Pompton Lakes, New Jersey
SIR Cancer Analysis, 1979-2007

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Purpose

The following analysis was completed as a follow-up to the *Health Consultation: Analysis of Cancer Incidence in the Pompton Lakes Neighborhood Impacted by the Dupont Groundwater Contamination* completed and presented to the Pompton Lakes community in December 2009.

This analysis expands on the initial report in that it contains one additional year of data (2007), separate analysis of two time periods (1979-1989 & 1990-2007), as well as the entire twenty-nine year period from 1979-2007. This analysis also covers the entire municipality of Pompton Lakes and evaluates total cancer incidence for 15 specific cancer types.

Methods

Survey Area and Population

The survey area for this analysis consisted of the entire municipality of Pompton Lakes. Population counts were obtained from the 1980, 1990 and 2000 censuses (U.S. Census Bureau).

Case Ascertainment and Survey Period

The New Jersey State Cancer Registry (NJSCR) was used to determine cancer cases. The NJSCR is a population-based cancer incidence registry that has been in operation since October 1, 1978 and maintains complete years of data from 1979 to 2007. Data for 2008 to 2010 are being collected but are not yet complete. By law, all cases of newly diagnosed cancer are reportable to the NJSCR. All primary invasive and in situ neoplasms are reportable to the NJSCR, except cervical cancer in situ diagnosed after 1995 and certain carcinomas of the skin. Benign and borderline intracranial and Central Nervous System tumors are also collected, effective with cases diagnosed on and after January 1, 2004.

In addition, the NJSCR has reporting agreements with the states of New York, Pennsylvania, Delaware, Maryland, North Carolina, and Florida. Information on New Jersey residents who are diagnosed in those states is supplied to the NJSCR.

The NJSCR has been awarded the North American Association of Central Cancer Registrars (NAACCR) Gold Standard, the highest standard possible, for the quality of data since the inception of this award several years ago. The criteria used to judge the quality of the data are timeliness, completeness of cancer case ascertainment, completeness of specific information on the cancer cases, percent of death certificate only cases, percent of duplicate cases, in addition to passing the data through a stringent edit program.

For additional information on the NJSCR please visit the website at

http://www.state.nj.us/health/ces/njscr.shtml

A "case" was defined as an individual who was diagnosed with a new primary malignant cancer during the survey period while residing in the survey area. NJSCR cases identified only through search of death or autopsy records were excluded from this evaluation. The reason for this exclusion was that the majority of these cases do not include accurate address information and therefore could not be accurately assigned as a Pompton Lakes case. To control for this exclusion, the cancer rates used to generate the expected cases also excluded the autopsy/death certificate only cases.

All cancer cases from the New Jersey State Cancer Registry identified as Pompton Lakes residents were reviewed to determine geographic location of residence at the time of diagnosis within the Borough.

It should be noted for this report, that information on important cancer risk factors, such as genetics, personal behaviors (e.g., diet and smoking), or occupational history, is not available from the NJSCR.

Data Analysis

Males and females were evaluated separately for all races combined. Analyses were completed for all malignant cancer types combined and for fifteen select cancer types for Pompton Lakes. The select cancer types analyzed include prostate, female breast, ovary, cervix, lung, colorectal, bladder, non-Hodgkin lymphoma (NHL), melanoma of the skin, leukemia, kidney, pancreas, thyroid, brain and central nervous system (CNS) and liver. These cancer types account for about 80% of all cancer diagnoses in New Jersey and the U.S.

The cancer types presented in the original health study (December 2009) were evaluated because they represent cancer groupings that may be more sensitive to the effects of environmental exposures. Several additional cancer sites were included in this analysis in response to concerns raised by some community members.

Recent legislation has required the reporting of non-malignant benign brain tumors to all state cancer registries nationally. The New Jersey State Cancer Registry (NJSCR) has been collecting data on benign brain tumors diagnosed in the State of New Jersey after

January 1, 2004.   In response to concerns raised by some Pompton Lakes community members, the number of benign brain cancers reported to the NJSCR from 2004 to 2007 were reviewed and found to be less than five cases for this four year period. The actual number of benign brain cancers diagnosed in Pompton Lakes from 2004-2007 was less than the expected number. The expected number of benign brain cancers was derived from the New Jersey State rates 2004-2007 and the estimated Pompton Lakes population for the years 2004-2007.

Standardized incidence ratios (SIR) were used for the quantitative analysis of cancer incidence in the study area (Kelsey et al. 1986; Breslow and Day 1987). The SIR is calculated by dividing the observed number of cases (from the NJSCR) by an expected number for the surveyed population separately for each of the three evaluation periods, 1979 to 2007, 1979 to 1989, and 1990 to 2007.

The expected number was derived by multiplying a comparison population's age-sex-specific cancer incidence rates and the study area age-sex-specific population figures. The comparison rates used to derive the expected number of cases were the New Jersey average annual incidence rates for the total survey period (1979 to 2007) and the two smaller time periods (1979-1989, 1990-2007). The use of the word "expected" in this report, refers to statewide comparisons and should not be construed to mean acceptability.

The observed and expected numbers are evaluated by interpreting the ratio of these numbers. If the observed number of cases equals the expected number of cases, the SIR will equal 1.0. An SIR less than 1.0 indicates that fewer cases are observed than expected. An SIR greater than 1.0 indicates that more cases than expected are observed. Random fluctuations may account for some SIRs being higher or lower than 1.0. The statistical significance of deviations from SIR equal to 1.0 was evaluated using a 95% confidence interval (CI). The 95% CI was used to evaluate the probability that the SIR may be greater or less than 1.0 due to chance alone, and was based on the Poisson distribution (Breslow and Day 1987; Checkoway et al. 1989). If the confidence interval includes 1.0, then the estimated SIR is not considered to be statistically significantly different than 1.0.

Results

Table 1 presents distribution of ages at cancer diagnosis for Pompton Lakes cases versus New Jersey for the entire analysis period (1979-2007). For the period 1979 through 2007, a total of 1,646 (791 males and 855 females) malignant incident cancer cases were diagnosed among Pompton Lakes residents. The distribution of ages at diagnosis for Pompton Lakes is similar to that of New Jersey.

Table 2 presents the standardized incidence ratio (SIR) results for Pompton Lakes by sex for the 29-year survey period from 1979-2007. Based on average state rates, overall cancer incidence was found to be slightly higher than expected for males and statistically

significantly elevated for females (SIR=1.11; 95% CI=1.04, 1.19). The only other statistically significantly elevated specific cancer type was female lung (SIR=1.29; 95% CI=1.06, 1.55), which is responsible in part for the overall cancer incidence to be elevated in females.

Table 3 presents the standardized incidence ratio (SIRs) results for Pompton Lakes by sex for the eleven-year survey period from 1979-1989. Based on average state rates, overall cancer incidence was found to be slightly higher than expected for males and females. Female lung cancer was statistically significantly elevated (SIR=1.69; 95% CI=1.23, 2.27).

Table 4 presents the standardized incidence ratio (SIRs) results for Pompton Lakes by sex for the eighteen-year survey period from 1990-2007. Based on average state rates, overall cancer incidence was found to be slightly higher than expected for males and statistically significantly elevated for females (SIR=1.12; 95% CI=1.03, 1.22). Colorectal cancer was statistically significantly elevated for males (SIR=1.28 ; 95% CI=1.01, 1.60).

Limitations

The Pompton Lakes population estimates after the year 2000 are based on the changes in population from 1990 to 2000. When the 2010 census data becomes available, several years from now, the intercensal estimates for the years between 2000 and 2010 may change and better reflect what the true population was for these years. Pompton Lakes appears to have a relatively stable population from 1980, 1990 and 2000 and there is no evidence at this time to suggest that the population has changed significantly in 2010.

Discussion

Female lung cancer was statistically significantly high for the periods of 1979-1989 (SIR=1.69; 95% CI=1.23, 2.27) and the entire study period of 1979-2007 (SIR=1.29; 95% CI=1.06, 1.55). Since the female lung cancer rate for the later time period (1990-2007) was not statistically significantly elevated, the elevation seen from 1979-2007 is being driven up by the earlier period (1979-1989).

Lung is a common site of metastases and it is possible, especially in the earlier years (1979-1990) of the NJSCR, that some of the female lung cancer cases seen in Pompton Lakes during this period were miscoded as lung cancer when they were actually metastases from cancers originating from another site. NJSCR staff recently reviewed the cases and found there is not adequate information to determine whether they were coded correctly or not.

A risk factor is anything that affects an individual's chance of developing a disease such as cancer. The presence of a risk factor, or even several risk factors, does not always mean that an individual will develop cancer. In addition, the presence of cancer does not always mean a particular risk factor(s) was present.

Lung cancer is the second most common cancer among both men and women in the U.S. and New Jersey. Cigarette smoking is the biggest risk factor and is responsible for nearly 90 percent of all lung cancers. Other risk factors include smoking cigars and pipes as well as second-hand smoke, air pollution, high doses of ionizing radiation, older age (over 50) and residential radon exposure. Also, occupational exposure to mustard gas, chloromethyl ethers, inorganic arsenic, chromium, nickel, vinyl chloride, radon, asbestos or byproducts of fossil fuel (including diesel exhaust) are thought to increase the risk of lung cancer. Because there are causes of lung cancer other than cigarette smoke, it is possible for a non-smoker to develop lung cancer, although the rate is much lower than that of smokers. Research that has been done in non-smokers suggests that genetic abnormalities may be linked to lung cancer development.

Colorectal cancer is the third most common cancer for both men and women in New Jersey and the U.S. Risk factors include personal or family history of colorectal polyps or inflammatory bowel disease, certain hereditary conditions, older age (over 50), a diet high in fat, a diet low in fiber, fruits and vegetables, obesity, physical inactivity, cigarette smoking and alcohol consumption. Researchers have not found a link between colorectal cancer and environmental contaminants.

The period of time between an exposure(s) and the development of cancer is referred to as latency. The latency for cancer in adults is generally 10 to 30 years or even more. Since the cancers we see now are generally related to a lifetime of certain habits or exposures to carcinogens, it is usually very difficult to pinpoint what caused a specific case of cancer.

Table 1.
Distribution of Invasive Cancers by Age Group
1979-2007

	Pompton Lakes		New Jersey	
Age Group	Count	%	Count	%
00-19 years	13	0.8%	11,140	0.9%
20-39 years	90	5.5%	56,784	4.8%
40-59 years	388	23.6%	284,514	23.8%
60-79 years	901	54.7%	645,052	54.0%
80+ years	254	15.4%	196,656	16.5%
Total	1646	100%	1,194,146	100%

Table 2.

Pompton Lakes SIR Analysis, by Cancer Type and Sex
All Races Combined, 1979-2007

		Observed	Expected	SIR	95% CI Lower	Upper
All Cancers	Male	791	761.33	1.04	0.97	1.11
	Female	**855**	**767.53**	**1.11 ***	**1.04**	**1.19**
Prostate	Male	197	204.05	0.97	0.84	1.11
Breast	Female	240	228.84	1.05	0.92	1.19
Ovary	Female	32	28.98	1.10	0.76	1.56
Cervix	Female	18	19.91	0.90	0.54	1.43
Lung	Male	138	120.25	1.15	0.96	1.36
	Female	**114**	**88.44**	**1.29 ***	**1.06**	**1.55**
Colorectal	Male	108	99.55	1.08	0.89	1.31
	Female	116	102.68	1.13	0.93	1.35
Bladder	Male	51	56.57	0.90	0.67	1.19
	Female	25	21.70	1.15	0.75	1.70
NHL	Male	31	29.81	1.04	0.71	1.48
	Female	29	27.98	1.04	0.69	1.49
Melanoma	Male	31	24.96	1.24	0.84	1.76
	Female	23	20.55	1.12	0.71	1.68
Leukemia	Male	18	20.74	0.87	0.51	1.37
	Female	18	16.77	1.07	0.64	1.70
Kidney	Male	25	22.78	1.10	0.71	1.62
	Female	21	14.73	1.43	0.88	2.18
Pancreas	Male	20	16.79	1.19	0.73	1.84
	Female	11	18.71	0.59	0.29	1.05
Thyroid	Male	5	5.72	0.87	0.28	2.04
	Female	21	17.40	1.21	0.75	1.85
Brain	Male	14	11.33	1.24	0.68	2.07
	Female	16	9.59	1.67	0.95	2.71
Liver --	Male	10	8.54	1.17	0.56	2.15
	Female	-	-	-	-	-

- Counts and Statistics suppressed when fewer than 5 cases to ensure confidentiality and statistical reliability. No statistics were supressed if statistically significantly elevated.

* Statistically significantly high
-- Liver includes Intrahepatic Bile Duct

Table 3.

Pompton Lakes SIR Analysis, by Cancer Type and Sex
All Races Combined, 1979-1989

		Observed	Expected	SIR	95% CI Lower	Upper
All Cancers	Male	263	245.35	1.07	0.95	1.21
	Female	283	257.72	1.10	0.97	1.23
Prostate	Male	52	41.98	1.24	0.92	1.62
Breast	Female	75	77.09	0.97	0.77	1.22
Ovary	Female	8	11.05	0.72	0.31	1.43
Cervix	Female	7	8.22	0.85	0.34	1.75
Lung	Male	54	48.95	1.10	0.83	1.44
	Female	**44**	**26.03**	**1.69 ***	**1.23**	**2.27**
Colorectal	Male	31	39.82	0.78	0.53	1.10
	Female	42	40.15	1.05	0.75	1.41
Bladder	Male	26	20.03	1.30	0.85	1.90
	Female	9	7.48	1.20	0.55	2.28
NHL	Male	8	8.35	0.96	0.41	1.89
	Female	5	7.77	0.64	0.21	1.50
Melanoma	Male	8	6.71	1.19	0.51	2.35
	Female	5	5.78	0.86	0.28	2.02
Leukemia	Male	7	6.72	1.04	0.42	2.15
	Female	-	-	-	-	-
Kidney	Male	8	6.53	1.23	0.53	2.41
	Female	8	4.00	2.00	0.86	3.94
Pancreas	Male	5	5.89	0.85	0.27	1.98
	Female	-	-	-	-	-
Thyroid	Male	-	-	-	-	-
	Female	-	-	-	-	-
Brain	Male	-	-	-	-	-
	Female	7	3.11	2.25	0.90	4.64
Liver --	Male	-	-	-	-	-
	Female	-	-	-	-	-

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Table 4.

Pompton Lakes SIR Analysis, by Cancer Type and Sex
All Races Combined, 1990-2007

		Observed	Expected	SIR	95% CI Lower	Upper
All Cancers	Male	528	513.18	1.03	0.94	1.12
	Female	**572**	**508.84**	**1.12 ***	**1.03**	**1.22**
Prostate	Male	145	158.66	0.91	0.77	1.08
Breast	Female	165	151.23	1.09	0.93	1.27
Ovary	Female	24	17.97	1.34	0.86	1.99
Cervix	Female	11	11.78	0.93	0.47	1.67
Lung	Male	84	72.20	1.16	0.93	1.44
	Female	70	62.40	1.12	0.87	1.42
Colorectal	**Male**	**77**	**60.03**	**1.28 ***	**1.01**	**1.60**
	Female	74	62.80	1.18	0.93	1.48
Bladder	Male	25	36.63	0.68	0.44	1.01
	Female	16	14.26	1.12	0.64	1.82
NHL	Male	23	21.23	1.08	0.69	1.63
	Female	24	20.05	1.20	0.77	1.78
Melanoma	Male	23	18.05	1.27	0.81	1.91
	Female	18	14.65	1.23	0.73	1.94
Leukemia	Male	11	13.94	0.79	0.39	1.41
	Female	14	11.42	1.23	0.67	2.06
Kidney	Male	17	16.09	1.06	0.61	1.69
	Female	13	10.64	1.22	0.65	2.09
Pancreas	Male	15	10.90	1.38	0.77	2.27
	Female	8	12.62	0.63	0.27	1.25
Thyroid	Male	-	-	-	-	-
	Female	19	13.50	1.41	0.85	2.20
Brain	Male	11	7.38	1.49	0.74	2.67
	Female	9	6.47	1.39	0.64	2.64
Liver --	Male	7	6.60	1.06	0.42	2.18
	Female	-	-	-	-	-

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