Trends in Incidence of Tobacco-Related Cancers in New Jersey, 1979-2013

Karen Pawlish[1], Stasia Burger[1], Jie Li[2], Gerry Harris[2], Sumathy Vasanthan[2], Lisa Paddock[2,3], Antoinette Stroup[2,3]
[1]New Jersey Department of Health, Trenton, NJ
[2]Rutgers Cancer Institute of New Jersey, New Brunswick, NJ
[3]Rutgers School of Public Health, Piscataway, NJ

Abstract

Background: Cigarette smoking is the main cause of lung cancer and increases the risk for oral, esophageal, larynx and other cancers. Cigarette use has declined dramatically in the U.S. since the 1960s. **Purpose**: To characterize changes in the incidence of tobacco-related cancers in New Jersey. **Methods**: We analyzed data from the NJ State Cancer Registry to calculate age-adjusted cancer incidence rates using SEER*Stat and estimated average annual percent changes and changes in time trends by sex and race using Joinpoint regression. **Results**: Lung cancer incidence trends changed significantly among men (p<0.05), decreasing by 0.5% per year from 1979-1991 and by 2.2% from 1991-2013. Similar trends in lung cancer incidence were observed in white and black men. Lung cancer incidence peaked later in women, with a 3.6% increase per year from 1979-1990, a 0.6% increase per year from 1990-2007, and a 2% decrease per year after 2007. Lung cancer incidence started to decline in black women in 1998, which was earlier than white women. Esophageal cancer incidence decreased by 0.4% per year in men, while incidence decreased steadily by 1.1% per year in women from 1979-2013. Esophageal cancer rates were higher in blacks than whites, but the decrease in incidence was more pronounced in blacks. Oropharyngeal cancer incidence declined steadily by 0.6% per year in women during the time period, while the incidence in men decreased by 1.4% per year until 2003, followed by a 0.7% increase per year from 2003-2013. Decreasing trends were also seen with other tobacco-related cancers. **Conclusion**: Although there is some evidence showing declines in tobacco-related cancer incidence, gender and racial disparities in cancer incidence remain. Lung cancer remains the leading cause of cancer death in NJ, and tobacco use causes substantial morbidity and mortality, emphasizing the importance of smoking prevention and cessation programs.

Background

- Cigarette smoking is the main cause of lung cancer and increases the risk of oral, esophageal, larynx, and other cancers[1,2], as well as cardiovascular and other diseases.
- In addition, the International Agency for Cancer Research (IARC) has concluded that there is sufficient evidence that exposure to secondhand smoke causes lung cancer in humans[1].
- Cigarette use has declined dramatically in the U.S. since the 1960s[3].
  - Prevalence of cigarette smoking in U.S. adults: 42% in 1965, 17% in 2014[4]
  - Cigarette smoking prevalence started to decline in men earlier than in women[3]

Objectives

Characterize changes in the incidence of lung cancer and other tobacco-related cancers in New Jersey
- by primary site
- by gender
- by race and ethnicity

Methods

- **Data Source**: New Jersey State Cancer Registry (NJSCR)
- **Statistical methods**:
  - Calculated annual age-adjusted cancer incidence rates by type of cancer, gender, race during 1979-2013, and by Hispanic ethnicity during 1990-2013 using SEER*Stat software version 8.2, 2015 (Surveillance Research Program, National Cancer Institute)
  - Rates for cancers identified by IARC as sufficient evidence that tobacco smoking causes cancer[1,2]:
    lung, larynx, oral cavity and pharynx, esophagus, stomach, pancreas, colorectal, liver, kidney, urinary bladder, cervix, ovary (mucinous), acute myeloid leukemia
  - Joinpoint regression analysis[5]
    - Calculated annual percent changes (APCs) in incidence rates and identified points in time when incidence rate trends change significantly (joinpoints) using Joinpoint Regression Program, Version 4.1.1, August 2014, National Cancer Institute

Table 1. Number of New Jersey Cancer Cases Diagnosed during 1979-2013

Cancer Site	Male	Female
	No.	No.
Lung and Bronchus	115,172	87,185
Oral Cavity/Pharynx	21,849	10,864
Esophageal	11,237	4,075
All Others*	233,516	190,150

*All other cancer sites included in the analyses: larynx, urinary bladder, kidney and renal pelvis, liver, pancreas, stomach, ovary (mucinous), cervix, and colorectal cancers and acute myeloid leukemia. See Table 2 for further details.

References

1. International Agency for Research on Cancer (IARC) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 83: Tobacco Smoke and Involuntary Smoking*. IARC, Lyon, 2004.

2. International Agency for Research on Cancer (IARC) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 100E: Personal Habits and Indoor Combustions*. IARC, Lyon, 2012.

3. CDC. Achievements in public health, 1900-1999: Tobacco use – United States, 1900-1999. MMWR 1999;48:986-993.

4. CDC. Trends in current cigarette smoking among high school students and adults, United States, 1965-2014. http://www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/ [Accessed May 13, 2016].

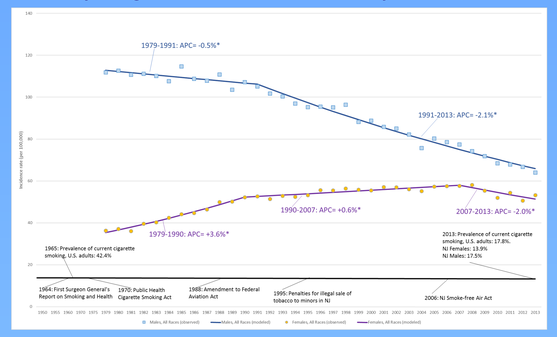
5. Kim HJ, Pay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with application to cancer rates. *Stat Med* 2000; 19:335-351 (correction: 2000; 20:655).

Acknowledgments

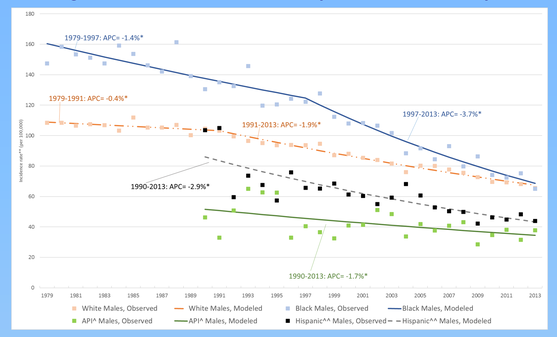
The New Jersey State Cancer Registry is supported by the National Program of Cancer Registries of the Centers for Disease Control and Prevention under cooperative agreement 5U58DP003931-02 awarded to the New Jersey Department of Health, the Surveillance, Epidemiology, and End Results program of the National Cancer Institute under contract HHSN 261201300021I No. N01PC-2013-00021 awarded to the Rutgers Cancer Institute of New Jersey, and the State of New Jersey.

Results

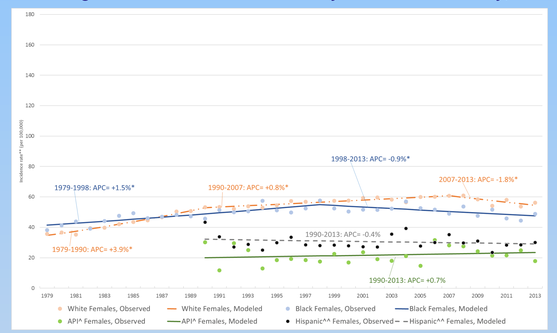
New Jersey Lung Cancer Incidence Rates** by Gender, 1979-2013



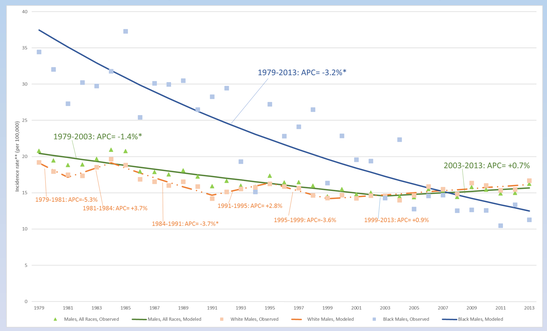
NJ Male Lung Cancer Incidence Rates** by Race and Ethnicity, 1979-2013



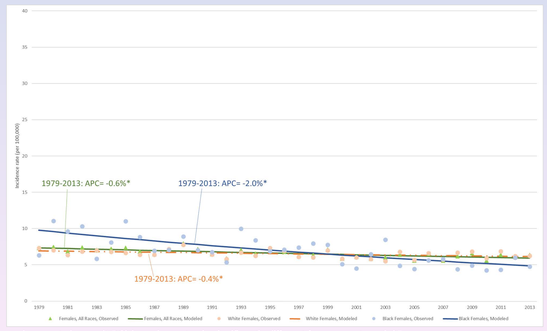
NJ Female Lung Cancer Incidence Rates** by Race and Ethnicity, 1979-2013



NJ Male Oral Cavity/ Pharynx Cancer Incidence Rates** by Race, 1979-2013



NJ Female Oral Cavity/ Pharynx Cancer Incidence Rates** by Race, 1979-2013

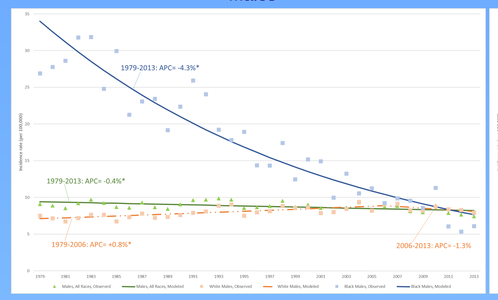


*The annual percent change (APC) based on rates is significantly different from zero at p < 0.05.
**Rates are per 100,000 and age-adjusted to the 2000 US standard population (19 age groups - Census P25-1130). 2013 data are preliminary.
Note: Incidence rates prior to 1990 were not calculated for API and Hispanics because the population estimates were not available.
^API = Asians and Pacific Islanders.
^^Persons of Hispanic ethnicity may be of any race or combination of races. The categories of race and ethnicity are not mutually exclusive.

Results (2)

New Jersey Esophageal Cancer Incidence Rates** by Race, 1979-2013

Males



Females

*The annual percent change (APC) based on rates is significantly different from zero at p < 0.05.
**Rates are per 100,000 and age-adjusted to the 2000 US standard population (19 age groups - Census P25-1130). 2013 data are preliminary.

Table 2. Trends in Incidence of Other Tobacco-Related Cancers in New Jersey by Cancer Site and Gender, 1979-2013

Gender	Cancer	No.**	Joinpoint Trend 1		Joinpoint Trend 2		Joinpoint Trend 3	
			Years	APC	Years	APC	Years	APC
Male	Larynx	11,544	1979-1992	-1.4*	1992-2013	-2.9*		
Female		2,970	1979-1993	´ -0.2	1993-2013	-2.9*		
Male	Urinary Bladder^	54,990	1979-2006	´ 0.0	2006-2013	-2.0*		
Female		20,286	1979-2006	´ +0.2	2006-2013	-2.1*		
Male	Kidney and	23,793	1979-2007	+2.1*	2007-2013	´ -0.7		
Female	Renal Pelvis	14,659	1979-2004	+2.5*	2004-2013	´ -0.3		
Male	Liver	9,175	1979-2004	+4.6*	2004-2013	+1.7*		
Female		3,689	1979-2013	+2.6*				
Male	Pancreas	18,106	1979-1997	-0.8*	1997-2013	+1.1*		
Female		19,556	1979-2013	+0.3*				
Male	Stomach	17,944	1979-2013	-1.8*				
Female		12,108	1979-2013	-1.5*				
Female	Ovary (mucinous)	2,125	1979-1990	´ -0.3	1990-2013	-5.0*		
Male	Acute myeloid	5,630	1979-2013	+1.1*				
Female	leukemia	4,854	1979-2013	+1.3*				
Female	Cervix	17,240	1979-1987	-2.6*	1987-1990	´ +3.6	1990-2013	-2.7*
Male	Colorectal^^	92,334	1979-1988	´ +0.3	1988-1994	-3.1*	1994-1999	0.0
Female		92,663	1979-1990	-0.6*	1990-1994	´ -3.1	1994-2001	´ -0.3

*The annual percent change (APC) based on rates is significantly different from zero at p < 0.05.
**Number of cases diagnosed during 1979-2013.
^Includes *in situ* cancers.
^^Additional trends for colorectal cancer: Males: 1999-2013: APC= -3.9*. Females: 2001-2009: APC= -3.8*; 2009-2013: APC= -1.4

Limitations

- Lack of information on smoking history & smokeless tobacco use
- No individual-level data on other cancer risk factors such as obesity, alcohol consumption, dietary factors, hepatitis B and C virus infection, human papilloma virus (HPV), occupational exposures
- Potential misclassification of race or ethnicity

Strengths

- Population based cancer registry with high-quality data
- Long term follow-up to evaluate cancer incidence trend data (34 years)
- Large numbers of cases and sufficient statistical power

Conclusions

- After declines in cigarette smoking, lung cancer incidence rates decreased in New Jersey, with declines occurring earlier in men than women, although the incidence remains higher in men. This reflects changes in smoking prevalence and the latency period (25+ years) between the onset of smoking and lung cancer incidence, as U.S. men started to quit in large numbers in the 1950s, earlier than women.
- NJ black men had higher lung cancer incidence than white men, but experienced a larger decrease in rates, with rates approaching those in white men by 2013. The decline in lung cancer incidence started earlier in NJ black women than in white women.
- Oral cavity/pharynx cancer incidence declined in NJ women during 1979-2013 and in men until 2003. The increasing use of smokeless tobacco products, especially in men, may play a role in this change in trend in men.
- Esophageal cancer incidence declined in NJ men and women. Esophageal cancer rates were higher in blacks than whites, but the decrease in incidence was more pronounced in blacks.
- The incidence of other smoking-related cancers, such as larynx and bladder cancer, decreased in NJ men and women during 1979-2013.
- In contrast, liver cancer incidence increased significantly in NJ men and women. The role of other liver cancer risk factors should be investigated in future studies.
- Lung cancer remains the leading cause of cancer death in NJ, and tobacco use causes substantial morbidity and mortality, emphasizing the importance of smoking prevention and cessation programs.