

Lung Cancer in Marion County, Indiana:

The leading cause of cancer deaths: 2000-2010

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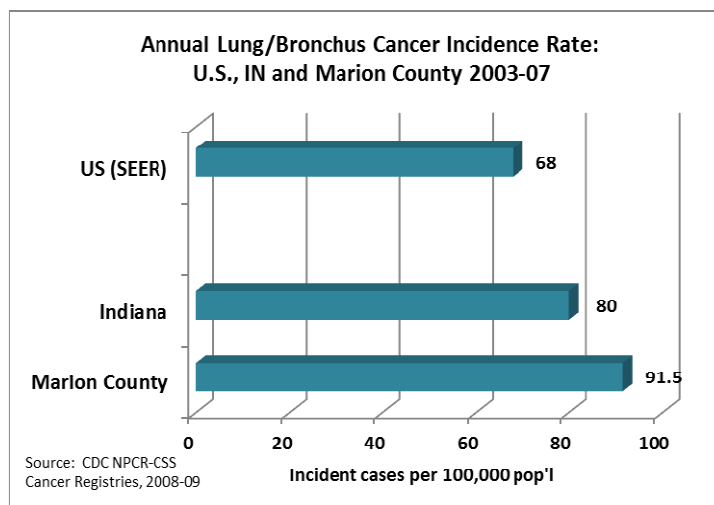
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Marion County Lung Cancer, 2010: Executive Summary

New cases of lung cancer¹:

- Approximately 717 Marion County residents are newly diagnosed with lung-bronchial cancer per year (annual average, 2003 through 2007).
- One in 3 cases (35.3%) occurs in adults under age 65.
- Lung cancer is the most common form of new cancer in the county, making up 18.2% of all new cancers (or cancer incidence), and the most common cause for men and women (following prostate and breast cancers, respectively which have well established screening protocols).
- Lung cancer incidence among Marion County men is 50% higher than among women (113 versus 76 per 100,000). While gender-specific rates are significantly different, Whites' and Blacks' incidence rates are similar (91.5 and 92.3, respectively).
- Men who smoke are 24 times more likely to develop lung cancer than similar non-smoking men. Women who smoke are 13 times more likely to develop lung cancer than similar non-smoking women².



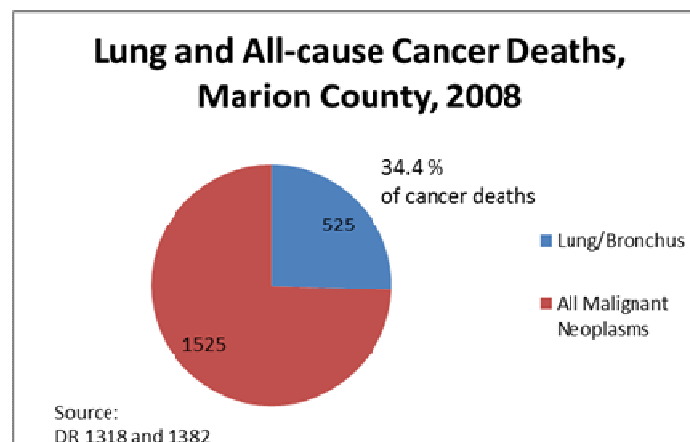
¹ National Cancer Institute, Incidence Rate Report for Indiana by County
<http://statecancerprofiles.cancer.gov/incidencrates/index.php?stateFIPS=18&cancer=047&race=00&sex=0&age=001&type=incd&sortVariable=Name=rate&sortOrder=default> Incidence rates (cases per 100,000 population per year) are age-adjusted to the 2000 US standard population (19 age groups: <1, 1-4, 5-9, ... , 80-84, 85+).

² Edwards, BK, Ward, E., Kohler, BA, et al., Annual report to the nation on the status of cancer, 1975-2006, featuring colorectal cancer trends and impact of interventions (risk factors, screening, and treatment) to reduce future rates. *Cancer*, Feb 2010, 116(3):544-73.
<http://onlinelibrary.wiley.com/doi/10.1002/cncr.24760/full>

- Marion County residents' rate for new lung cancer cases, or 91.5 per 100,000 population, significantly exceeded the state (80.0 cases), and national rate of 68.0, by 14% and 33%, respectively (period 2003-2007).
- Marion County's lung cancer incidence exceeds that of other large Indiana metropolitan counties (Lake, Allen, and Monroe), and 4 other counties in our own MSA.
- New lung cancer incidence in the county declined from 128.9 per 100,000 for the period 1998-2002, to 113.6 during 2003-2007. This change was driven primarily by declining incidence among White men, following earlier declines in smoking in that group. No significant changes occurred among women or Blacks, groups whose smoking rates have increased in recent decades.
- There is nearly a 20-fold excess risk of developing lung cancer for smokers, compared to persons who have never smoked³.

The high cost of lung cancer: Lung cancer mortality

- Nationally, lung cancer is the leading cause of smoking related deaths (29% of all smoking-attributed deaths, or 129,000 preventable deaths per year), leading to lost productivity for smoking related lung cancer of \$36.8 billion⁴.
- Lung cancer made up 34% of all Marion County cancer deaths, and about 8% of all deaths, killing approximately 525 residents in 2008.

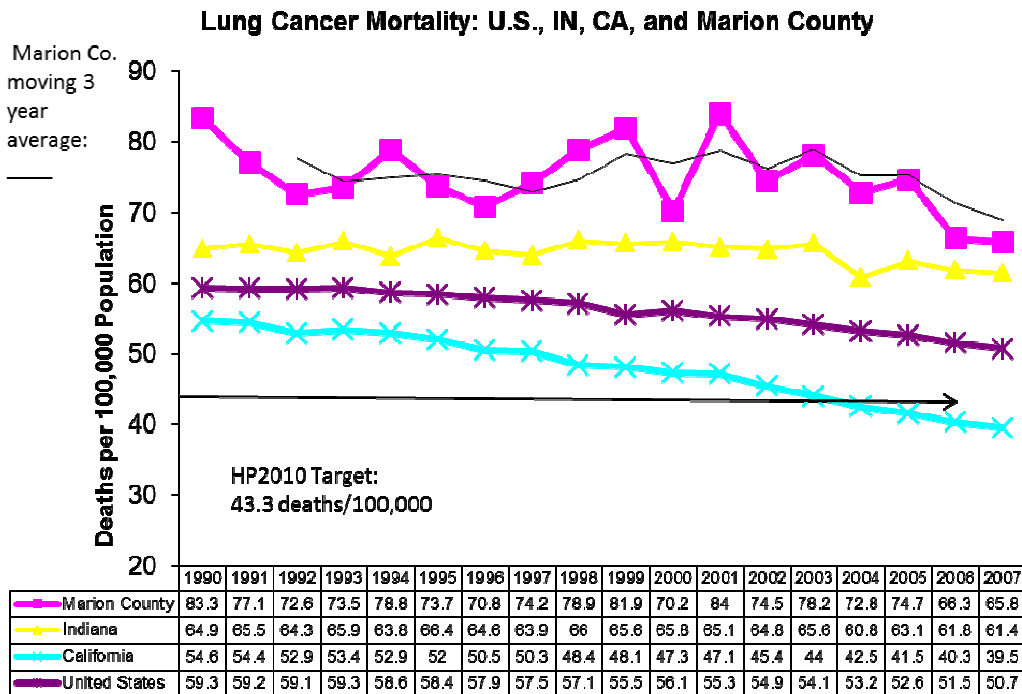


- Smoking exposure is estimated to cause 82% of all trachea-bronchus-lung cancer deaths⁵. Of the 525 Marion County lung cancer deaths in 2008, conservatively 430 deaths were preventable had these individuals not been exposed to direct or second hand tobacco smoke.

³ Wu-Williams AH, Samet JM. Lung cancer and cigarette smoking. In Samet JM, editor. *Epidemiology of Lung Cancer*. New York: Marcel Dekker, 1994:71-108.

⁴ Smoking Attributable Mortality, Years of Potential Life Lost, and Productivity losses: United states 2000-2004, *MMWR* November 14, 2008, 57(45):1226-28.

- If Marion County lung cancer mortality rates had been the same as the U.S. rate, 200 deaths per year would have been avoided. County death rates (72.7 per 100,000, 2003-07) exceeded the U.S. rate of 52.5 by 38%, the Indiana rate of 62.6 by 16%, and the Healthy People 2010 and 2020 objectives by 52%. Indianapolis had the 6th highest rate of lung cancer deaths among the 54 largest U.S. cities in 2004⁶.



- Marion County lung cancer mortality (2003-2007) changed at such a slow pace, that the National Cancer Institute labeled our lung cancer death rates as “stable”, not “falling.”
- Lung cancer is a deadly cancer. Less than 1 in 5 (17.8%) Marion County lung cancers are diagnosed in an early (localized) stage⁷. Even at this earliest detection, the five-year probability of survival is only 55-67 percent (data for the period 1998-2008).
- In Indiana, lung cancer caused more deaths than colorectal, breast and prostate cancers together (2006). Indiana ranks 8th highest in the nation in lung cancer mortality (2007)⁸.

⁵ Smoking Attributable Mortality, Years of Potential Life Lost, and Productivity losses: United states 2000-2004, *MMWR* November 14, 2008, 57(45):1226-28. Lung/Bronchus/Trachea cancer deaths include ICD10 classifications C33 –C34.

⁶ *Big Cities Health Inventory: The Health of Urban America*, 2007, National Association of County and City Health Officials, Benbow, N., Editor. Washington, D.C. 2007.

⁷ Marion County for 2003-07: Indiana State Cancer Registry , 22 September 2009, Report Generator. <http://www.in.gov/isdh/24360.htm>

⁸ *Indiana Cancer Facts and Figures 2006*, ISDH and the American Cancer Association, 2006 American Cancer Society, Great Lakes Division, Inc., page 21.

- The lung cancer death rate among Marion County men was 70% greater than among women (2003-2007). While mortality rates have significantly fallen among Marion County men, lung cancer death rates for women are still increasing.
- Marion County Blacks are 14% more likely to die of lung cancer than Whites, but do not differ significantly in the stage of diagnosis when this cancer is detected.
- In the U.S. lung cancer alone contributes over one-third (36.3%) of the 1.9 million years of potential life lost (YPLL) for all smoking-related diseases in the U.S., including other cancers, heart disease, stroke, bronchitis, asthma/COPD, and perinatal conditions⁹.

Stemming the tide: Prevention options

- While 1992-2009 smoking rates have declined, state and county rates have decreased at a slower pace (-1.5% per year) than those of the U.S. (-2.6% per year).
- In 2009, the proportion of adults who smoke in the state (23.1%) and Marion County (21.5%) remained at nearly double the Healthy People 2010/2020 target of reducing smoking to 12% of the adult population.
- The 2004 Surgeon General's report concludes that cigarette smoking causes the great majority of lung cancer cases. Despite a better understanding of respiratory cancer, lung cancer screening and detection efforts have not changed survival rates. Smoking prevention and cessation remain the fundamental strategies for controlling the lung cancer epidemic¹⁰.

⁹ Smoking Attributable Mortality, Years of Potential Life Lost, and Productivity losses: United States 2000-2004, *MMWR*, November 14, 2008, 57(45):1226-28.

¹⁰ U.S. Department of Health and Human Services, Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2004.

Introduction: The epidemiology of lung cancer

Lung cancer refers to clinically diverse respiratory tract malignancies occurring mostly in the lining of the trachea and lung airways. Four principal types include: squamous cell carcinomas, small-cell undifferentiated carcinomas, large-cell carcinomas, and the most common, adenocarcinomas¹.

Following the great increase in lung cancer cases during 1900-1950, researchers identified lung cancer's causal agents², with cigarette smoking established as the largest cause worldwide by far. A substantial research literature, following the seminal 1964 Surgeon General's report,³ has established smoking as the primary *risk factor* or cause of lung cancer. This research now includes molecular level evidence of change in cellular DNA transforming normal cells to malignant ones, building the picture of mechanisms by which smoking exposure leads to malignancies in exposed tissues.⁴ Adenocarcinoma is now the most common type of lung cancer in smokers, and may reflect changes in the carcinogens in cigarette smoke⁵.

The risk of lung cancer varies strongly with years of smoking (duration of exposure to a risk factor) and with the number of cigarettes regularly smoked (intensity of exposure)⁶. There is nearly a 20-fold excess risk of developing lung cancer for smokers (e.g. a Relative Risk [RR] of 20 or higher) compared with lifetime nonsmokers.⁷

No risk-free level of smoking has been identified, and while lung cancer risk decreases for former smokers with long periods of abstinence, even after 15 to 20 years the risk of developing lung cancer is never reduced to that for persons who have never smoked⁸. It has been established that any exposure to environmental tobacco smoke also increases lung cancer risk among nonsmokers as well⁹.

Certain occupational exposures also increase lung cancer risk, including both indoor and outdoor air pollution, especially small-particulate pollution which contributes approximately 5 percent of all trachea-lung-bronchial cancer mortality¹⁰. These exposures often have a synergistic relation with smoking in increasing the risk of developing lung cancer.¹¹ Genetic factors, including a first-degree relative diagnosed with lung cancer¹², may also determine risks in smokers, but specific genes for lung cancer have not been identified. The risk of lung cancer also increases with advancing age.

Patterns of new lung cancer cases [*incidence*] and lung cancer mortality reflect a lagged effect following changes in smoking behaviors among U.S. adults over the decades¹³. Smoking began to decline earlier among men than among women beginning in the 1950s, and more recent lung cancer rates reflect these earlier changes in smoking prevalence rates. In U.S. men, the age-adjusted annual incidence rate has declined steadily, from 102.1 cases per 100,000 in 1984 to 80.8 in 2000. In the 1990s, the rate of increase began to slow for women, but by 2000 the incidence rate among women was 49.6 per 100,000¹⁴. During the 1990s, deaths attributable to lung cancer declined significantly in men, while mortality rates in women continued to increase.

Nationally, lung cancer is the leading cause of newly diagnosed cancer cases and of cancer mortality, accounting for 13 percent of all cancer diagnoses, and over one in four (28%) of all U.S. cancer deaths. Survival remains poor, with five-year survival rates of only 15 percent over all stages of lung cancer combined.¹⁵ Even cases detected in early, localized stages have a 55-67% 5-year survival rate¹⁶ and screening for lung cancer has unproven value in improving survivorship¹⁷.

The 2004 Surgeon General's report concluded that cigarette smoking causes the clear majority of lung cancer cases, and in spite of increased understanding of respiratory carcinogenesis and potential screening for lung cancer, smoking prevention and cessation remain the fundamental strategies for controlling the lung cancer epidemic¹⁸.

Understanding cancer incidence and mortality rates

Chronic diseases like cancer are generally reported as population-based indicators for public health purposes, as they reflect major costs to the health care system and quality of life. Newly detected cancer cases, or *incidence rates* are represented as the number of new cases of cancer per 100,000 population from which those cases emerge (like a county total population), reported by hospitals to state cancer registries. Incidence represents how rapidly cases arise and are diagnosed in the population. For example, if a county's lung cancer incidence rate is 40.0, 40 new cases of lung cancer were diagnosed for every 100,000 people in a specified time period [one or multiple year period]. If the county's population is 25,000, then an incidence rate of 40.0 means 10 new cases of lung cancer were diagnosed in that county that year.

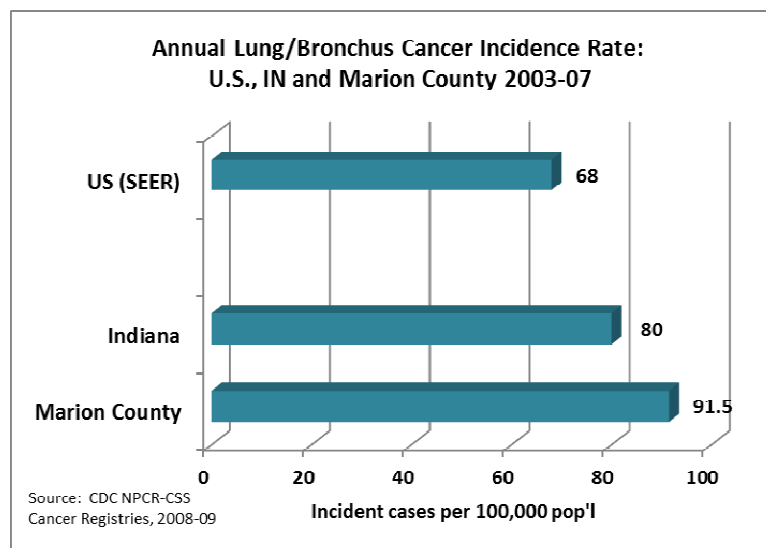
Similarly, *lung cancer mortality rates* reflect the number of deaths due to lung cancer as the leading cause of death (as documented in death certificates) per 100,000 population, during a specific time period.

Rates appearing in this report are also *age-adjusted* to a common population standard (U.S. 2000)¹⁹, to account for differences in the age structures of compared groups or geographies (e.g. minority populations tend to be younger overall than white), as cancer risk differs across the lifespan. Age-adjusted population-based rates are useful in comparing cancer burden regardless of population sizes, compared time periods, demographic groups or geographic areas.

Indiana and Marion County Lung Cancer Incidence: New cases of cancer

For the period 2003-07, the National Cancer Institute (NCI) and the Indiana State Cancer Registry (ISCR) calculated 5 year averaged annual rates of new lung cancers [incidence] at the state and county level²⁰. Indiana (Annual Incidence Rate: 80.0 (CI: 79.0, 81.0²¹) and Marion County rates (91.2 (CI: 88.2, 94.3) significantly exceeded the national rate of 68.0 (CI: 67.9, 68.2) new cases per 100,000 population by 16% and 33%, respectively (Figure 1).

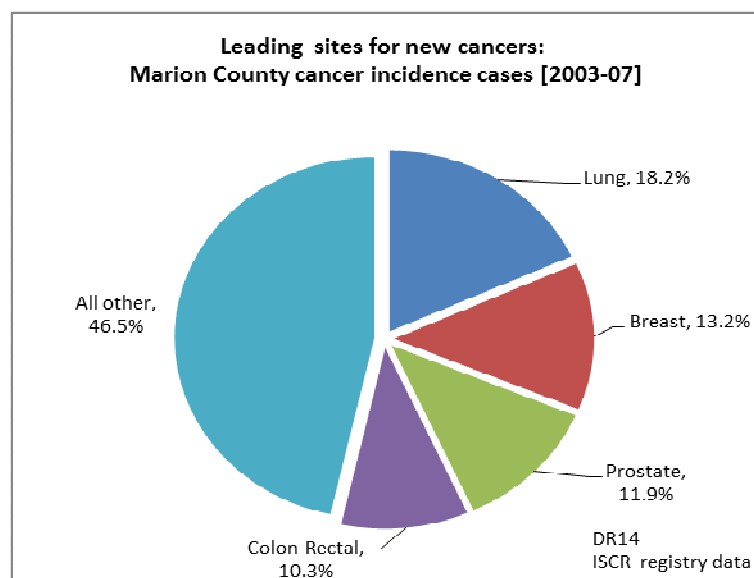
Figure 1 U.S., Indiana and Marion County Incidence Rates [2003-2007]



Marion County's annual incidence rate for new lung cancers for 2003-2007 also significantly exceeded Indiana's by 14%, as well as rates for four other Indianapolis MSA counties²² and certain other large Indiana metropolitan counties, such as Lake and Allen. Both Allen and Monroe Counties' incidence rates are similar to national rates.

This means on average 717 Marion County residents were diagnosed with lung-bronchus cancer per year (for the 2003-2007 period)²³. Lung cancer is the leading cause of new cancer in Marion County, and makes up almost one in five (18.2%) new cases of cancer (Figure 2)²⁴.

Figure 2 Lung Cancer as a Leading Cause of Cancer: Marion County [2003-07]



Gender, ethnicity and age differences in incident cases of lung cancer

Overall lung cancer incidence rates were similar for Marion County Whites (91.5, CI: 88.1, 95) and Blacks (92.3, CI: 85.7, 99.3) but gender differences are more significant than ethnicity²⁵ (Figure 3). Lung cancer incidence rates among all Marion County men (113 per 100,000) are 50% higher than among all resident women (76 per 100,000).

Given the major causal role of tobacco-smoke exposure in the risk of lung cancer incidence, men who smoke are 24 times more likely to develop lung cancer than similarly aged non-smoking men; women who smoke are 13 times more likely to develop lung cancer than non-smoking women²⁶. While point estimates appear to indicate racial disparities between Black and White men and women, respectively (Figure 4), these differences are not statistically significant between Whites and Blacks within either gender²⁷.

Figure 3 Marion County Lung Cancer Incidence, 2003-2007, by Gender

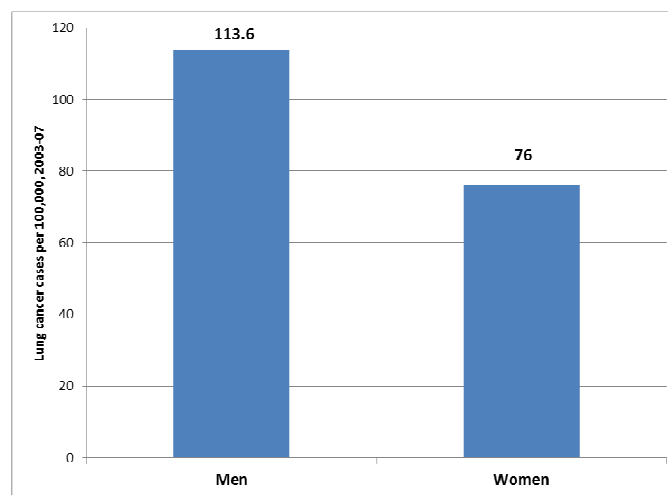
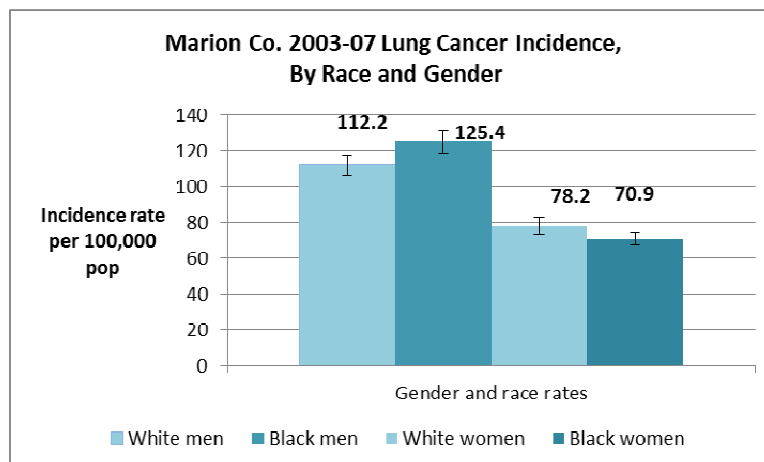


Figure 4 Marion Co. Incidence: Race-Gender Groups

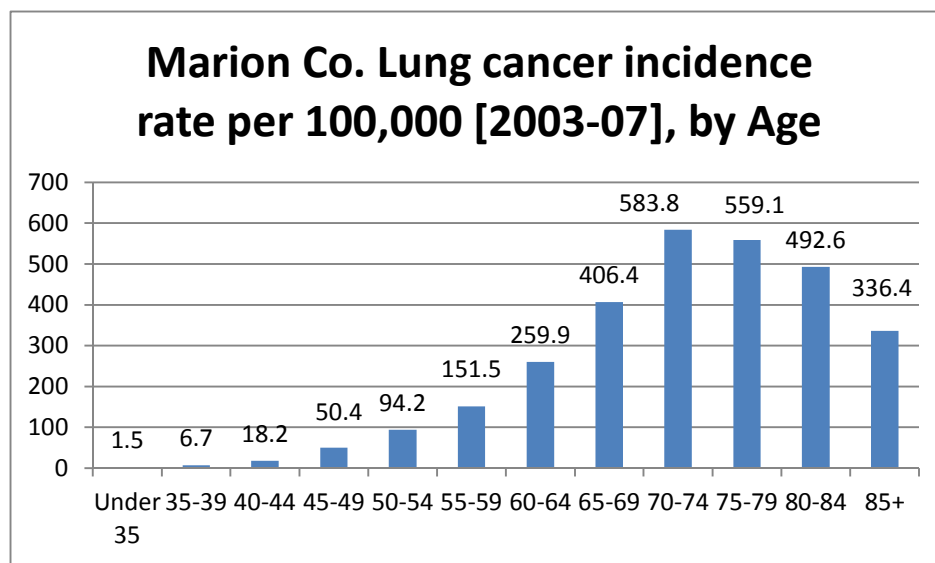


Age-related incidence rates of lung cancer

Lung-bronchus cancer is often a slow developing cancer, depending on an individual's intensity and duration of exposure to environmental carcinogens, and is often not detected until several years after cancer develops. Therefore new cases of lung cancer are relatively rare before age 50. One-third (35.3%) of all Marion County 2003-2007 lung cancer cases occurred in working-age persons under age 65²⁸.

Lung cancer incidence rates increase greatly between ages 65 and 84 (Figure 5). Age-specific lung cancer incidence rates did not differ significantly in any age group for White, Black, and Other ethnicity county residents.

Figure 5 Incidence Rates by Age: Marion County, 2003-07



Temporal changes in lung cancer incidence rates

The picture for new lung cancer incidence differs for men and women over time. Nationally, from 1975 through 2006, incidence rates have declined among men at nearly 2% per year (-1.8% average annual percentage change), but have been increasing for women (+0.4%) from 1990-2006²⁹.

In Marion County the trends are similar to the national picture. While overall rates of new cases in the county have declined significantly between two averaged 5-year periods, 1999-2002 and 2003-2007, this has been driven mainly by changes among White males only (Table 1). Lung cancer incidence rates for other race-gender subgroups, and especially for women, have been stagnant over the 10-year period³⁰ [Noted as "NS" or non-significant change in Table 1 as confidence intervals for the compared periods overlap].

Table 1 Trends in Incidence by Gender: Marion County, 1998-2007

Marion County	Lung cancer incidence per 100,000		Trend '98-'07?	Male Rates		Trend '98-'07?	Female Rates		Trend '98-'07?
	1998-2002	2003-2007		1998-2002	2003-2007		1998-2002	2003-2007	
All Races	97.7 [94.6-110.9]	90.8 [87.8-93.9]		128.9 [123.3-134.8]	113.6 [108.3-119]		76.8 [73.2-80.6]	76 [72.4-79.8]	NS
White	97.9 [94.4-101.5]	91.5 [88.1-95]	NS	127.1 [120.9-133.7]	112.2 [106.4-118.3]		78.6 [74.5-83]	78.2 [74.1-82.6]	NS
Black	100.6 [93.5-108.2]	92.3 [85.7-99.3]	NS	141.6 [128.1-156.4]	125.4 [113-139]	NS	73.1 [65.3-81.7]	70.9 [63.5-78.9]	NS

Deaths due to Lung Cancer:

Lung cancer accounts for 6.5 percent of all U.S. deaths³¹, 28 percent of all U.S. cancer deaths, and is the leading cause of cancer deaths³².

Nationally, lung cancer is the leading cause of cancer death among men (70.0 deaths per 100,000) and women (40.9 deaths per 100,000) for the period 2002-2006. U.S. mortality rates for this cancer have declined faster among men (-4.2% decline in average annual percent change (AAPC)) compared to a 1.1% annual percent change increase among all U.S. women, for the period 1997-2006³³. Deaths from lung cancer have decreased among U.S. men over the last several decades as the prevalence of men who smoke has declined, whereas reductions in smoking among U.S. women began in the late 1970s, and lung cancer death rates for U.S. women are among the highest in the world³⁴.

U.S. Black-White disparities in 2002-2006 lung cancer mortality rates were significant for men (Blacks: 90 per 100,000; Whites: 60 per 100,000) but not among women (Blacks: 40 per 100,000; Whites: 41.9 per 100,000). Declines in lung cancer mortality between 1997 and 2006 were greatest among Black men (-2.9% per year), followed by White men (-1.8% per year), with slight reductions by White women (-.8% per year) and no significant change in rates among Black women for the period³⁵.

In Indiana, like the nation, lung cancer causes more deaths each year than colorectal, breast, and prostate cancers combined³⁶. Among the states, Indiana ranked 8th highest in lung cancer death rates (61.4 per 100,000) for 2007, with over 4,000 lives lost. The state's lung cancer mortality rate was 21% higher than the U.S. rate of 50.7 deaths per 100,000 population in 2007,³⁷ and 50% greater than the HP2010 objective for lung cancer deaths³⁸.

Deaths due to lung cancer: Marion County and comparison geographies

Lung cancer made up 34% of all Marion County cancer deaths and 7.8% of all deaths in 2008 (Figure 6).

Marion County's lung cancer 2003-2007 mortality rate (72.7 per 100,000) exceeded the U.S. rate (52.5 per 100,000) by 38 percent, the Healthy People 2010 objective by 52 percent, and Indiana's mortality rate of 62.6 by 16 percent (Figure 7)³⁹. If Marion County's lung cancer mortality rate had been like that of the United States for the 2003-2007 period, 200 deaths in Marion County would not have occurred.

Figure 6 Lung Cancer as Proportion of all Cancer Deaths: Marion County, 2008

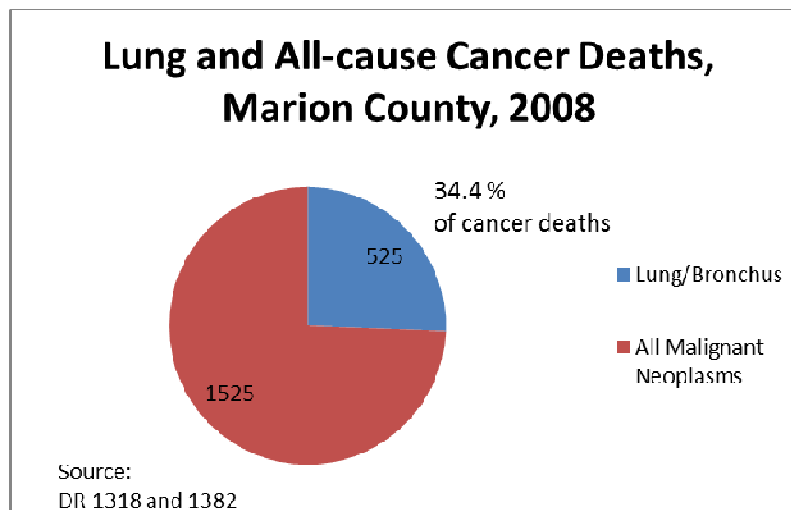
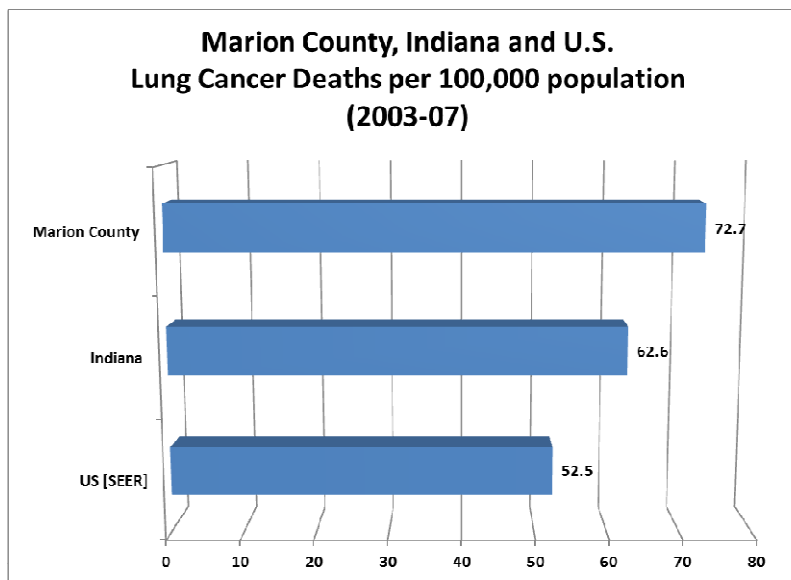


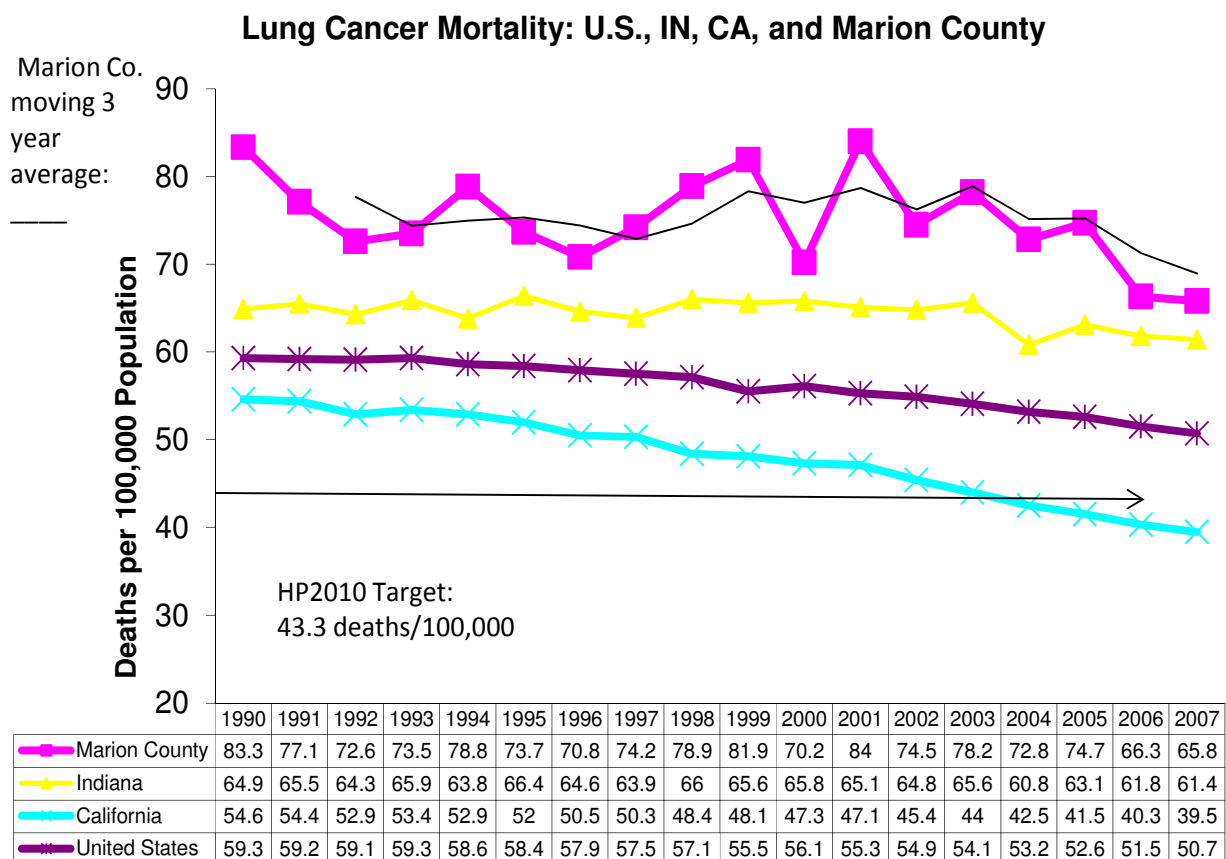
Figure 7 U.S., Indiana and Marion County Lung Cancer Mortality, 2003-07



While lung cancer death rates have declined in the nation and state, Marion County's recent declines in lung cancer mortality have lagged at a slower pace (- 0.2 annual percent change during 2003-2007) than the state or nation (-1.1- to -1.6 annual percent change, respectively), such that the NCI labeled the county's lung cancer death rates as "stable" rather than "falling"⁴⁰.

Indiana and county death rates are also declining more slowly, when compared to states with historically low rates of adult smoking (Utah) or with early comprehensive smoke-free workplace laws (e.g. California), as seen in Figure 8⁴¹. Nine states now meet HP2010 objectives to reduce lung cancer mortality to 43.3 deaths per 100,000 or less.

Figure 8 U.S., Indiana, California and Marion County Mortality Rates, 1990-2007



Lung cancer mortality rates and changes by gender

Like the U.S., Marion County lung cancer mortality among men was nearly 70% greater than among women for the period 2003-2007⁴²(Figure 9), in part due to men's historically earlier and heavier smoking exposure.

Figure 9 Marion County Lung Cancer Mortality by Gender, 2003-2007

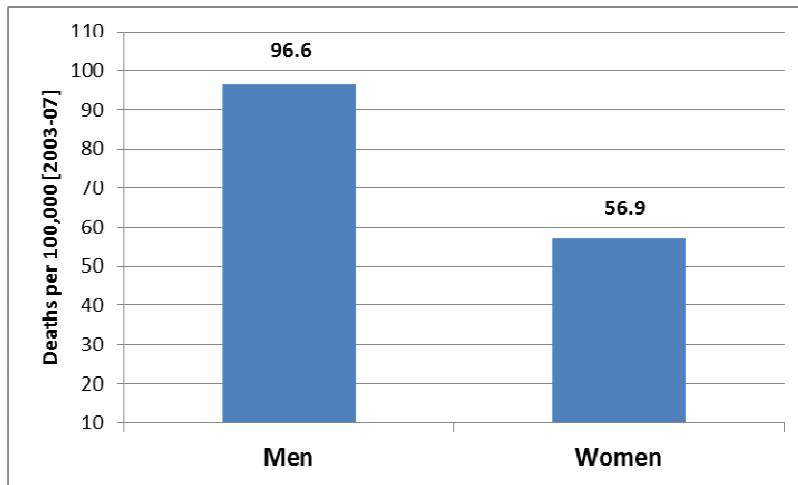
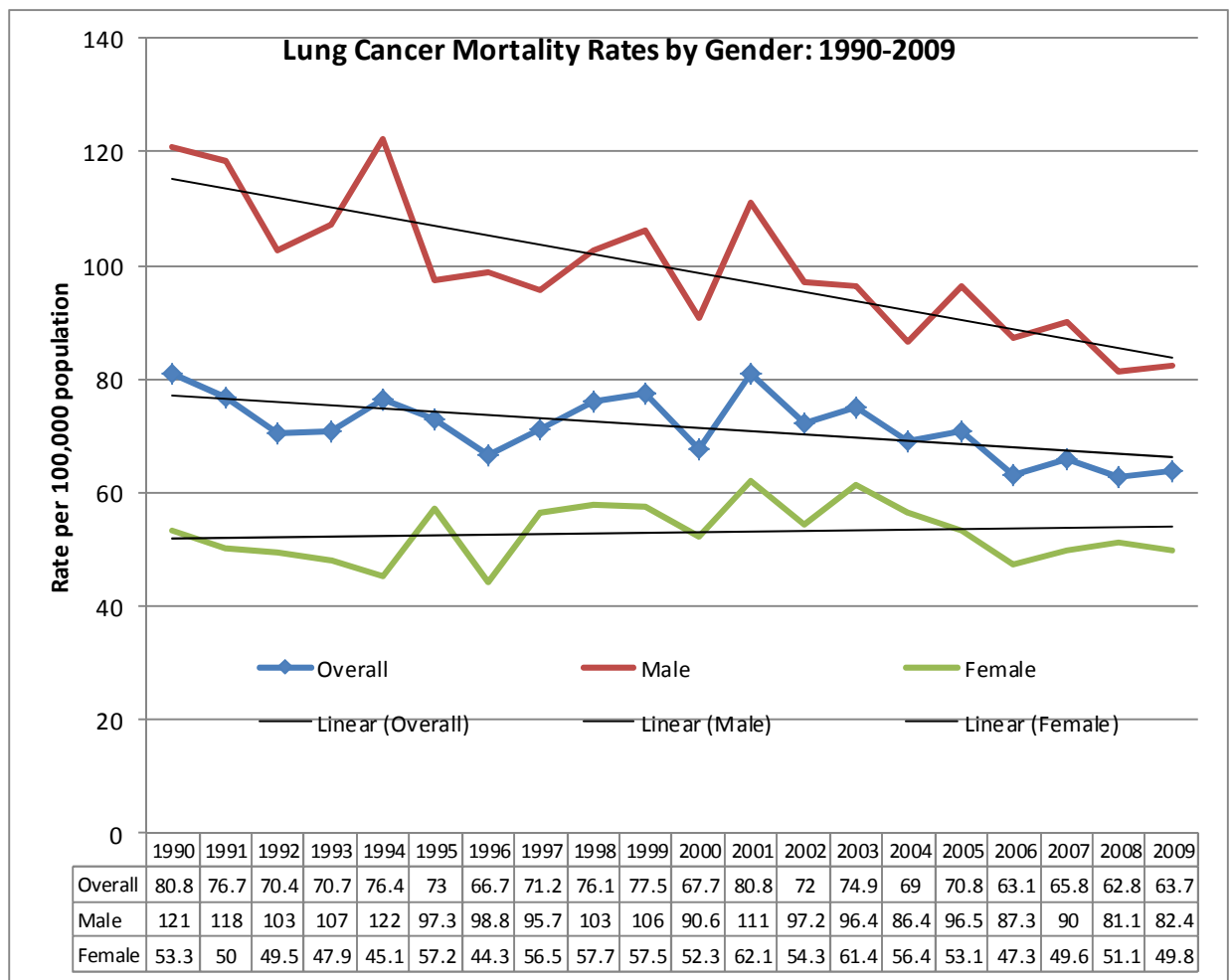


Figure 10 Marion County Lung Cancer Mortality Rate Trends by Gender



Like national trends, Marion County lung cancer mortality rates have declined more quickly among men than women over the past three decades⁴³. Overall, lung cancer mortality in the county has declined very slowly over the 20-year period (Figure 10).

In the most recent 5 year period (2003-2007) while lung cancer mortality continued to fall among men in Marion County, rates for women increased. Lung cancer death rates for men and women are 15-19% greater than Indiana men and women, respectively (Table 2)⁴⁴.

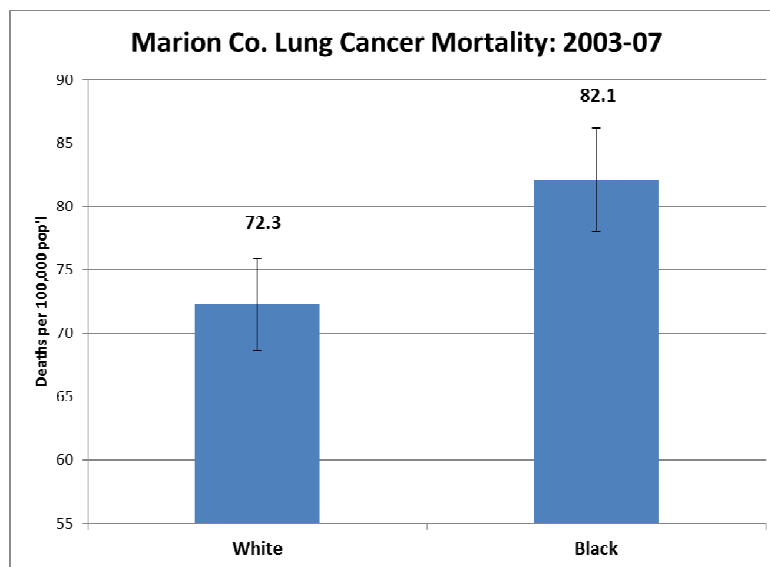
Table 2 Lung Cancer Mortality by Gender: Marion County, 2003-2007

Lung-bronchus cancer mortality ⁴⁵	Averaged Annual Mortality rate [CI] for 2003-2007	Averaged Annual % Change [CI] for 2003-2007	Averaged Lung cancer deaths/year [2003-2007]	County versus IN Mortality Rate Ratios	County versus IN Mortality Rates
MEN	96.6 [91.8,101.6]	-1.3%  [-1.7,-1.0]	313	1.15	Above
WOMEN	56.9 [53.9,,60.1]	0.8%  [0.1,1.6]	259	1.19	Above
OVERALL	72.7 [70.1, 75.5]	-0.2  [-0.5, 0.1]	569	1.16	Above

Lung cancer mortality differences by ethnicity

Blacks in Marion County were 14 percent more likely to die of lung cancer (82.1 per 100,000) than their White counterparts (72.3 per 100,000) for the period 2003-2007 (Figure 11). As fewer than 20 deaths occurred among residents of other ethnicities for the period, stable mortality estimates are not available for these groups⁴⁶. Stage at diagnosis did not differ significantly among ethnicity groups in the county (see Figure 12).

Figure 11 Marion County Lung Cancer Mortality Rates by Race, 2003-2007



Lung cancer mortality comparisons: Other urban areas

Compared to the 54 largest U.S. cities, Indianapolis had the 6th highest rate of lung cancer mortality for 2000-2004⁴⁷. Marion County's 2003-05 lung cancer mortality was higher than the range of 80% of all its national peer counties of similar demographic makeup (Table 3)⁴⁸.

Table 3 Lung Cancer Mortality: Marion and Example Midwestern Peer Counties

2003-2005 Lung cancer death rates	<i>Indianapolis, Marion County, IN</i>	<i>Columbus, Franklin County, OH</i>	<i>Louisville, Jefferson County, KY</i>	<i>Range of rates for MC Peer Counties</i>	<i>U.S. 2005</i>	<i>HP 2010 Target</i>
<i>Lung cancer deaths per 100,000</i>	<i>78.9</i>	<i>68.4</i>	<i>76.4</i>	<i>40.6 - 60.2</i>	<i>52.6</i>	<i>43.3</i>

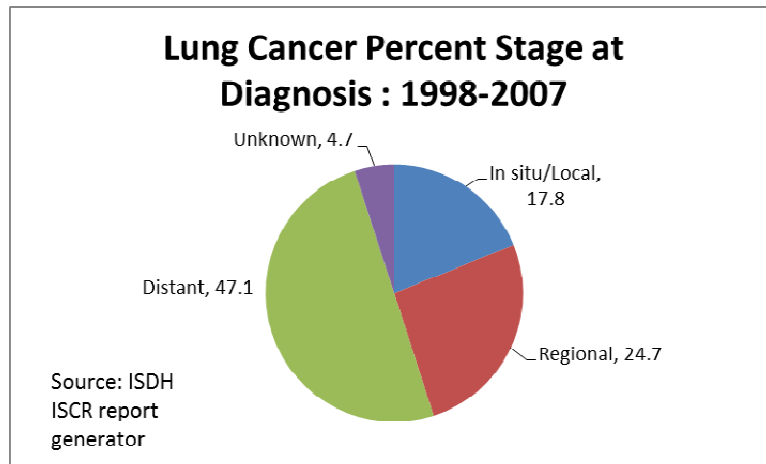
Source: DR1301 Community Health Status Indicator s CDC

Risk of mortality in lung cancer:

Like other cancers, lung cancer survivorship is greatest when detected in its earliest and most localized stages. For lung cancers diagnosed at the local stage (when cancer is confined entirely within the lung), the five-year probability of survival is 55-67%⁴⁹. This cancer is often diagnosed at a later stage (or non-localized state), where cancerous cells have proliferated beyond the lung wall, which greatly reduces the probability of longer-term survival. In Indiana, only 14.3% of lung-bronchus cancers were diagnosed at the local or in-situ stages for the 2003-2007 period, and 40% were diagnosed at a distant or late stage of spread to other areas of the body⁵⁰.

Marion County 1998-2008 data for stage-at-diagnosis (Figure 12) are similar to the state's, with fewer than 1 in 5 lung cancers diagnosed in an early stage (17.8%)⁵¹.

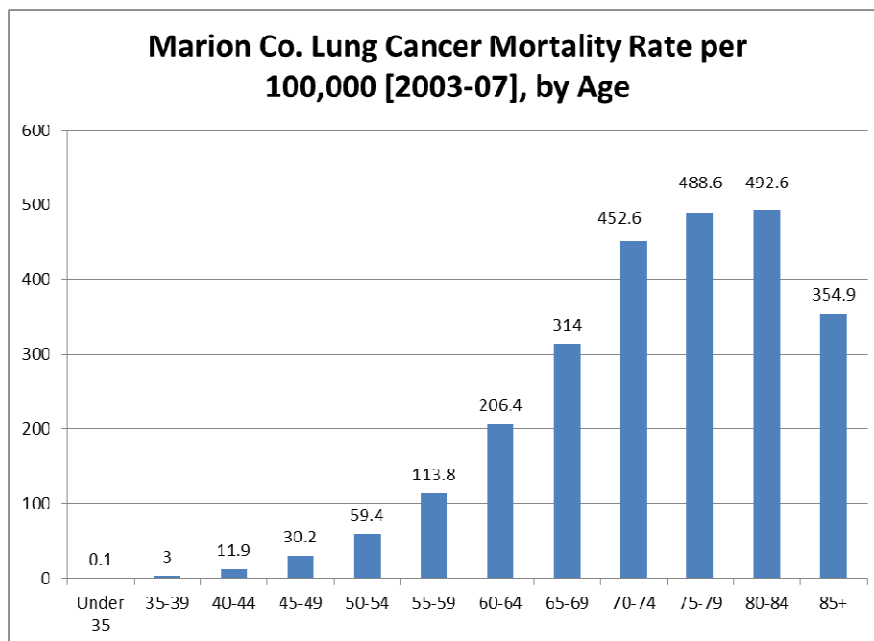
Figure 12 Marion County Lung Cancers: Stage at Diagnosis



Lung cancer deaths by age group

As in new lung cancer cases [incidence], lung cancer deaths are more likely to occur in older age groups (Figure 13). The greatest lung cancer mortality rates are seen among Marion County residents over 70 years of age, and lowest rates of mortality occur before age 45.

Figure 13 Lung Cancer Mortality by Age, 2003-2007



Only 31% of lung cancer deaths in Marion County occurred in residents under 65 years of age. Age-specific lung cancer death rates were not significantly different among Whites, Blacks and other ethnicity groups⁵².

Preventable Lung Cancer Deaths due to Smoking

U.S. estimates of deaths attributable to direct and secondhand smoking exposure have recently shown that lung cancer is the leading cause of all smoking related deaths, contributing 29% of all smoking related premature deaths⁵³. Smoking exposure is estimated to cause 82% of all trachea-bronchus-lung cancers⁵⁴, including 87% of lung cancers among men and 84% among women. Efforts to control tobacco use during the 1980s and 1990s were responsible for much of the declines in lung cancer death rates since 2000⁵⁵.

Translated to Marion County, of the 525 lung cancer deaths in 2008 for county residents⁵⁶, a conservative estimate would be that 82%, or 430 persons, would have lived had they not been exposed to direct or second hand tobacco smoke. In Indiana, 9,700 Hoosiers die from smoking-related diseases each year. Nearly 40% of those deaths are due to lung cancers, largely due to Indiana's high smoking rates⁵⁷.

Putting that risk into perspective, *the absolute risk* of death due to lung cancer among smokers is impressively large when compared to other causes which the public may perceive as important causes of death. For example, the likelihood of dying in a motor vehicle accident for a 35 year old U.S. man before his 65th birthday is less than 1% (.7%) whereas if that 35 year old smokes at least a pack per day (25+ cigarettes), his chance of dying of lung cancer is 16% or over 16 times greater⁵⁸.

Smoking-related lung cancer caused nearly 129,000 preventable U.S. smoking-related deaths per year (or 29% of all smoking-attributed deaths), leading to 1.9 million years of potential life lost (YPLL), and \$36.8 billion in lost productivity. Lung cancer alone contributes over one-third (36.3%) of the YPLL *for all smoking-related diseases in the U.S.*, including other cancers, heart disease, stroke, bronchitis, asthma/COPD and perinatal conditions⁵⁹.

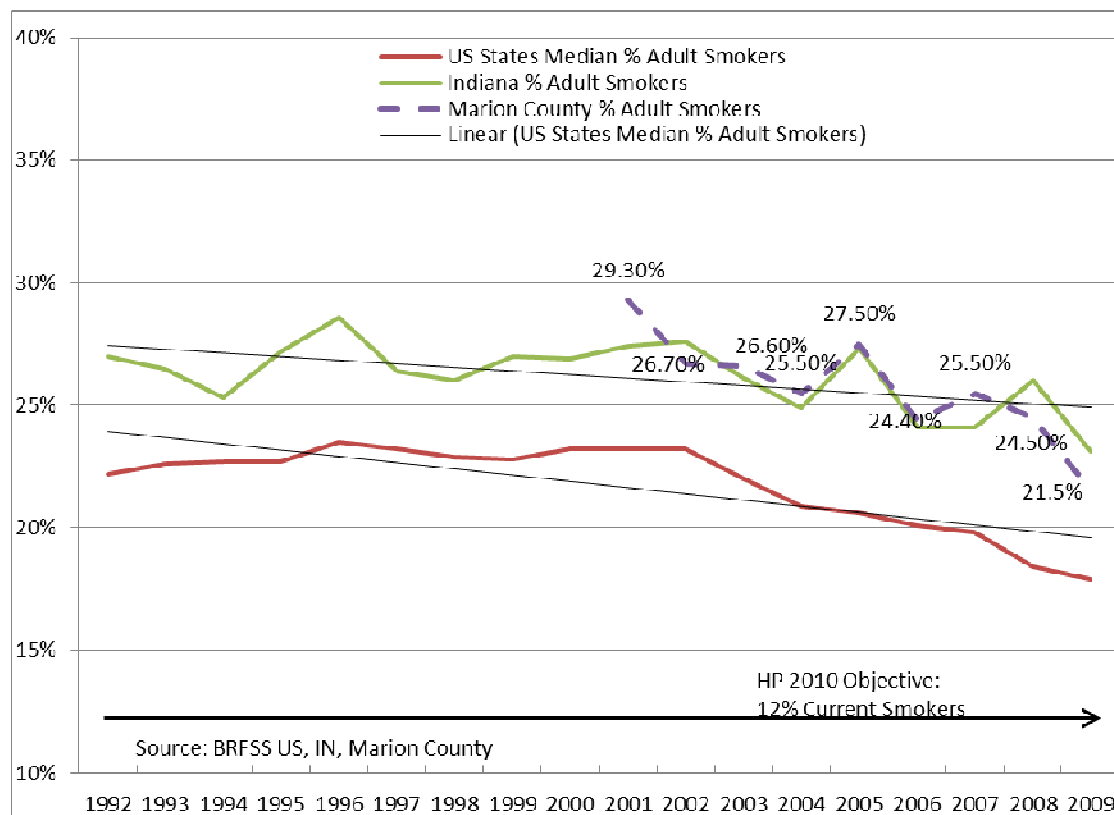
Indiana and Marion County Smoking: Continuing risk exposure

In the past decade, Marion County's annual prevalence of adult smoking (e.g. percent of adult population over age 18 reporting current smoking) has not been significantly different from the state, but both have been significantly higher than average U.S. smoking rates for many years (Figure 14).

The national, state (-1.5% per year) and county rates of smoking have been slowly decreasing⁶⁰, with the U.S. declining at a slightly faster pace (-2.6% per year), as seen by the trend lines for 1992-2009. Both the state and Marion County remain at nearly double the Healthy People 2010/2020 target of reducing smoking prevalence to 12% for the adult population, but have been trending downward since 2007 (Figure 14).

Risk factor reduction leads to long-term, not short-term, changes in cancer incidence. Past decades' reductions in U.S. smoking rates are just recently reflected in reductions in lung cancer incidence, and states with comprehensive tobacco-control programs have seen more rapid decreases in lung cancer than states without such programs⁶¹.

Figure 14 Prevalence of Smoking, U.S. Indiana and Marion County



Conclusions

Marion County's lung cancer incidence, exposure to smoking as a primary causal factor for this cancer and mortality rates significantly exceed patterns seen in the nation, state and comparable urban settings. For 2003-2007 Marion County's lung cancer mortality rate exceeds the U.S. rate by 38 percent, the Healthy People 2010 and 2020 objectives by 52 percent, and the state rate by 16 percent.

Lung cancer makes up the leading cause of cancer deaths in the county (34% of all cancer deaths) and is the second leading cause of new cancers in both men and women. An estimated 430 Marion County lives lost to lung cancer might have been saved had these residents not been exposed to smoking; 200 might have lived if our lung cancer mortality rates were reduced just to that of the nation.

Marion County men have a 50% greater risk of developing lung cancer and 70% greater risk of death from this cancer, than do women. However, while men's incidence and death rates are falling, both rates among women are still increasing. Blacks in Marion County are 14% more likely than Whites to die from lung cancer, though incidence rates are similar for these ethnicity groups.

Less than 20% of Marion County lung cancers are detected at early stages, and even then the five-year probability of survival is only 55-67 percent. Thus the Surgeon General's office has found the prevention and cessation of smoking to be the best practice in reducing new and fatal cases of lung cancer.

National lung cancer mortality among men has declined since the early 1990s as their smoking rates have declined⁶², and states such as California (with a comprehensive tobacco control program since 1989) have seen reductions in rates of tobacco-related disease and deaths in the past 2 decades⁶³. Evidence from state tobacco control programs indicate that the magnitude and rate of change in smoking rates are related to the level and continuity of comprehensive prevention program efforts⁶⁴, including targeting reductions in youth initiation, promoting smoking cessation, and protecting nonsmokers from tobacco smoke exposure.

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- ²⁰ National Cancer Institute Incidence Rate Report for Indiana by County <http://statecancerprofiles.cancer.gov/incidencerates/index.php?stateFIPS=18&cancer=047&race=00&sex=0&age=001&type=incd&sortVariableName=rate&sortOrder=default>
Incidence rates (cases per 100,000 population per year) are age-adjusted to the 2000 U.S. standard population (19 age groups: <1, 1-4, 5-9, ... , 80-84, 85+). Rates are for invasive cancer only.
- ²¹ 95% confidence Intervals are given for each estimate in parentheses and represent the upper and lower boundaries of a range of values in which the true estimate is expected or likely to occur.
- ²² The Indianapolis-Carmel Metropolitan Statistical Area includes Boone, Hamilton, Hancock, Hendricks, Johnson, Marion, Morgan and Shelby Counties. Hamilton, Hendricks, Johnson and Boone Counties have significantly lower lung cancer incidence rates than Marion for the 2003-2007 period; rates for Morgan, Johnson and Hancock do not significantly differ from Marion County.
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County and State Source: State Cancer Registry and the CDC's National Program of Cancer Registries Cancer Surveillance System (NPCR-CSS) November 2008/January 2009 data submission. State rates include rates from metropolitan areas funded by SEER.
<http://statecancerprofiles.cancer.gov/incidencerates/index.php?stateFIPS=18&cancer=047&race=00&sex=0&age=001&type=incd&sortVariableName=rate&sortOrder=default>
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- ²⁵ Source: IN Cancer Registry ISDH <http://www.in.gov/isdh/24360.htm> Small numbers of cancer cases for "Other" ethnicities preclude stable estimates for this group.
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- ²⁷ Source: IN Cancer registry ISDH <http://www.in.gov/isdh/24360.htm> Interpretation: while point estimates for each ethnicity by gender appear to show disparate rates, these estimates are based on small numbers of cases. The 95% confidence intervals (CIs) for each rate, indicated by the vertical bars on each column, overlap, signifying that the estimates for each gender's compared ethnicity groups are not significantly different at the .05 level.
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Death data provided by the National Vital Statistics System public use data file. Death rates calculated by the National Cancer Institute using SEER*Stat. Death rates are age-adjusted to the 2000 U.S. standard population. Rate comparisons: “above”: when both the absolute rate’s 95% CIs and the rate ratio exceed 1.10. Trends are recorded as “stable” when the 95%CI of the calculated annual percent change is greater than zero; “falling” when the 95%CI of the calculated annual percent change is less than zero.

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⁴⁹ Indiana Cancer Facts and Figures 2006, ISDH and the American Cancer Association, 2006 American Cancer Society, Great Lakes Division, Inc. page 21.

⁵⁰ Query Results for Marion County for 2003-07: Indiana State Cancer Registry 22 September 2009, Report Generator. <http://www.in.gov/isdh/24360.htm>

⁵¹ “Staging” of lung cancer describes location, size of tumor, spread of cancer to the lymph system, and spread of cancer cells beyond the site in which the cancer originated. Each type of lung cancer (small cell and non-small cell) is staged differently. Stage 1 (includes in situ/localized) includes the earliest detection when there is no spread into the lymph nodes, the tumor is small, and confined to the original area of the lung where the tumor first started. For further details see <http://www.cancerhelp.org.uk/type/lung-cancer/treatment/more-about-lung-cancer-staging>

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