2012

A Descriptive Analysis of Lung Cancer in Montgomery County, Ohio

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Table of Contents

Abstract 4

Introduction 5

Literature Review 6
- A. Incidence and Prevalence 6
- B. Regional Trends 6
- C. Gender Differences 7
  1. Men
  2. Women
- D. Diagnosis 8
  1. Age
  2. Stage
- E. Lung Cancer Types 8
  1. Non-Small Cell Lung Cancer (NSCLC)
  2. Small Cell Lung Cancer (SCLC)
- F. Risk Factors 9
  1. Modifiable Risk Factors
     a. Cigarette Smoking
     b. Cigar and Pipe Tobacco
     c. Second-hand Smoke
     d. Occupational Environments
     e. Radon
     f. Asbestos
  2. Non-modifiable Risk Factors
     a. Family History
     b. Racial
     c. Environmental
  3. Disparities
     a. Racial
     b. Socioeconomic

Methods 16
- A. Setting 16
- B. Data Collection 17
- C. Data Analysis 19

Results 19
- A. Lung Cancer Incidence Rates in Montgomery County 19
  1. Overall
  2. Lung Cancer Incidence Rates by Age
  3. Lung Cancer Incidence Rates by Race
  4. Lung Cancer Incidence Rates by Marital Status
  5. Lung Cancer Mortality

6. Smoking History
7. Socioeconomic Status
8. Stage at Diagnosis

B. Lung Cancer Risk Factors across Montgomery County 25
1. Smoking History

Discussion 28
A. Preventive Consideration 29
1. School Programs
2. Public Programs
3. Work Place Programs
B. Earlier Detection 31
1. Screening
C. Implications for Further Investigation 32
D. Additional Considerations 34

Limitations 35

Conclusion 35

References and Resources 36

Appendix A: List of Public Health Competencies Met 39

List of Tables

Table 1. Secondary Data Sources

Table 2. Variables of Interest with Missing Data

Table 3. Cancer Incidence Rate per 100,000, 2003-2007

Table 4. Marital Status Reported, Montgomery County

Table 5. History of Tobacco Product Use, Montgomery County

Table 6. Insurance Payer at Time of Diagnosis

Table 7. Current Smoking Use, Adults 18 and Older, Montgomery County

List of Figures

Figure 1. Cancer Mortality Rate by Race: Montgomery County, 2006-2008

Figure 2. Reported Smoking History at Time of Diagnosis, Montgomery County 1996-2006

Figure 3. Prevalence of Current Adult (18 and older) Smokers by Zip Code in Montgomery County, 2007-2008

Figure 4. Cancer of Lung & Bronchus: Stage at Diagnosis, 2003-2007

Figure 5. Montgomery County and State of Ohio Lung Cancer: Stage at Diagnosis, 2003-2007

Abstract

Background: Lung cancer statistics are alarming, especially when it is considered by many to largely be a preventable disease. Lung cancers are the leading cause of all cancer deaths, more than breast cancer, prostate cancer, and colon cancer combined. Cancers of the bronchus and lung make up the greatest percentage of the newly diagnosed cancers reported to the Ohio Cancer Incidence Surveillance System (OCISS). The stage of diagnosis of lung and bronchus cancers is an important determinant of survival. Smoking is the primary cause of lung cancer. Race and gender disparities also exist with lung cancer, and socioeconomic factors have an impact. **Methods:** The purpose of this study to describe lung cancer incidence and the presence of select risk factors in Montgomery County for the time period of 1996-2006. A secondary purpose was to describe the presence of lung cancer risk factors across Montgomery County in the general population. **Results:** Montgomery County lung cancer incidence rates ranked third highest among all cancers reported. Additionally, Montgomery County incidence rates were higher than state and US rates. The average age of lung cancer diagnosis was 68.7 years old, lower than the US average age, and 70% were late stage at diagnosis. The incidence of lung cancer reported during those years was greater in whites and among married people. More than three quarters of those diagnosed were smokers or had a smoking history. **Discussion:** The late stage of diagnosis, the strong history of smoking, the greater incidence among whites, and the older age at diagnosis all are factors identified in this study that need to be considered. Programs for earlier detection and education of risk factors, strongly aimed at smoking in both the younger population (prevention) as well as for the general population need to be developed. Socioeconomic factors that influence smoking habits as well as impact ability to afford screenings should also be considered.

Montgomery County Lung Cancer Study

A Descriptive Analysis of Lung Cancer in Montgomery County, Ohio

Lung cancer is the leading cause of cancer death in the United States. Surprisingly, lung cancer is responsible for more deaths than breast cancer, prostate cancer, and colon cancer combined.

Lung cancer prevalence and mortality have been steadily rising since the 1930s, largely due to the increased popularity and peak of smoking among men during World War I and World War II, and peaking among women about a decade later. Since the 1950s, lung cancer has been the leading cause of cancer deaths among men, and in 1987 it surpassed breast cancer as the leading cause of death in women (American Lung Association, 2010).

Lung cancer statistics are alarming, especially when it is considered by many to largely be a preventable disease. An estimated 222,250 new cases of lung cancer were diagnosed in 2010, accounting for almost 15% of all cancer diagnoses. Smoking is the primary cause of lung cancer in 90% of men and 80% of women (American Lung Association, 2010). This risk factor is preventable, making education and awareness, especially among younger people and higher risk lifestyles, a priority.

The risk of developing most types of cancer can be reduced somewhat by making changes in a person's lifestyle; for example, by quitting smoking, limiting time in the sun, being physically active, and eating a better diet. Earlier detection, also improves cancer outcomes. The sooner a cancer is found and treated, the better the chances are for living for many years (American Cancer Society, 2011).

The primary purpose of this study was to describe the incidence of lung cancer in Montgomery County, Ohio for the years 1996 to 2006 and to compare this county data to Ohio

and United States (US) trends using available data sets and the recently published County Health Assessment. Looking at age, gender, race, and socioeconomic variables, this project attempted to identify a descriptive profile of a person diagnosed with lung cancer. Establishing a profile of a person diagnosed with lung cancer may help answer the question of who should programming and screenings be addressed to for prevention or earlier detection. By identifying those high-risk individuals, it may be possible to change the current poor outcomes of late-stage diagnosis.

Literature Review

Incidence and Prevalence

Half of all men and one-third of all women in the US will develop cancer during their lifetimes. Today, about 11 million people alive in the United States have had some type of cancer.

Lung cancers are responsible for 29% of cancer deaths in the United States, and lung cancer is the leading cause of all cancer deaths, more than breast cancer, prostate cancer, and colon cancer combined. The number of deaths due to lung cancer has increased approximately 4.3% from 1999 to 2006. White males had the greatest number of deaths due to lung cancer in 2006, with black females having the lowest rate (Centers for Disease Control & Prevention [CDC], 2009).

Regional Trends

Looking at a map of the United States (US), state and regional trends are noted with lung cancer incidence. Kentucky and the south region of the US report the highest incidence of lung cancer and Utah and the west report the lowest rates (CDC, 2011). The most rapid decline of lung cancer was recently noted in the west, with a correlation noted between a low-smoking prevalence and a high ratio of former smokers and never smokers (CDC, 2011). Ohio and the

midwest trends follow those of the south for lung cancer incidence trends as well as smoking prevalence (CDC, 2011; Jemal et al., 2008).

Gender Differences

Deaths due to lung cancer also trend differently by gender. Overall, lung cancer affects men more than women, but that gap is closing. The American Cancer Society's most recent lung cancer statistics in the US for 2009 include an estimated 116,900 men and 103,350 women being diagnosed with lung cancer, and an estimated 88,900 men and 70,490 women will die from lung cancer (American Cancer Society, 2009).

Men

Men generally began smoking at an earlier age, smoked more cigarettes per day and for a longer duration, inhaled more deeply, and smoked cigarettes with a higher tar content. Death rates in men have been declining since their peak in 1991, with the most recent data showing a decline of about 1.6% per year from 2003 to 2007.

In the United States, the risk of lung cancer in black men has been about 50% higher than that of white men over the past 10 to 15 years, but the annual rate of decline after 1990 in black men was equal to that of their counterparts (-2.5% versus -2.3%). White men born before 1900 had higher (50%) age-specific mortality rates than black men, but this trend reversed after 1915.

Women

With increasing incidence and duration of tobacco smoking in women after World War II, lung cancer mortality statistics increased substantially in North America and Western Europe (Pass et al., 2010). While declining in males, death rates among females climbed for several decades until the last few years when they have appeared to plateau (CDC, 2011). The most recent data released has, for the first time, shown a decline of 0.9% in women.

In the US the age-adjusted lung cancer prevalence for black women during 1975 to 2000 was 10% to 20% higher than that of white women; however, during the past 10 years this higher incidence among black women has continued, but at a smaller rate (39.3 versus 40.9 per 100,000). After 1990, the incidence rates have continued to increase at an annual average rate of 0.7% to 0.8% for both black and white women (Pass et al., 2010).

Diagnosis

Age

Because lung cancer can take years to develop, it is mostly found in older people. In the United States, the average age of diagnosis for lung cancer is 71 years old, and less than 3% of lung cancers are diagnosed under the age of 45.

Stage

Because there are people with few or no symptoms of lung cancer at an early stage, most are usually discovered incidentally on a chest x-ray done for other medical reasons, and only 15% of lung cancers in the US are diagnosed early (stages I-II) (Jett & Midthun, 2011). However, survival for lung cancer is much improved when diagnosed early, increasing to 60% to 80% 5-year survival when diagnosed at a localized stage 1. But this survival rate drops down significantly to less than 10% 5 years survival when diagnosed at stage 4 (Jett & Midthun, 2011). Early detection and diagnosis is instrumental to successful treatment and long-term survival.

Lung Cancer Types

There are 2 main types of lung cancer, non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). These names refer to how the cancers look under a microscope to a pathologist. Most cancers are non-small cell.

Non-Small Cell Lung Cancer

There are subtypes of non-small cell lung cancer (NSCLC). These different types of cancers originate in different parts of the lung, are treated differently, and have different prognosis.

Non-small cell lung cancer accounts for about 80% of lung cancers. There are different types of NSCLC, including squamous cell carcinoma (also called epidermoid carcinoma). This is the most common type of NSCLC. It forms in the lining of the bronchial tubes and is the most common type of lung cancer in men. Adenocarcinoma cancer, another type, is found in the glands of the lungs that produce mucus. This is the most common type of lung cancer in women and also among people who have not smoked. Bronchioalveolar carcinoma is a rare subset of adenocarcinoma. It forms near the lungs' air sacs. And lastly, there is undifferentiated carcinoma. This cancer forms near the surface or outer edges of the lungs where it can grow rapidly (Molina, Yang, Cassivi, Schild, & Adjei, 2008).

Small Cell Lung Cancer

Small cell lung cancer (SCLC) accounts for the remaining 20% of all lung cancers. Although the cells are small, they multiply quickly and form large tumors that can spread throughout the body. Smoking is almost always the cause of SCLC. Survival rates for SCLC are greater than those seen for small cell lung cancer. Between 1999 and 2005 the survival rate for NSCLC was 18% compared to only 6.3% for SCLC (American Lung Association, 2010).

Risk Factors

Risk factors are those behaviors or traits that have been shown to have an association with a condition. Smoking is by far the leading risk factor for lung cancer, with tobacco smoke causing nearly 9 out of 10 cases of lung cancer.

Modifiable Risk Factors

Modifiable risk factors are those risk factors generally known to be contributors to a disease that can be changed or altered, thereby decreasing the probability of the disease.

Cigarette Smoking

Cigarette smoking is the most important, modifiable risk factor for lung cancer. Smoking is the primary cause of lung cancer in 90% of men and 80% of women (American Lung Association, 2010). The causal relationship between lung cancer and smoking was first established by epidemiologic studies conducted in the 1950s and 1960s. In 1964, the first Surgeon General's report on smoking summarized the existing evidence and declared cigarette smoking to be the major cause of lung cancer among American men. Over the next 30+ years further studies established the increased risk among women and further associations were made with onset, duration, intensity, and cessation of smoking (Halpern, Gillespie, & Warner 1993).

Though nicotine concentration in cigarettes is addictive and toxic, it is not carcinogenic. Tobacco smoke is very complex, with over 3,000 different chemicals, which has made it difficult to identify the contribution of the more than 55 carcinogenic agents contained. Studies have shown that switching to low-tar, filtered cigarettes may modestly reduce the risk of lung cancer, however recent studies have proven the greatest reduction in risk would be derived from smoking cessation. The relative risk of lung cancer among ex-smokers decreases significantly after 5 years of smoking cessation, but not during the first five years. And the relative risk of a previous smoker never returns to that of a nonsmoker (Hecht, 1999).

Additionally, cigarette smoking can cause cancers other than lung cancer, such as cancers of the esophagus, pancreas, larynx, bladder, and others; therefore, stopping smoking will reduce the risk of developing those cancers, too. Depending on how long and how much was smoked,

quitting may not completely erase the development of lung cancer, but it will definitely reduce the risk (Weitberg, 2002).

Cigarette smoking is preventable, making education and awareness, especially among younger people and higher risk lifestyles, a priority.

Cigar and Pipe Tobacco

Cigar and pipe smoking are almost as likely to cause lung cancer as is cigarette smoking. Smoking low tar or "light" cigarettes increases lung cancer risk as much as regular cigarettes. There is concern that addition of menthol cigarettes may increase the risk even more since the menthol allows smokers to inhale more deeply.

Tobacco smoke produced by tobacco in pipes and cigars is both harsher and more alkaline than that produced by cigarettes and has also been linked to lung cancer. In countries such as Sweden where these forms of smoking are nearly as common as cigarette smoking, the relative risk of lung cancer was equally high for all forms of smoked tobacco (Boffetta, Pershagen, & Jockel, 2000). A prospective sub-set analysis of the cigar smoking men participating in the Cancer Prevention Study II showed a 5-fold increased risk of lung cancer among this population (Shapiro, Jacobs, & Thun, 2000).

Second-Hand Smoke

Second hand smoke is the smoke circulating around a smoker that pollutes the surrounding air. This smoke places those around them at an additional risk. Nonsmokers who live with a smoker, for instance, have about a 20% to 30% greater risk of developing lung cancer. Nonsmokers exposed to tobacco smoke in the workplace are also at risk and are more likely to get lung cancer.

Programs aimed at reducing second-hand smoke and states establishing smoke-free environments are beginning to show reductions in percent of smokers as well as some early improvements in health outcomes. California, the first state to implement a comprehensive state-wide tobacco program, has made significant progress in reducing tobacco use with smoking prevalence decreasing from 14.7% in 1997 to 11.4% in 2006. During that same time, the average percent decrease in lung cancer deaths among men was more than twice that of men in the Midwest and South (Jemal et al., 2008).

Occupational Environments

While cigarette smoking causes the majority of lung cancer, occupational exposures account for approximately 9% to 15% of additional lung cancers. Arsenic, asbestos, cadmium, beryllium, chromium, nickel, and radon are just a few of the many carcinogenic agents used frequently among workers in various industries that have shown positive associations with lung cancer (Weitberg, 2002). It has been estimated that radon can cause 10%, occupational exposure to carcinogens account for approximately 9% to 15%, and outdoor pollution is responsible for another 1% to 2%. Because of the interaction between exposures, the attributable risk for lung cancer can exceed 100% (American Lung Association., 2010).

Radon

Radon exposure is the second leading cause of lung cancer (American Lung Association, 2010). Radon is a radioactive gas made by the normal breakdown of uranium in soil and rocks. Uranium is found at higher levels in the soil in some parts of the United States. Radon can't be seen, tasted, or smelled. It can build up indoors and create a possible risk for cancer. The lung cancer risk from radon is much lower than that from tobacco smoke. But the risk from radon is much higher in people who smoke than in those who don't.

Asbestos

In addition to radon, asbestos exposure is another risk factor for developing lung cancer. Asbestos is a group of naturally occurring fibers used in the production of many products such as insulation, brake linings, ceiling tiles, floors, textiles, and fireproofing. The first case reports of lung cancer in asbestos workers were noted in 1935 in the US and in the United Kingdom (UK). Since then multiple studies and reports have been published, continuing to support the link between asbestos and lung cancer. People who work with asbestos have a 6% to 23% higher risk of getting lung cancer. Lung cancer incidence among asbestos workers is further increased if they smoke, based on a synergistic effect between asbestos and tobacco smoke (Weitberg, 2002). Both smokers and nonsmokers exposed to asbestos also have a greater risk of developing a type of cancer that starts in the lining of the lungs (called mesothelioma).

Malignant mesothelioma is the most serious of asbestos-related diseases. Malignant mesothelioma is an uncommon cancer that is difficult to diagnose and responds poorly to treatment. In 2006, the mesothelioma cancer incidence rate was 0.9 per 100,000 persons. Although this is a small incidence, it has increased at a rate of 50% from 1977 to 2006. The majority of these cases were noted in males that had occupational exposure to asbestos (American Lung Association, 2010).

Non-Modifiable Risk Factors

Non-modifiable risk factors are those attributes or exposures that may increase disease but are not necessarily controlled by an individual.

Family History

There is a genetic predisposition to lung cancer. Brothers, sisters, and children of people who have had lung cancer have a higher risk themselves, especially if the relatives were

diagnosed at a younger age. Though research is continuing to be done in this area, several studies have shown that for patients with lung cancer there is an increased risk directly proportional to the number of affected first-degree relatives (Shaw, Falk, Pickle, Mason, & Buffer, 1991). Additional epidemiologic studies have shown this risk to be as high as two-fold, attributable to a family history of lung cancer after controlling for tobacco smoke exposure.

Race

African Americans are more likely to develop lung cancer than any other population group in the US (American Lung Association, 2010). First-degree relatives of black individuals with lung cancer also at a two-fold risk of lung cancer, compared to white individuals. And recently, an inherited chromosomal linkage was found by the Genetic Epidemiology Lung Cancer Consortium and continues to be studied (Sun, Schiller, Spinola, & Minna, 2007).

Environmental

Air pollution may slightly increase the risk of lung cancer. Worldwide, about 5% of all deaths from lung cancer may be due to outdoor air pollution. Studies have repeatedly evaluated the relationship between air pollution and mortality in US cities, monitoring ambient concentrations of pollutants to estimate the components of air pollution. A positive association between sulfate particles air pollution and lung cancer has been consistently observed (Dockery et al., 1993).

Disparities

Race

Racial disparities have been noted in both lung cancer incidence and mortality (American Lung Association, 2010). Despite lower smoking rates, African Americans are more likely to develop and die of lung cancer than whites. Genetic differences in susceptibility have been

studied extensively and differences have been noted in the African American population. Specifically, a gene code for enzymes involved in the breakdown of carcinogens found in cigarettes has been identified, making this race a risk factor in itself for lung cancer.

Additionally, it has been noted that African Americans have higher blood cotinine levels, which affects the breakdown rates of nicotine and other tobacco-related carcinogens. Higher cotinine levels may also play a role in higher cigarette addiction rates and the lower rate of smoking cessation in African Americans compared to other racial groups (Caraballo et al., 1998). Racial differences in familial risk have also been observed. First-degree relatives of black individuals with lung cancer are at a 2-fold increased risk of lung cancer compared to their white counterparts (Sun, 2007).

Survival rates also reflect a racial difference. Compared to whites, blacks experience a lower 5-year survival rate for lung cancer, even when controlling for age at diagnosis, 12.9% compared to 16.6% during the period spanning 1999 to 2005 (American Lung Association, 2010).

Socioeconomic

Various studies have reported an inverse relationship between lung cancer mortality and socioeconomic status. A 2-fold gradient in mortality was observed between low and high social class, as measured by occupation, income, or education level. Smoking patterns accounted for part of the difference in risk by social class, with smoking incidence rates increased among blue-collar workers and among those with lower levels of education. Socioeconomic markers may serve as a surrogate measure for other risk factors such as occupation, diet, ambient air pollutants, asbestos exposure, as well potentially impacting the quality, access, and utilization of health care services (Pass, Carbone, Johnson, Minna, & Tirrisi, 2005).

Level of education is also often used as a marker of socioeconomic status. In a recent analysis of socioeconomic status and cancer, the largest socioeconomic disparity in cancer types was noted in lung cancer; the death rate in men was 5 times higher for the least educated than for the most educated. Also noted was a 31% prevalence of lung cancer deaths for men with 12 years or less of education that are current smokers, compared to 12% of college graduates and 5% of men with graduate degrees (Siegel, Ward, Brawley, & Jemal, 2011).

Methods

The purpose of this project was to describe lung cancer incidence and the presence of select risk factors in Montgomery County for the time period of 1996-2006. A secondary purpose of this project was to describe the presence of lung cancer risk factors across Montgomery County in the general population.

Data for Montgomery County was obtained for residents diagnosed with cancer during the years 1996 to 2006, and reported to the Ohio Cancer Incidence and Surveillance System (OCISS). Data on new cases of lung cancer reported in Montgomery County residents was drawn from the OCISS. Physician practices enter data from patient medical records into the OCISS.

Setting

Montgomery County is an urban county located in southwest Ohio with a population of 539,000 ranking it the fifth most populated Ohio county (U.S. Census Bureau, 2010). Approximately 75% of Montgomery County residents are Caucasian, 20% Black, 2% Hispanic, and 1.5% are Asian (U.S. Census Bureau, 2010). The average age in Montgomery County is 39 years, and approximately 45% of the people are married. The average household size is 2.31, and roughly 60% of residents have children but are single.

The median household income in Montgomery County is $40,156 compared to the state average of $45,395. For the years 2006-2010, approximately 15.7% of county residents lived below the poverty level versus 14.2% for state estimates (U.S. Census Bureau, 2006-2010). Nearly 15% of Montgomery County adults and 5% of children have no health insurance (Montgomery County Health Assessment, 2010). The unemployment rate for Montgomery County is 9.5% (vs. 9.1 National). Manufacturing was a primary source of employment though the recent job growth has been negative (-1.78%) due to several plant closures. Wright Patterson Air Force Base and health care (Premier Health Partners and Kettering Health Network) are now the largest local employers.

Data Collection

Primary data for this analysis were drawn from newly reported cases of cancer in Montgomery County for the years 1996-2006, obtained from the Ohio Cancer Incidence and Surveillance System (OCISS). Specifically, lung cancer patients within Montgomery County were then identified and evaluated for risk factors and other key variables.

To complete a more descriptive picture of lung cancer in Montgomery County, the use of secondary data was necessary. This data was obtained from several publically available sources (Table 1) and provided additional information on risk factors, demographic information, tumor staging, and socioeconomic background for Montgomery County, Ohio, and United States (US) segments. Reporting time periods for data obtained from these sources were varied, making some comparisons difficult.

Table 1. *Secondary Data Sources*

Publication Source	**Variable**	**Data Source**	**Year**
Montgomery County Health Assessment	Smoking: Age of initiation Racial differences Exposures in home	Behavioral Risk Factors Surveillance System (BRFSS)	2007-2008
	Socioeconomic: Poverty status	U.S. Census Bureau	2006-2008
	Insurance	U.S. Census Bureau	2006-2008
	Socioeconomic Doctor visits Health Care Coverage	BRFSS	2007-2008
	Demographics Employment Status Household Income	U.S. Census Bureau	2006-2008
American Lung Association	Lung Cancer rates by State	Centers for Disease Control and Prevention (CDC)	2009
Centers for Disease Control and Prevention	State Mortality Rates	National Program of Cancer Registries	1999-2006
Ohio Department of Health	Risk Factors: County Behavior Health Ranking Cancer Screening Practices	Ohio BRFSS	2004-2007
	Socioeconomic: Population Household Income	U.S. Census Bureau	2000
Ohio Cancer Facts & Figures	Tumor Staging	Ohio Cancer Incidence Surveillance System (OCISS)	2010
National Cancer Institute	State Incidence Rates of Lung Cancer	North America Association of Central Cancer Registries (NAACCR)	2001-2005
Ohio Department of Health	Staging of Tumors	Data Warehouse	2007-2008

Data Analysis

Lung cancer incidence rates were described in Montgomery County, and then compared to Ohio and US rates. When available, lung cancer incidence rates were described further by looking at age, race, gender, stage at diagnosis, family history of cancer, history of tobacco use, and insurance provider. Employment type and status of employment at time of diagnosis could not be evaluated from this data set due to inconsistent reporting or data not available, as was occupation.

Table 2. *Variables of Interest with Missing Data*, n=5,434

Variable	**Number Reported (Percent of Total)**
Industry	322 (5.9%)
Occupation	323 (5.9%)
Employment Status	Not tracked

A secondary purpose of this project was to describe the presence of lung cancer risk factors across Montgomery County in the general population. Published assessments of community health and behavioral risk factors for county, Ohio and the US were reviewed. Results specific to lung cancer risk were recently reported in the Montgomery County Health Assessment. These risk factors were extracted, reported and discussed here.

Results

Lung Cancer Incidence Rates in Montgomery County

Overall

Montgomery County incidence rates for cancer of the lung and bronchus ranked as the third highest cancer among all cancers reported. Prostate cancer and breast cancer were higher,

with rates of 152.2 and 124.5 per 100,000, respectively, compared to lung and bronchus, which had a rate of 80.2. This county rate (80.2) was higher than both the Ohio (74.9) and the US (68.0) rates. This rate was almost double the next highest cancer, that of colon, which was 49.0.

Additionally, Montgomery County incidence rates for all cancers combined were again higher than Ohio and the US rates. The overall cancer incidence rate in Montgomery County was 473.2 compared to 470.0 for Ohio, and 461.6 for US (Table 2).

Table 3. *Cancer Incidence Rates per 100,000, 2003-2007*

	Montgomery	**Ohio**	**United States**
All Cancer Sites [a]	473.2	470.0	461.6
Breast (female) [b]	124.5	119.9	120.6
Colon & Rectum [b]	49.0	51.1	48.8
Lung & Bronchus [b]	**80.2**	**74.9**	**68.0**
Melanoma of the Skin [b]	17.4	18.3	18.3
Prostate [b]	152.2	145.5	153.5

a Ohio Cancer Incidence Surveillance System, Ohio Department of Health, March 2010
b State Cancer Profiles, National Cancer Institute, 2003-2007

Lung Cancer Incidence by Age

As noted earlier, lung cancer is generally found in older adults and at later stages. The average age for lung cancer diagnosis in Montgomery County was 68.7 years old. Secondary data for Montgomery County showed age at time of diagnosis higher than a national average age of 71 years old. Compared to Ohio, with a state average of 66% being older than age 65, Montgomery County age at diagnosis is similar. A state average for age at time of diagnosis was not found, so this percent over age 65 was used for comparison.

Lung Cancer Incidence by Race

Over 79% of the lung cancer incidences reported for Montgomery County were among whites. An additional 16.8% reported were among blacks, and the remaining 4% were other racial categories or unknown.

Lung Cancer Incidence by Marital Status

Almost half of all lung cancer incidence for Montgomery County was reported among married people (48.6%). Widowers were next highest at 23.9%. Single and divorced status was reported with rates of 8.2% and 13.3%, and separated was <1%. The remaining 5% was unknown or blank (see Table 4).

Table 4. *Marital Status Reported, Montgomery County*

Status	**Number Reported**	**Percent**
Single	446	8.2
Married	2644	48.6
Separated	25	.03
Divorced	724	13.3
Widowed	1300	23.9
Unknown or Blank	295	5.0

N=5,434

Lung Cancer Mortality

The 2006 to 2008 overall mortality rate for lung and bronchus cancer was 61.7 per 100,000. Blacks have a higher rate than whites, 70.0 versus 60.8 per 100,000 (Montgomery

County Health Assessment, 2010). This racial trend is consistent with the rest of the state as well as within the United States (see Figure 1).

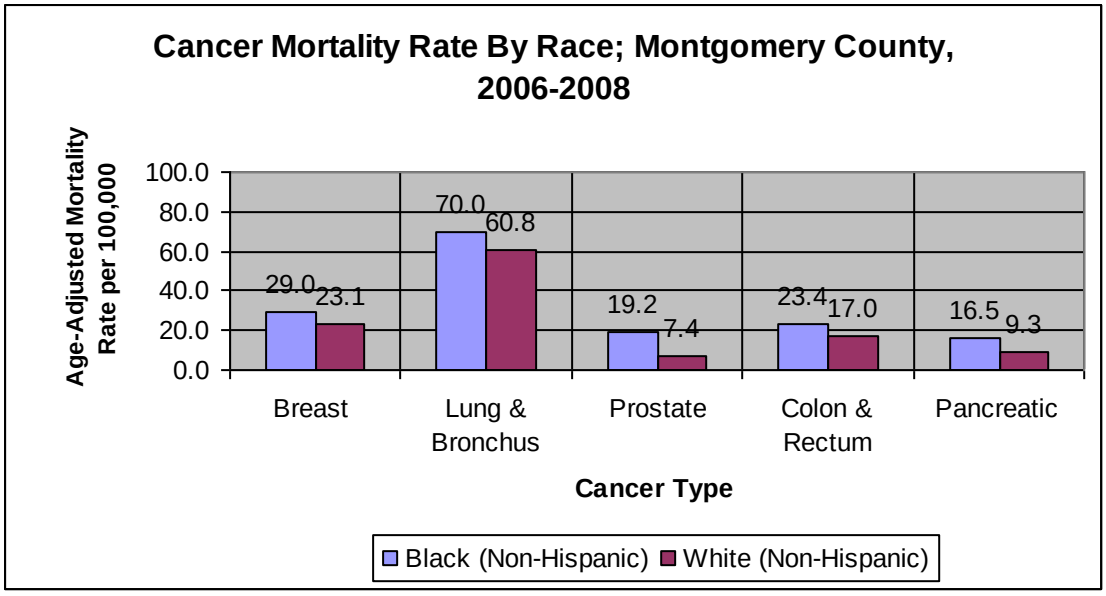

Figure 1. Cancer Mortality Rate by Race

Data Source: Data Warehouse: Ohio Department of Health, 2006-2008

Smoking History

More than three quarters of those diagnosed with lung cancer were smokers or had a history of using some smoking substance at the time of diagnosis. A third of those reported were current smokers (37.6%), with an additional 25.6% noting a previous history of smoking. No data or status unknown was the remaining 19.6%. In OCISS, smoking status habits and numbers are self-reported at time of diagnosis (Figure 2).

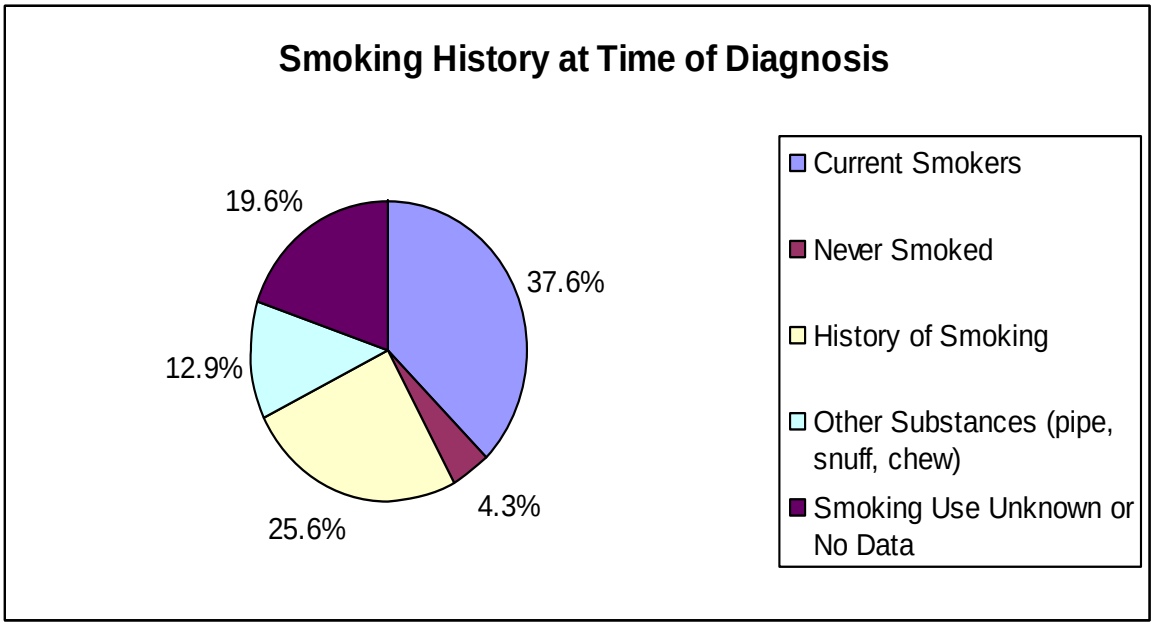

Figure 2. Reported Smoking History

Data Source: Ohio Cancer Incidence and Surveillance System, 1996-2006

In addition to cigarette smoking, other tobacco agents were also reported to be used regularly. Substances such as pipes, snuff and chew were reported among 12.9%, with cigar and pipe use being the largest portion of that (9.4%), snuff, chew and smokeless tobacco products were used among 2.3%, and a combination of products was reported among 1.2%.

Table 5. *History of Tobacco Product Use, Montgomery County*

Never	4.3%
Current Cigarette Smoker	37.6%
Current Cigar/Pipe Smoker	9.4%
Current Snuff/Chew/Smokeless	2.3%
Current Combination Use	1.2%
Previous Use (no use within past year)	25.6%
Unknown or No Data	19.6%

Data Source: Ohio Cancer Incidence Surveillance System, 1996-2006

Socioeconomic Status

One method to capture socioeconomic status is to look at insurance and payer mix at time of diagnosis. Not surprisingly Medicare was the largest insurance provider reported (52.1%), reflecting the higher age at time of diagnosis (68.7 years in Montgomery County). Private insurance was the next highest insurance group with 22.2% having this coverage. The insurance provider information reports a high number of unknown or no data along with no insurance, accounting for a combined 21% (Table 6).

Table 6. *Insurance Payer at Time of Diagnosis*

Not Insured	103	1.8%
Private Insurance	1195	22.2%
Medicaid	216	3.9%
Medicare	2831	52.1%
TriCare/Military/VA	25	.5%
Indian Health Service	18	.3%
No Data/Unknown	1046	19.2%

Data Source: Ohio Cancer Incidence Surveillance Survey, 1996-2006

Stage at Diagnosis

The majority of lung cancers are diagnosed at a late stage, and the later a cancer is found the poorer the prognosis. In Ohio, 17% of new cases of lung cancer were diagnosed at an early stage, 68% are diagnosed at late stage, and 15% are diagnosed with stage unknown. Within Montgomery County, 19% of new cases of lung cancer are early stage, 70% are late stage, and 11% are unknown stage at time of diagnosis (Ohio Cancer Facts & Figures, 2010).

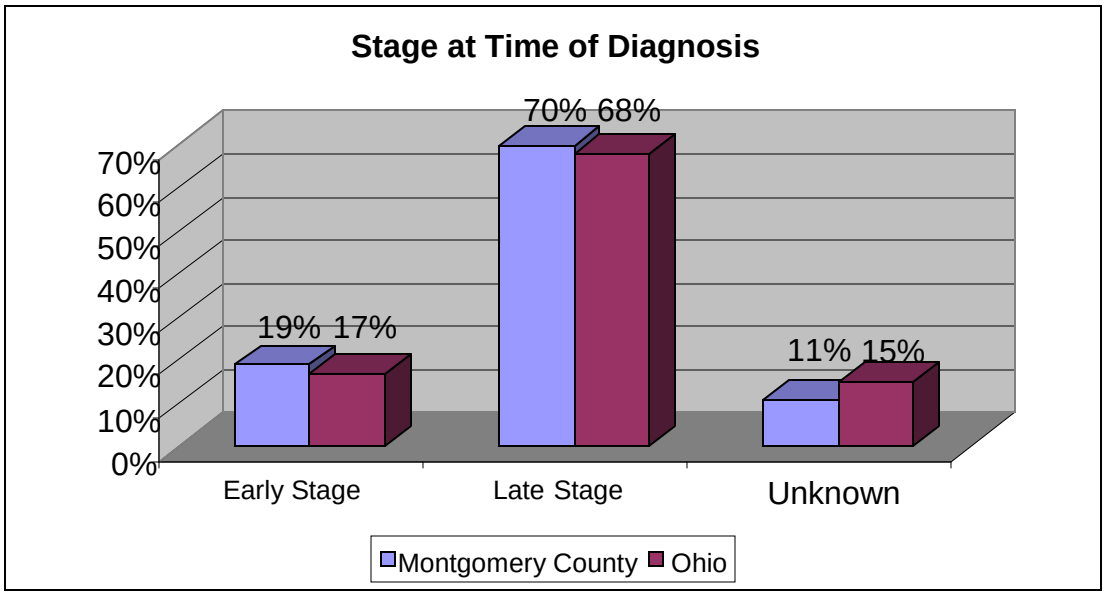

Figure 4. Cancer of Lung & Bronchus: Stage at Diagnosis, 2003- 2007 [1,2]

[1] Data Source: Ohio Cancer Surveillance System, Ohio Department of Health, 2010

[2] The total case counts by stage at diagnosis include early stage diagnosed in situ and localized stages, late stages include tumors diagnosed at regional and distant stages.

Lung Cancer Risk Factors across Montgomery County

The secondary purpose of this project was to describe the presence of lung cancer risk factors across Montgomery County in the general population. To complete this description secondary data was obtained from publically available sources.

Smoking History

Daily smoking rates in Montgomery County closely resemble those of Ohio, both of which are higher than US smoking rates (15.6% County and Ohio, versus 12.8% US).

There was a slightly higher proportion of males (16%) than females (13%) that smoke daily. Other key findings for Montgomery County include 12% of smokers aged 12 and older use cigarettes monthly, and 12% of children less than 15 years old live in a household with someone that smokes.

Table 7. *Current Smoking Use, Adults 18 and Older*

	Montgomery County	**Ohio**	**United States**
Smoke Every Day	15.6%	15.6%	12.8%
Smoke Some Days	5.6%	4.7%	5.0%
Former Smokers	26.4%	25.8%	25.5%
Never Smoked	52.5%	53.8%	55.3%

Data Source: Montgomery County Health Assessment, 2010

For current smokers, the difference between black and white smokers within Montgomery County is not statistically significant (19% versus 17.1%). However this is not the case for Ohio data where there is a higher rate of smoking among blacks compared to whites (29.7% versus 21.1% whites). Among those that have quit smoking in Montgomery County, there is a larger proportion of whites that have quit (30.0%) than blacks that have quit (25%).

Using OCISS data, self-reported smoking rates were broken out by zip code. The highest prevalence of current smokers (28.1%) falls within the 45449 zip code. This zip code is followed by 45322 reporting 21.5% smokers, followed by zip code 45414 reporting 20.5% smokers.

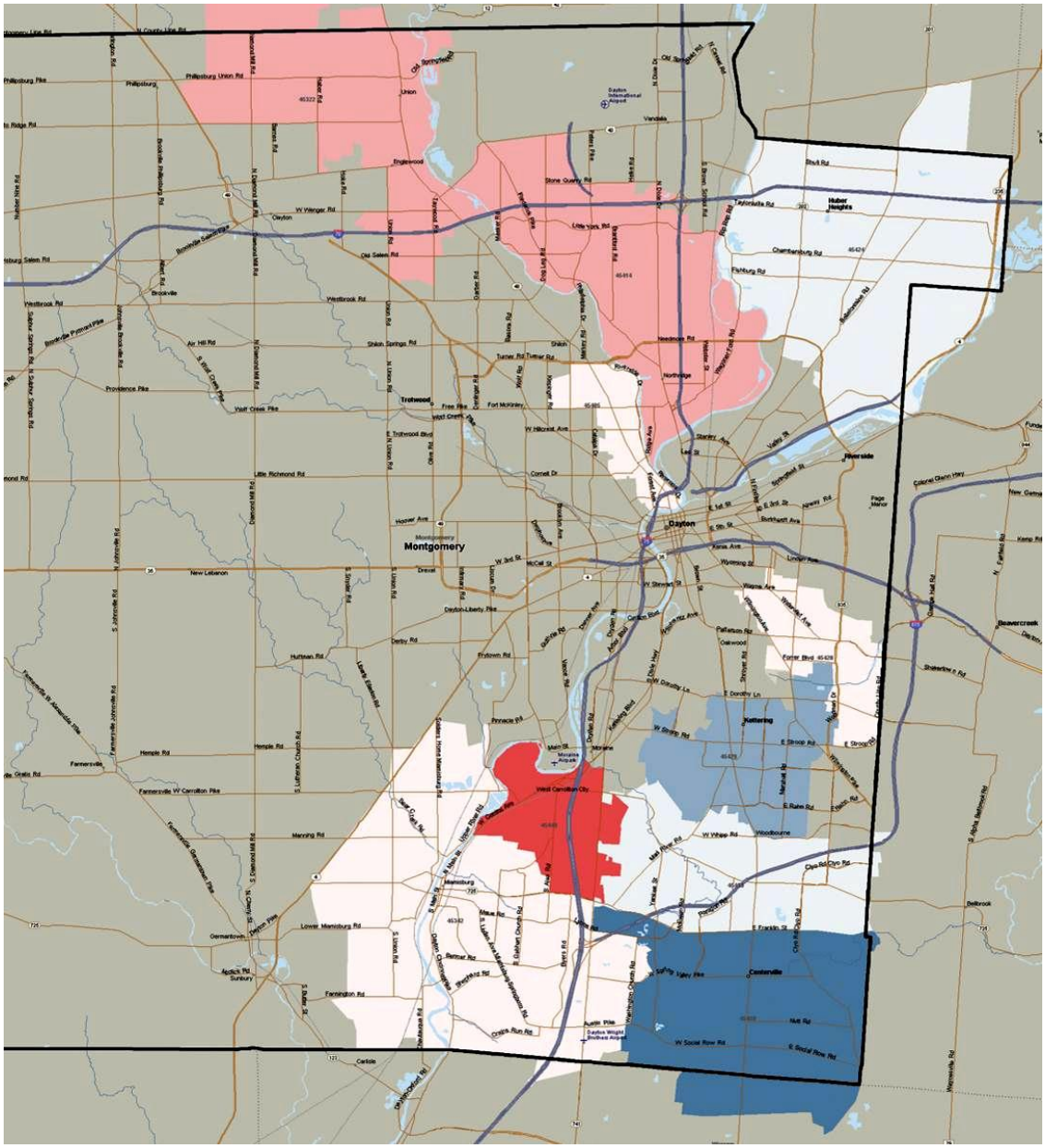

Figure 5. Prevalence of Current Adult (18 and older) Smokers by Zip Code in Montgomery County, 2007-2008

Data Source: County Cancer Profiles, Ohio Cancer Incidence Surveillance System, Ohio Department of Health, 2008.

As noted earlier, a higher incidence of smoking is reported among lower socioeconomic levels. Smoking is strongly linked to lung cancer. Montgomery County has 15.7% of families living below the poverty level. The poverty rate is higher than both the Ohio rate of 14.2%,

and a national rate of 13.8% (U.S. Census Bureau, 2006-2010). This lower socioeconomic level increases the risk of Montgomery County residents.

Health insurance also impacts screenings and prevention. Screening for early symptoms of lung cancer are at risk further, since in Montgomery County nearly 67,000 residents have no health insurance. And, 13% of adults reported they could not see a doctor because it costs too much (Montgomery County Health Assessment, 2010). Thus, regular medical monitoring for early symptoms of lung cancer among low income uninsured smokers is unlikely. Screening data is self-reported and not currently reported. Evaluating and monitoring this rate would be helpful to further identify additional potential cancer risks and behaviors of Montgomery County residents.

Discussion

The data and statistics presented in this description of lung cancer in Montgomery County are alarming. The incidence of lung cancer in Montgomery County is 80.2, higher than both the Ohio (74.9), and US (68.0) rates. Lung cancer ranks third among all cancers in Montgomery County, behind prostate (152.2) and breast (123.5) cancers. However, lung cancer deaths are greater than those of breast and prostate.

A secondary purpose of this study was to build a descriptive profile of those individuals diagnosed with lung cancer. In Montgomery County, 70% of lung cancers were diagnosed at late stage, and in older individuals. The average age of diagnosis in Montgomery County is 68 years old. By identifying a population of people to focus prevention programming and earlier detection and screening programs there may be an opportunity to impact and change these alarming findings.

Preventive Considerations

Prevention offers the greatest promise for fighting lung cancer. Smoking accounts for almost 9 out of 10 lung cancer deaths (American Lung Association, 2010). In Montgomery County, more than three quarters of those diagnosed with cancer were smokers or had a history of using some smoking substance. Daily tobacco use in Montgomery County tends to be higher among males over females (16% vs. 13%), similar to the Ohio trend. Tobacco use is also reported among less educated, and lower income. Most tobacco use begins in youth. In Montgomery County, 12% of smokers age 12 and older use cigarettes at least monthly, and 12% of children under 15 years old live in homes with smokers.

Reduction in tobacco use provides the largest single opportunity to prevent cancer deaths. By quitting smoking the relative risk of lung cancer decreases significantly after 5 years of not smoking (Hecht, 1999). Studies focusing on how best to help people quit smoking through counseling, nicotine replacement, and other medicines need to be reviewed. Education of smokers on this reduction of risk, association of smoking with lung cancer incidence, and approaches to smoking cessation continues to be necessary.

School Programs

Education of young people on the risks of smoking is critical. The statistics for smoking among high school students is alarming, 51% have tried smoking at least once, and 14% smoked a whole cigarette before age 13 (Montgomery County Health Assessment, 2010). And again, 12% of children under 15 years old live in households with smokers. Research has shown that there is a 20-30% greater risk of getting lung cancer for those living with a smoker (American Lung Association, 2010). Programs aimed at those younger ages of smoking (12 years) and exposure to second hand smoke should be considered. Smoking prevention programs for schools

continue to be challenged financially and yet we stand to make the greatest impact in this population. Montgomery County initiatives should remain focused on this age group with education programs mandated in our schools and health classes.

Public Programs

Racial differences noted in this study should be considered with focus of public programs. Montgomery County mortality rates for lung cancer were higher in blacks versus whites (70% versus 60.8%). Screening and programs for education and earlier detection should recognize this racial difference and adequately direct programs to this racial level.

Public education, programs, and publicity aimed at smoking prevention must be continued and funding for these programs is essential. California set an example showing the positive impact that state programming, policies, and funding support can make a difference. This decrease in smokers after a smoking ban was instituted was significant (14.7% down to 11.4%), followed by a significant decrease in lung cancer deaths, demonstrating state policies can have an important influence on smoking initiation, cessation, and protecting nonsmokers from second-hand smoke. Funding cuts throughout the US have recently severely limited monies available for smoking prevention and smoking cessation programs. Montgomery County and Ohio could learn from California, prioritizing initiatives and providing funding for these programs.

Work Place Programs

Prevalence of smoking among blue collar workers and those with a lower level of education has shown to be higher. The Miami Valley has a significant amount of employees that would fall within this segment. In Montgomery County, 67,000 residents have no health insurance, and 13% of residents report they could not see a doctor because of costs.

Incentives and encouragement of a smoke-free work place should be supported. Smoking policies and work place screenings should be considered and regularly evaluated. Employee insurance coverage for these screenings should also be evaluated. If they are not aware of them, employers should be educated on these lung cancer risks and then share equally in prevention and cessation programs for their workers.

An additional risk in the work place is the environment. Occupational exposure to agents account for 9-15% of lung cancer, as reported earlier. Local work place environments that may provide higher occupational exposure to carcinogenic agents such as asbestos, cadmium, chromium, etc. These manufacturing occupations are found in the Montgomery County area. Again, work place policies and practices to minimize exposure should be evaluated. Education of exposure risks should be regularly conducted and screenings supported and conducted.

Earlier Detection

During the years 1996-2006, 70% of lung cancers in Montgomery County and 69% in Ohio were diagnosed at late stage. Only 19% of lung cancers were diagnosed at an early stage, usually discovered incidentally, leaving much room for improvement with increasing earlier detection. The average age of lung cancer diagnosis in Montgomery County was 68 years old, slightly younger than the average US age of 71 years, but again, the cancer was still diagnosed at a late stage.

Survival rates can improve greatly when diagnosed earlier, increasing from an abysmal less than 10% 5-year survival at stage 4, to a 60% to 80% 5-year survival if diagnosed at a localized stage 1. Since there are few or no symptoms in the early stages of the disease, the majority of lung cancers are thus diagnosed in the later stages. Early detection of lung cancer is critical for offering any chance of improving survival of this disease

Screening

A screening program that identified a greater proportion of early stage lung cancer could improve mortality from lung cancer. Currently, active screening for high-risk patients remains controversial and inconsistent, with most lung cancers currently being diagnosed incidentally by a chest x-ray. At the time of diagnosis, most patients have advanced unresectable disease. It has been considered that an annual chest x-ray of high-risk patients can favorably influence stage diagnosis and survival in those patients diagnosed with lung cancer. Mortality from lung cancer remains higher than for any other malignancy in both men and women. Developing a profile of high-risk people for more aggressive screening would focus on the average age of diagnosis, 68 years old, coupled with the known history of smoking among men and women, post World War II. Not surprising, other than unknown, Medicare was the largest insurance payer of OCISS patients at time of diagnosis, supporting this older patient demographic.

Implications for Future Investigation

The goal of a screening program is to find cancer at an early stage when there are fewer symptoms but opportunities for a better outcome. Currently there is no screening test approved to detect localized (had not spread) disease. Treatment at early stages of cancer can lead to more treatment options, less invasive surgery, and a higher survival rate. In recent years, the 5-year survival rate of persons whose cancers were diagnosed when they were still localized was almost 50%. This drops to 2% for persons whose cancers were diagnosed after their cancers had spread distantly.

Testing people who are known to be at a high risk for developing lung cancer may help find tumors at an earlier stage when they are small and more easily treated. People at high risk include men and women aged 60 years and older who currently smoke or have a history of

smoking, those with previous lung tumors, and people with chronic obstructive pulmonary disease (COPD).

Before now, lung cancer screening tests (like chest x-ray and sputum cytology) had not been shown to lower the risk of these dying from this disease. Major medical groups have not recommended routine screening tests for all people or even for people at increased risk, such as smokers. There are studies underway, though, to find appropriate screening tools.

Efforts are underway to find more effective ways to screen for lung cancer. Currently, in addition to chest x-ray, other tests include microscopic analysis of cells in sputum, fiberoptic examination of bronchial passages (bronchoscopy), low-dose spiral computed tomography (CT) scans, and evaluation of molecular markers in the sputum. One of these, the CT scan, has recently shown some promise in finding early lung cancers in heavy smokers and former smokers. Spiral CT gives more detailed pictures than a chest x-ray and is better at finding small changes in the lungs.

The National Lung Screening Trial (NLST) is a large study that compared spiral CT scans to chest x-rays in people at high risk of lung cancer to see if these scans could help lower the risk of dying from lung cancer. People in the study were current or former heavy smokers aged 55 to 74. They underwent either 3 spiral CT scans or 3 chest x-rays, each one year apart. They were then followed for several years to see how many people in each group died of lung cancer. Early results from the study found that people who got spiral CT had a 20% lower chance of dying from lung cancer than those who received chest x-rays.

In addition to cost, spiral CT scans are also known to have some downsides that need to be taken into account. One drawback of this test is that it also identifies many non-cancerous findings that require follow up testing. For some people, this may lead to further, sometimes

unnecessary, tests such as biopsies or surgery. Additionally, spiral CT scans expose people to a small amount of radiation with each test. While it is less than the dose from a standard CT, it is more radiation than a chest x-ray.

Additional Considerations

As noted earlier, some patient populations have shown a greater genetic sensitivity and higher incidence of lung cancer. Future studies should also be directed toward gene changes that make some people and populations much more likely to get lung cancer if they smoke or are exposed to second-hand smoke. Recent press has centered on genotype-phenotype identification, directed toward better treatment-specific approaches as well as use of this cell typing for better identification of high-risk populations.

Some risk factors may never be controlled, or at best, can only be minimized. With the close proximity of Kentucky, many families and workers in Montgomery County travel frequently to that area or have relatives visit frequently from this area. Kentucky has consistently led the nation in highest rate of smoking as well as lung cancer incidence and mortality. This "creep" across the state border is not controllable; however the influence from these factors must be recognized and minimized. Public awareness, education, and programs directed to this community and demographic group may help to minimize this hazardous habit.

A future comparison of lung cancer in southern Ohio counties to northern Kentucky counties may be interesting and show more similarities than comparing counties in southern to northern Ohio, for reasons of the "creep" just described.

Conditions in Montgomery County may contribute to a higher risk for lung cancer, namely bordering a state with the highest incidence for both smoking and lung cancer, as well as having a population of significant numbers of uninsured, less-advantaged, lower-educated adults.

These socioeconomic variables coupled with a higher number of smokers all set the stage for greater risk of lung cancer in our community.

Limitations

While this data set provided some valuable information, it was not complete. Several key pieces of information were lacking including family history of cancer and other risk factors, such as occupation, as well as further detailed zip code information for household and employment history. Industry and occupational information would be helpful for both socioeconomic associations as well as comparison to the United States Environmental Protection Agency (USEPA) issues areas of concern. Evaluable data was not available to consider environmental factors and any potential impact on lung cancer incidence as well as air quality. Additionally, as noted earlier, this information is self-reported, therefore the reliability and accuracy of this information may not be complete.

Conclusion

More people have died in this century from lung cancer than all other cancers combined. The statistics of lung cancer in Montgomery County are equally alarming. The strikingly high lung cancer mortality rate is largely the result of smoking. Smoking cessation and programs aimed at reducing initiation are needed. In addition, the down-the-road effects of smoking should also be considered when lung cancer gets diagnosed at a later age. Considerations should be given to screening of smokers, a high-risk population, in order to identify lung cancers at an earlier stage. Further, workers should be evaluated for possible occupational exposures and social conditions in the work place that may contribute to lung cancer development. The best chance we stand of making a positive impact on lung cancer in our community is through prevention of smoking in our young people and with earlier stage identification of this cancer.

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Appendix A: List of Public Health Competencies Met

Specific Competencies
Domain #1: Analytic Assessment Skill
Defines a problems
Determines appropriate uses and limitations of both quantitative and qualitative data
Selects and defines variables relevant to defined public health problems
Identifies relevant and appropriate data and information sources
Evaluates the integrity and comparability of data and identifies gaps in data sources
Applies ethical principles to the collection, maintenance, use, and dissemination of data and information
Partners with communities to attach meaning to collected quantitative and qualitative data
Makes relevant inferences from quantitative and qualitative data
Obtains and interprets information regarding risks and benefits to the community
Applies data collection processes, information technology applications, and computer systems storage/retrieval strategies
Recognizes how the data illuminates ethical, political, scientific, economic, and overall public health issues
Domain #2: Policy Development/Program Planning Skills
Collects, summarizes, and interprets information relevant to an issue
States policy options and writes clear and concise policy statements
Identifies, interprets, and implements public health laws, regulations, and policies related to specific programs
Articulates the health, fiscal, administrative, legal, social, and political implications of each policy option
States the feasibility and expected outcomes of each policy option
Utilizes current techniques in decision analysis and health planning
Decides on the appropriate course of action
Develops a plan to implement policy, including goals, outcome and process objectives, and implementation steps
Domain #3: Communication Skills
Communicates effectively both in writing and orally, or in other ways
Solicits input from individuals and organizations
Advocates for public health programs and resources
Leads and participates in groups to address specific issues
Effectively presents accurate demographic, statistical, programmatic, and scientific information for professional and lay audiences
Attitudes
Listens to others in an unbiased manner, respects points of view of others, and promotes the expression of diverse opinions and perspectives

Domain #4: Cultural Competency Skills
Utilizes appropriate methods for interacting sensitively, effectively, and professionally with persons from diverse cultural, socioeconomic, educational, racial, ethnic and professional backgrounds, and persons of all ages and lifestyle preferences
Identifies the role of cultural, social, and behavioral factors in determining the delivery of public health services
Develops and adapts approaches to problems that take into account cultural differences
Attitudes
Understands the dynamic forces contributing to cultural diversity
Understands the importance of a diverse public health workforce
Domain #5: Community Dimensions of Practice Skills
Establishes and maintains linkages with key stakeholders
Identifies how public and private organizations operate within a community
Identifies community assets and available resources
Describes the role of government in the delivery of community health services
Domain #6: Basic Public Health Sciences Skills
Identifies the individual's and organization's responsibilities within the context of the Essential Public Health Services and core functions
Defines, assesses, and understands the health status of populations, determinants of health and illness, factors contributing to health promotion and disease prevention, and factors influencing the use of health services
Understands the historical development, structure, and interaction of public health and health care systems
Identifies and applies basic research methods used in public health
Applies the basic public health sciences including behavioral and social sciences, biostatistics, epidemiology, environmental public health, and prevention of chronic and infectious diseases and injuries
Identifies and retrieves current relevant scientific evidence
Identifies the limitations of research and the importance of observations and interrelationships
Domain #7: Financial Planning and Management Skills
Manages information systems for collection, retrieval, and use of data for decision-making
Domain #8: Leadership and Systems Thinking Skills
Identifies internal and external issues that may impact delivery of essential public health services (i.e. strategic planning)