

Letter Health Consultation

CANCER INCIDENCE, 1992-2006:
RESIDENTS OF PEMBROKE AND ALLENSTOWN

MERRIMACK COUNTY, NEW HAMPSHIRE

EPA FACILITY ID: NHD000791509

Prepared by
New Hampshire Department of Environmental Services

OCTOBER 7, 2010

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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LETTER HEALTH CONSULTATION

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The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

August 12, 2010

Thomas Niejadlik
Administrator
Environmental Health Program
New Hampshire Department of Environmental Services
P.O. Box 95
Concord, NH 03302-0095

Dear Mr. Niejadlik:

In September 2007, the Department of Environmental Services, Environmental Health Program (EHP) completed a Public Health Assessment entitled “Ambient Air Quality in Suncook Village.” One of the Public Health Action Plans stated in that document (Section 11.0; page 63) read, “EHP will update health outcome reports for Pembroke and Allenstown as additional years of cancer incidence and hospitalization data become available.” The current Letter Health Consultation is the first update of cancer information provided. It is EHP’s intention to provide a copy of this letter health consultation to the Air Resources Division, Air Permit Programs and to make it available to the public by providing copies to interested stakeholders in these communities.

Introduction

This Letter Health Consultation was prepared as an update to an analysis of cancer incidence in Pembroke and Allenstown (1987-2001) reported in the 2007 Public Health Assessment “Ambient Air Quality in Suncook Village.” The original analysis was carried out in response to a community concern about local cancer rates. The review of environmental data in the PHA did not reveal any ambient air exposure levels in Suncook Village that would be expected to result in any detectable increase in cancer rates. The current report updates the previous study through data year 2006.

Methods

Rates of cancer incidence (1992-2006) were calculated for 24 major cancer types taking into account the age and gender composition of the population. The study population included residents of Pembroke and Allenstown, New Hampshire (NH), referred to throughout as residents of the “Suncook area”. (Suncook is a Census Designated Place that encompasses one-quarter of Allenstown’s population and one-half of Pembroke’s. The towns also share the same postal zip code.) All cancer statistics for the study population were compared with those of the State of New Hampshire as a whole.

Data Sources

Cancer Incidence 1992-2006. Cancer became a reportable disease in New Hampshire in 1985, and since 1986 the New Hampshire State Cancer Registry (NHSCR) has been charged with identifying all new cases of cancer occurring among New Hampshire residents. Health Statistics and Data Management (HSDM), under the New Hampshire Department of Health and Human Services (DHHS), Division of Public Health Services (DPHS) has overall responsibility for the NHSCR, which it funds through a state contract. Dartmouth Medical School has continuously held the contract to operate the NHSCR since its inception. The registry is administratively located in the Norris Cotton Cancer Center. The US Centers for Disease Control and Prevention (CDC) currently provides a grant to DHHS, and these funds have been used to help increase the scope of registry information and to assure the quality of the data collected. Cancer data are collected in accordance with NH Administrative Rules. NHSCR currently collects reports from hospital physician practices, freestanding radiation oncology centers, out-of-state pathology laboratories and other sources, as required by NH Administrative Rules. In addition, NHSCR receives reports for NH residents who are diagnosed outside of NH based on exchange agreements with other states.

The time period 1992-2006 was selected for evaluation of cancer incidence because it was the most recent for which data were available. Multiple years of data are also needed to provide large enough numbers to yield meaningful statistics for smaller areas such as individual towns. An incident case was defined as *an individual member of the study population who was diagnosed with a new primary malignant cancer during the evaluation period*. The study population included residents of Pembroke and Allenstown (the “Suncook area”). Variables analyzed included: primary cancer type, date of diagnosis, age at diagnosis, and gender. Information on other risk factors such as health-related behaviors, environmental and occupational exposures, or access to medical care, is not captured in the cancer registry data base.

Population Data 1992-2006. Statewide and town population estimates for 1992-2006 are from NH City and Town Population estimates calculated by the Claritas Corporation. The population of Pembroke was estimated as 7390 in 2006 while Allenstown had an estimated 4951 residents for a combined total of 12,341.

Data Analysis

This study employed the Standardized Incidence Ratio (SIR) technique to analyze cancer incidence among Suncook area residents. The SIR is used to analyze disease incidence in small areas and is the first step in NH’s disease cluster investigation protocol. The SIR is the ratio of the actual (observed) number of cases in the study population to the number that would be “expected” to occur if that population had the same age-gender composition as the State of NH reference population as a whole. The purpose of an SIR is to identify unusually high (or low) disease rates in an area. Once identified, an

assessment is made as to whether elevated rates might be amenable to public health intervention. It is important to emphasize that the term “expected” as used in this study is based only on the characteristics of age and gender. It does not take into account other determinants of elevated disease and death rates such as health-related behaviors (e.g., tobacco and alcohol use, diet), environmental or occupational exposures, or access to health care (e.g., insurance status, other financial and personal barriers).

The SIR tells us how much higher or lower cancer rates for the study population are than those of the comparison population (State of New Hampshire) taking age and gender into account. If the observed number of cases is the same as the age-gender expected number, the SIR will equal 1.00. If there are more observed cases than would be expected, then the SIR will be greater than 1.00. If there are fewer observed cases than expected, the SIR will be less than 1.00. For example, if 10 cases are observed in the study population, but 5 cases are expected, then the $SIR = 10/5 = 2.00$ and the area has twice the number of cancer cases as expected. But if 20 cases were expected, then the $SIR = 10/20 = 0.50$, meaning that the area has half the expected number.

Caution should be exercised when interpreting the SIR. The interpretation must take into account the actual number of cases observed and expected, not just the ratio. Two SIRs can have the same ratio but represent very different scenarios. For example, an SIR of 1.50 could mean 3 cases were observed and 2 were expected ($3/2 = 1.50$), or it could mean 300 cases were observed and 200 were expected ($300/200 = 1.50$). In the first instance, only 1 “excess” cancer case occurred, which would most likely have been due to chance. But in the second instance, 100 excess cancers occurred, which would unlikely have been by chance alone. This elevated ratio would then be investigated further to determine if it can be linked to any known cause or set of causes.

To determine if the observed number of cases is different from the expected number by a “statistically significant” margin, a 95 percent confidence interval (CI) is calculated for each SIR. The 95 percent CI provides an indication of the magnitude and stability of an SIR or SMR. Specifically, a 95 percent CI is the range of estimated SIR values that has a 95 percent probability of including the true SIR for the population. If the 95 percent CI range does not include the value 1.00, then the cancer rate of the study population is characterized as “significantly” different from that of the comparison or “normal” population. If the SIR is found to be statistically significant, then the difference between the expected and observed cases is probably due to some set of factors that influence the rate of that disease, and not to random fluctuations in the rate. For example, if both confidence limits (the end points of a confidence interval) are above 1.00 (e.g., 1.05-1.30), then there is a statistically significant excess in the number of cancer cases. Conversely, if both confidence limits are below 1.00 (e.g., 0.45-0.96), then the number of cancer cases is lower than expected by a statistically significant margin. If the confidence interval range includes 1.00, then the difference between the true SIR of the study population and the true SIR of the reference population is not considered to be statistically significant. Statistical significance should not be assessed when fewer than five cases are observed. In the current study, cells with between one and four cases are suppressed in accordance with the NH DHHS data release policy.

In addition to the range of the estimates contained within the confidence interval, the width of the confidence interval also reflects the stability of the SIR estimate. For example, a narrow confidence interval (e.g., 1.03-1.15) allows a fair level of certainty that the calculated SIR is close to the true SIR for the population. A wide interval (e.g., 1.85 to 4.50) leaves considerable doubt about the true SIR, which could be much lower or much higher than the calculated SIR. This would indicate an unstable statistic.

Results

This section presents results of the Suncook Area SIR analysis for the fifteen year period 1992-2006. Data were analyzed first as a fifteen-year block, and subsequently were divided into three five-year periods (1992-1996, 1997-2001, and 2002-2006) to assess whether there is evidence of possible trends in Suncook cancer rates.

Cancer Incidence 1992-2006. Table 1 presents cancer incidence statistics based on the SIR analysis of Suncook Area residents. Data are presented for each of the 24 major cancer types. Statistics include:

- 1) **Observed number** of cancer cases in the Suncook area for the 1992-2006 period;
- 2) **Expected number** of cases based on the 1992-2006 State age-sex average;
- 3) **Observed minus expected** number of cases;
- 4) Ratio of Observed-to-Expected cases (**SIR**) for each cancer type; and
- 5) 95% **confidence intervals** for each SIR.

There were no statistically significant elevations in cancer rates among Suncook residents for the 1992-2006 period (Table 1). Among the 25 ratios calculated, however, two of the observed numbers were significantly *lower* than their age-sex expected numbers: Brain and Other Central Nervous System (SIR=0.41; CI= 0.13 - 0.95); and Kidney and Renal Pelvis (SIR=0.50; CI=0.23 – 0.95).

The 15-year SIR for Lung Cancer (SIR=1.19; CI = 0.99 – 1.42) came close to statistical significance and resulted in an estimated 20 more cases than expected during the 15-year period.

Cancer Incidence: 1992-1996, 1997-2001, and 2002-2006. Examination of SIRs over time (Table 2) showed an improvement in the Total Invasive SIR for the Suncook area relative to that of the state as a whole, although the change was not statistically significant. The total SIR declined from 1.13 (CI= 0.99 – 1.28) in 1992-1996 and 1.11 (CI= 0.97-1.26) in 1997-2001, to 0.97 (CI= 0.86-1.09) in 2002-2006 (Table 3). This means that for the most recent five years of data available, overall cancer incidence among Suncook area residents was 3% lower than the state rate.

None of the SIRs from the most recent 5-year period (2002-2006) approached statistical significance (Table 3).

Conclusions

A standardized incidence ratio (SIR) analysis for the Suncook area (towns of Pembroke and Allenstown) for the years 1992-2006 found that incidence rates for 22 of 24 major cancer types were within their expected ranges based on corresponding rates for the state as a whole. The other two, "Brain and Other CNS" and "Kidney and Renal Pelvis" were significantly *lower* than expected.

None of the SIRs from the most recent five-year period (2002-2006) approached statistical significance.

Recommendations

EHP will provide interested parties (including the DES Air Permit Programs) with a copy of this document and will post it on the DES website.

No further actions are recommended.

Thank you for your ongoing support on this project. Please feel free to contact me at 603-271-4509, if you have any questions.

Sincerely,

John P. Colby, Jr., PhD
Environmental Epidemiologist
State of New Hampshire
Environmental Health Program
Dept of Environmental Services
Concord, NH 03302-0095
603-271-4509

cc: Dennis Pinski
Jeff Kellam

Resources

Community members can find more information on cancer and cancer prevention by contacting the following organizations:

NH Health Statistics and Data Management (<http://www.dhhs.state.nh.us/DHHS/HSDM>)

NH State Cancer Registry (<http://www.dartmouth.edu/~nhscr/>)

National Cancer Institute (<http://cancer.net.nci.nih.gov>)

American Cancer Society (www.cancer.org)
800-ACS-2345

Division of Cancer Prevention and Control
Centers of Disease Control and Prevention (<http://www.cdc.gov/cancer>)
888-842-6355

Certification

The New Hampshire Department of Environmental Services, Environmental Health Program prepared this letter health consultation for cancer incidence in Pembroke and Allenstown NH under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedure existing at the time the health consultation was initiated. Editorial review was completed by the cooperative agreement partner.



Jeff Kellam, M.S.
Technical Project Officer
Division of Health Assessment and Consultation (DHAC)
ATSDR

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.



Alan W. Yarbrough
Cooperative Agreement Team Leader, DHAC, ATSDR

Table 1. Standardized Incidence Ratios (SIRs) by cancer type: Residents of Pembroke and Allenstown, Merrimack County, New Hampshire, 1992-2006.

Cancer Type	Observed Number	Age-Sex Expected Number	Observed minus Expected	SIR (Obs/Exp)	95% CI Lower	95% CI Upper
Bladder	38	39	-1	0.97	0.69	1.34
Brain & Other CNS	5	12	-7	0.41#	0.13	0.95
Breast (Female)	126	117	9	1.08	0.90	1.28
Cervical	6	8	-2	0.80	0.29	1.74
Colorectal	75	81	-6	0.93	0.73	1.17
Esophagus	9	9	0	1.02	0.46	1.93
Hodgkin's Disease	7	6	1	1.26	0.50	2.59
Kidney & Renal Pelvis	9	18	-9	0.50#	0.23	0.95
Larynx	11	7	4	1.52	0.76	2.71
Leukemia	21	19	2	1.09	0.67	1.66
Liver	9	6	3	1.59	0.73	3.03
Lung & Bronchus	124	104	20	1.19	0.99	1.42
Melanoma of the Skin	34	36	-2	0.93	0.65	1.31
Multiple Myeloma	8	8	0	1.01	0.43	1.99
Non-Hodgkin's Lymphoma	21	29	-8	0.72	0.44	1.10
Oral Cavity & Pharynx	23	17	6	1.36	0.86	2.05
Other	58	54	4	1.08	0.82	1.40
Ovary	12	14	-2	0.87	0.45	1.52
Pancreas	20	16	4	1.24	0.76	1.92
Prostate	104	105	-1	0.99	0.81	1.21
Stomach	6	9	-3	0.66	0.24	1.44
Testis	5	6	-1	0.83	0.27	1.94
Thyroid	8	12	-4	0.66	0.29	1.31
Uterine	24	23	1	1.04	0.66	1.54
TOTAL INVASIVE	763	754	9	1.01	0.94	1.09

SIR is significantly lower than expected (p<.05).

Table 2. Standardized Incidence Ratios (SIRs) by cancer type and five-year intervals: Residents of Pembroke and Allenstown, Merrimack County, New Hampshire, 1992-2006.

Cancer Type	1992-2006			Five-year SIRs		
	Observed Number	Expected Number	92-06 SIR	92-96	97-01	02-06
	Bladder	38	39	0.97	1.04	0.78
Breast (Female)	126	117	1.08	1.33	0.97	1.12
Colorectal	75	81	0.93	1.05	1.04	0.76
Leukemia	21	19	1.09	1.15	1.16	1.20
Lung & Bronchus	124	104	1.19	1.40**	1.05	1.26
Melanoma of the Skin	34	36	0.93	1.32	1.34	0.80
Non-Hodgkin's Lymphoma	21	29	0.72	1.06	0.93	0.50
Other	58	54	1.08	1.44	1.08	1.01
Ovary	12	14	0.87	0.86	0.65	1.10
Pancreas	20	16	1.24	1.67	1.43	1.08
Prostate	104	105	0.99	1.02	1.26	0.88
Uterine	24	23	1.04	1.30	1.47	0.75
Miscellaneous Other	106	117	0.91	0.66	1.30	0.89
TOTAL INVASIVE	763	754	1.01	1.13	1.11	0.97

** SIR is significantly higher than expected ($p < .05$).

Table 3. Standardized Incidence Ratios (with confidence intervals) by cancer type: Residents of Pembroke and Allenstown, Merrimack County, New Hampshire, 1992-1996, 1997-2001, and 2002-2006.

Cancer Type	1992-1996			1997-2001			2006-2006		
	SIR (Obs/Exp)	95% CI Lower	95% CI Upper	SIR (Obs/Exp)	95% CI Lower	95% CI Upper	SIR (Obs/Exp)	95% CI Lower	95% CI Upper
Bladder	1.04	0.54	1.82	0.78	0.36	1.49	1.13	0.66	1.81
Breast (Female)	1.33	0.97	1.78	0.97	0.67	1.36	1.12	0.82	1.48
Colorectal	1.05	0.69	1.53	1.04	0.69	1.52	0.76	0.47	1.15
Leukemia	1.15	0.42	2.50	1.16	0.42	2.52	1.20	0.55	2.27
Lung & Bronchus	1.40	1.02	1.89	1.05	0.72	1.48	1.26	0.93	1.67
Melanoma of the Skin	1.32	0.63	2.43	1.34	0.64	2.46	0.80	0.44	1.34
Non-Hodgkins Lymphoma	1.06	0.45	2.08	0.93	0.37	1.91	0.50	0.18	1.10
Other	1.44	0.88	2.22	1.08	0.60	1.78	1.01	0.64	1.52
Ovary	0.86	0.23	2.20	0.65	0.13	1.89	1.10	0.35	2.57
Pancreas	1.67	0.67	3.44	1.43	0.52	3.11	1.08	0.43	2.23
Prostate	1.02	0.69	1.45	1.26	0.89	1.73	0.88	0.61	1.22
Uterine	1.30	0.56	2.57	1.47	0.67	2.78	0.75	0.30	1.55
Miscellaneous Other	0.66	0.41	1.00	1.30	0.94	1.75	0.89	0.64	1.21
TOTAL INVASIVE	1.13	0.99	1.28	1.11	0.97	1.26	0.97	0.86	1.09