening activities in an area |
| Stomach | Geographic areas with coal mining | Incidence and mortality rates in Lackawanna, Luzerne, and Wayne counties historically have been high |
| | Diet and nutrition | |
| | Occupational exposure to particulates | |
| | Chronic infection with the Helicobacter pylori bacterium | |
| | Exposure to coal dust is also possible | |

| | | |
|----------------|--|---|
| Thyroid | History of x-radiation to the neck (Frequently provided during dental treatment between 1940 - 1960) | |
| | Seafood | |
| | Iodine deficiency | |
| | Iodine excess | |
| Uterus | Determined by women's exposure to estrogen | Risk factors are similar to breast cancer |
| | Obesity | |
| | No known environmental factors are related | |

DISCUSSION

The study found that, during the 1996-2002 period, the rates for the majority of cancer types in the tri-county area were generally similar to the state's rates. Modifiable risk factors are considered responsible for a large number of the cancers in the region, while increased screening practices can also have an impact on incidence rates. In addition, many of the cancers identified in Table 1 are associated with urban settings.

As was previously noted, limited years of incidence data for polycythemia vera hampered PADOH's ability to make any inferences about its occurrence. To better understand the distribution of this disease, additional years of data will be needed. With proper outreach, education, and services, however, the risk of many of these cancers can be reduced.