INVESTIGATION OF CANCER INCIDENCE IN THE NORTHPORT-EAST NORTHPORT SCHOOL DISTRICT, SUFFOLK COUNTY, NEW YORK 1999-2018

INTRODUCTION

This report presents the findings of an investigation conducted by the New York State Department of Health (NYSDOH) into the occurrence of all types of cancer among people of all ages living in the Northport-East Northport School District in Suffolk County. The investigation was initiated in response to an inquiry from members of the community who shared information about leukemias and other cancers diagnosed among members of the Northport High School graduating class of 2016 since their graduation and among other children and young adults in the Northport area. NYSDOH confirmed that the number of leukemias diagnosed among members of the class of 2016 was statistically unusual. The number of other cancers was small and not statistically unusual. During this same time frame, concerns were raised about conditions at Northport Middle School, one of the two middle schools in the district. The investigation therefore also examined cancer occurrence separately in the areas served by the two middle schools.

METHODS AND SOURCE OF DATA

This study was designed to learn more about the occurrence of cancer in this area and to determine whether the number of cases of cancer was different from what is typically found in communities. The primary source of data was the New York State Cancer Registry. The Cancer Registry contains information on all individuals in the state diagnosed with cancer as required by New York State law.

Statistical analyses for this study were based on a comparison of the number of cases of cancer actually diagnosed among residents of an area with the number of cases of cancer one would expect to find, if rates of cancer in the area were the same as in similar areas of the state. Data from the Cancer Registry were used to identify residents of the study area who were diagnosed with cancer (observed cases) and to calculate the number of cancers that would be expected to be diagnosed in the area. These calculations were done by applying incidence rates by age and sex for different types of cancer and all cancers combined for a comparison area to the population of the study area by age and sex. New York State excluding New York City was used as the comparison area.

The period of the statistical analyses was selected as 1999-2018, the time from the diagnosis of the earliest case reported by community members to the latest year for which Cancer Registry data were official at the time the analyses were conducted. The area studied is illustrated on the map. Separate analyses were done for the Northport-East Northport school district as a whole and for portions of the district approximating the Northport Middle School attendance district and the East Northport Middle School attendance district.

Statistical testing by means of the Poisson distribution was used to determine whether any differences between observed and expected numbers of cancer were likely to occur by chance. If the probability of observing a difference, either an excess or a deficit, was 0.025 (2.5%) or

less, the result was considered to be statistically significant. Non-significant excesses or deficits were considered to represent random variations in observed patterns of disease.

FINDINGS

Findings of the analyses are shown on the tables below.

Table 1 presents observed and expected numbers of cases of 23 different types of cancer and all types of cancer combined among people of all ages in the entire Northport-East Northport school district over the 20-year period 1999-2018. We identified 4,593 cases of cancer among district residents, compared with 4,454 that would be expected. This 3% excess was statistically significant, meaning it was unlikely to occur by chance. The excess was made up of significant excesses in numbers of cases of pancreatic cancer, malignant melanoma of the skin, uterine (corpus) cancer, and prostate cancer. There were significantly fewer than expected numbers of cases of stomach cancer and lung cancer. Numbers of cases of leukemia, other blood cancers (Hodgkin and non-Hodgkin lymphomas and multiple myeloma), and 13 other types of cancer examined separately were not significantly different from expected.

Table 2 presents the results for people of all ages by middle school district. The area approximating the Northport Middle School district showed an approximately 7% excess in the total number of cancers, with 2,655 cases observed and 2,486 cases expected. This difference was statistically significant. There were significantly greater than expected numbers of cases of malignant melanoma and prostate cancer, and a lower-than-expected number of cases of stomach cancer. For the East Northport Middle School area, the total number of cancer cases was not significantly different from the number expected. There were higher than expected numbers of cancers of the esophagus and pancreas, and lower than expected numbers of cases of lung cancer. None of the blood cancers was elevated in either middle school district taken separately.

Tables 3 and 4 present numbers of cases of cancer in children ages 0-14. To protect patient confidentiality, only cancer types or geographic areas with six or more cases are displayed. Table 3 shows that the number of total cases of childhood cancers and the numbers of cases for the major childhood cancer types (leukemias, lymphomas, central nervous system etc.) in the entire school district were not statistically different from expected. Table 4 shows that the numbers of total childhood cancers in each middle school area were not statistically different from the numbers expected. When the major types of childhood cancers were examined separately for each middle school area (not shown), there were no excesses in any cancer type for either middle school area.

Cases of leukemia and lymphomas in young adults ages 15-24 were also examined separately. Between 1999 and 2018, seven young adults living in the school district were diagnosed with leukemia, which was significantly greater than the just under two that would be expected. This total includes some, but not all, of the members of the graduating class of 2016 that were reported to us, as well as other young people. If the members of the graduating class of 2016 were subtracted from this total, the number of young adults with leukemia would still be greater

than the number expected, but the difference would not be statistically significant. Numbers of cases were about the same in each middle school area. There were fewer than six cases each of Hodgkin lymphoma and non-Hodgkin lymphoma in young adults. For confidentiality reasons, the exact numbers are not disclosed. The numbers of each were greater than the numbers expected, but the differences were not statistically significant. Most of the young adults with lymphomas lived in the Northport Middle School area, and when Hodgkin and non-Hodgkin lymphomas were combined, the total number of lymphomas diagnosed among young adults living in the Northport Middle School area was significantly greater than the total number expected.

Cancers among the members of the graduating class of 2016 at Northport High School who were originally reported to the NYSDOH were examined more closely. Most of the cancers were diagnosed in 2018 and 2019. As noted above, the number of cases of leukemia among the graduates was significantly greater than the number expected. Since the observed number was less than six, the exact number is not reported to protect patient confidentiality. One or more other types of cancer were also confirmed. The confirmed cases of leukemia were of different leukemia subtypes, including AML and ALL, the subtypes most frequently found in young adults. The graduates with leukemia did not all attend the same middle school. (The number of these young people was small, so any further generalizations about the middle schools they attended would not be meaningful.)

Medical records from the time of cancer diagnosis were reviewed for the graduating class members. This review confirmed the diagnoses of the type and subtype of cancer as listed in the Cancer Registry for all. The medical records did not contain information on whether there was a family history of cancer for all the graduates. Of those for whom this information was available, some of the graduates showed a family history of cancer. None of these cancers was leukemia, although one graduate had an extensive family history of other types of cancer including lymphoma. There was no indication that any of the young people had conditions or characteristics that are strong individual risk factors for leukemia or any other type of cancer.

Although Cancer Registry data for years after 2018 were not yet official at the time of these analyses, the data contain many cases diagnosed in later years, particularly in 2019. When information on childhood cancers and leukemias and lymphomas in young adults diagnosed after 2018 in this area was reviewed, there were no other young adults with leukemia or lymphoma other than the 2016 graduates who were reported to us. There was a small number of children ages 0-14 who had a record of a cancer diagnosis in 2019 or later; all of these cancers were among the cancers most frequently diagnosed in childhood.

DISCUSSION

General cancer information

Some basic facts about cancer may help put the results in perspective. Cancer is a common disease, more common than many people realize. About 40% of all Americans will develop cancer at some time in their lives. Although it can affect people of all ages, cancer occurs most often among the middle-aged and elderly. And different cancers are different diseases, each

with its own occurrence patterns, effective treatments, outlooks and risk factors. Incidence patterns for different cancers are affected by a number of factors, including those related to sociodemographics, personal behaviors, occupation and the environment. These patterns may also be affected by differences in how cancer is diagnosed across the state or over time.

Environmental concerns

In 2017, before this cancer investigation began, the Northport School District contacted NYSDOH to assist with interpretation of indoor air testing results in one of the wings of the Northport Middle School. The testing results indicated the presence of chemicals in the indoor air that appeared to be associated with storage of various products used for repair and maintenance of the school grounds. In response, the school removed all these maintenance and repair products from the classroom buildings. NYSDOH and the Suffolk County Department of Health Services also provided technical advice on ways to improve overall indoor air quality in the wing and in other areas of the school.

In 2019, in response to concerns about other locations at the Northport Middle School, the Northport-East Northport School District Board of Education engaged an environmental firm to conduct testing of soil, groundwater, injection wells, sub-slab vapor, and indoor air. In June 2020, a final report entitled the "Comprehensive Investigation Report and the Soil and Materials Management Plan for the Northport Middle School," was released to the community. While some of the environmental test results led to recommendations for corrective actions, the Comprehensive Investigation Report did not identify sources and pathways for student exposures to hazardous chemicals at levels that posed a significant health risk.

NYSDOH was asked to comment on the report and its recommendations. After review, NYSDOH responded in January 2021 that the report addressed past and more recent environmental concerns at the school, and that the Soil and Materials Management Plan, if implemented, would be expected to mitigate against potential future exposures. Links to the report, additional recommendations, and other details about actions that have been taken can be found on the School District's webpages via this link: Northport-East Northport Schools District | BG - Northport MS Information (http://web.northport.k12.ny.us/district/bg_northport_ms_information).

Study limitations

Migration, that is, the movement of people in or out of the study area, limits the conclusions that may be drawn from this study. Cancer cases were identified among persons who resided in the study area when their cancers were diagnosed. Former residents of the study area who moved away prior to being diagnosed with cancer could not be included, while persons who developed cancer shortly after moving into the area were included. If people who lived in the study area were at greater risk of developing cancer, migration of some persons out of the study area might reduce the size of any cancer excesses that may have been related to living in the study area.

A statistical factor that should be kept in mind relates to the multiple statistical tests that were done. In this study, differences were marked as statistically significant if they could occur by

chance less than 5% of the time. However, the more statistical tests are done, the greater the probability that one or more will be statistically significant purely due to chance. In this study, a large number of comparisons were made between observed and expected numbers of cancers for different cancer types for different geographic areas. Therefore, some of the statistically significant results may have nevertheless occurred by chance. It is not always possible to determine if a significant difference is due to chance alone.

It is not possible with currently existing data to reconstruct information about the varied types of environmental exposures that may have occurred in the past. Past exposures are important due to the long latency, or period of time from when a hazardous exposure occurs to the development and diagnosis of disease, for most cancers. Cancer latency can range from five to 40 years, although it can be less in children or for some blood cancers. This is a limitation for almost all types of studies of cancer in individuals and communities.

CONCLUSIONS

This investigation was conducted after the finding of a significantly high number of leukemias among 2016 graduates of Northport High School. The investigation found, however, that, aside from the 2016 graduates, diagnoses of leukemia were not significantly elevated among young adults in the Northport-East Northport school district or among children. None of the blood cancers, including leukemia, lymphoma and multiple myeloma, were elevated among people of all ages living in the district. The leukemia diagnoses among the graduates thus do not appear to be part of any larger patterns of cancer occurrence. This investigation did not identify any strong risk factors among the graduates that might account for their leukemia or other cancers individually.

It is possible that the elevated occurrence of leukemia among 2016 graduates could be related to factors not possible to uncover, including environmental exposures. Because the overall patterns for blood cancers among young people were not unusual, however, this investigation was not able to suggest hypotheses about specific types of blood cancers or specific types of exposures for additional investigation. It is also possible that the elevation was due to chance.

The investigation also found statistically significant elevations of various cancers among people of all ages in the district as a whole, and in the Northport Middle School and East Northport Middle School attendance districts taken separately. The cancers that were elevated (pancreatic cancer, malignant melanoma of the skin, uterine cancer, prostate cancer and esophageal cancer) have few known risk factors in common. Other than esophageal cancer, which has been linked to workplace exposures to certain industrial solvents, none of these cancers has been conclusively linked to exposures to environmental contaminants. Other well established risk factors for these cancers include smoking (pancreatic and esophageal cancers), fair skin and a history of severe sunburn (melanoma), and obesity and childbearing history (uterine cancer). Few risk factors other than family history are known for prostate cancer, but prostate cancer incidence is closely related to the level of prostate cancer screening in an area.

NORTHPORT-EAST NORTHPORT SCHOOL DISTRICT AND STUDY AREA
SUFFOLK COUNTY, NEW YORK

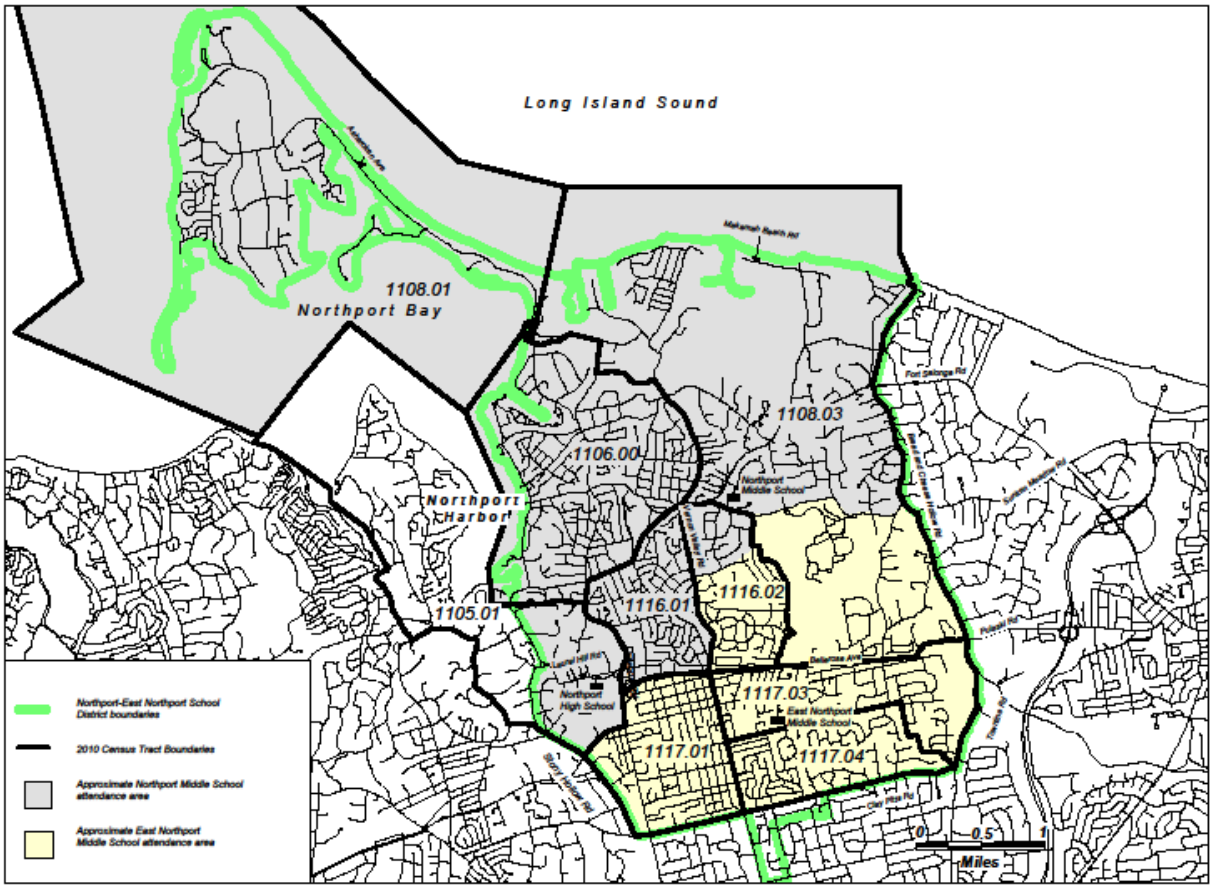

Table 1

Observed and Expected Numbers of Incident Cancer Cases
Northport Study Area
Suffolk County, New York, 1999-2018
New York State, exclusive of New York City Standard

SITES (ICD-O-3)[a]	Males and Females Combined except where noted	
	Observed[b]	Expected[c]
All Sites	**4,593***	4,454
Oral Cavity / Pharynx	97	96
Esophagus	55	48
Stomach	**44^**	65
Colorectal	387	399
Liver / Intrahepatic Bile Duct	52	56
Pancreas	**143***	117
Larynx	24	35
Lung / Bronchus	**531^**	603
Melanoma of the Skin	**242***	171
Females Only		
Female Breast	646	616
Cervix uteri	26	29
Corpus Uterus / Uterus NOS	**167***	141
Ovary	70	61
Males Only		
Prostate	**708***	649
Testis	24	21
Urinary Bladder (including *in situ*)	257	241
Kidney / Renal Pelvis	151	147
Brain / Other Nervous System	58	58
Thyroid	115	120
Hodgkin Lymphoma	32	23
Non-Hodgkin Lymphoma	184	187
Multiple Myeloma	66	61
Leukemias	138	140
All Other Sites	376	370

[a]Classification of site is based on ICD for Oncology, 3rd Edition.
[b]Data were obtained from the New York State Cancer Registry (database as of November 2020).
[c]Expected numbers are based on standard cancer incidence rates by age and sex for New York State, exclusive of New York City. Standard rates are applied to the 1999-2018 study population (total of 713,145 males and females) to obtain expected numbers of cases.
*Significant excess in observed number of cancer cases. The probability that this excess is due to chance is less than 2.5%.
^Significant deficit (lower number) in observed number of cancer cases. The probability that this deficit is due to chance is less than 2.5%.

Table 2

Observed and Expected Numbers of Incident Cancer Cases
Northport Middle School and East Northport Middle School
Suffolk County, New York, 1999-2018
New York State, exclusive of New York City Standard

SITES (ICD-O-3)[a]	Males and Females Combined except where noted			
	Northport Middle School		East Northport Middle School	
	Observed[b]	Expected[c]	Observed[b]	Expected[c]
All Sites	**2,655***	2,487	1,938	1,968
Oral Cavity / Pharynx	56	55	41	42
Esophagus	17	27	**38***	21
Stomach	**20^**	36	24	29
Colorectal	226	219	161	180
Liver / Intrahepatic Bile Duct	25	32	27	24
Pancreas	74	65	**69***	53
Larynx	16	20	8	15
Lung / Bronchus	319	336	**212^**	267
Melanoma	**153***	96	89	75
Females Only				
Female Breast	373	346	273	269
Cervix uteri	14	16	12	13
Corpus Uterus / Uterus NOS	98	80	69	61
Ovary	44	34	26	27
Males Only				
Prostate	**433***	370	275	280
Testis	13	11	11	10
Urinary Bladder (including *in situ*)	146	133	111	108
Kidney / Renal Pelvis	80	83	71	64
Brain / Other Nervous System	29	32	29	26
Thyroid	66	68	49	53
Hodgkin Lymphoma	19	13	13	11
Non-Hodgkin Lymphoma	116	104	68	83
Multiple Myeloma	39	34	27	27
Leukemias	73	77	65	63
All Other Sites	206	203	170	167

[a]Classification of site is based on ICD for Oncology, 3rd Edition.
[b]Data were obtained from the New York State Cancer Registry (database as of November 2020).
[c]Expected numbers are based on standard cancer incidence rates by age and sex for New York State, exclusive of New York City. Standard rates are applied to the 1999-2018 study populations (totals of 393,467 males and females and 319,678 males and females) to obtain expected numbers of cases.
*Significant excess in observed number of cancer cases. The probability that this excess is due to chance is less than 2.5%.
^ Significant deficit (lower number) in observed number of cancer cases. The probability that this deficit is due to chance is less than 2.5%.

Table 3

Observed and Expected Numbers of Incident Cancer Cases, Children (0-14 years)
Northport Study Area
Suffolk County, New York, 1999-2018
New York State, exclusive of New York City Standard

SITES (ICCC)[a]	Males and Females	
	Observed[b]	Expected[c]
All Sites	19	25[d]
Leukemias	7	7
Central Nervous System	6	6
Other (includes lymphomas, neuroblastoma, malignant bone tumors, and other epithelial cancers)	6	7

[a]Classification of site is based on International Classification of Childhood Cancer.
[b]Data were obtained from the New York State Cancer Registry (database as of November 2020).
[c]Expected numbers are based on standard cancer incidence rates by age and sex for New York State, exclusive of New York City. Standard rates are applied to the 1999-2018 study population (total of 147,250 males and females) to obtain expected numbers of cases.
[d]Includes expected numbers of cases at sites of cancer not listed below. There were no observed cases of retinoblastoma, renal tumors, hepatic tumors, soft-tissue sarcomas, germ-cell tumors or other/unspecified malignant neoplasms.

Table 4

Observed and Expected Numbers of All Sites of Cancer Combined, Children (0-14 years)
Northport Study Area
Suffolk County, New York, 1999-2018
New York State, exclusive of New York City Standard

Study Area	Males and Females	
	Observed[a]	Expected[b]
Northport Study Area	19	25
Northport Middle School	11	14
East Northport Middle School	8	12

[a]Data were obtained from the New York State Cancer Registry (database as of November 2020).
[b]Expected numbers are based on standard cancer incidence rates by age and sex for New York State, exclusive of New York City. Standard rates are applied to the 1999-2018 study population (totals of 147,250 males and females in the Northport study area, 80,005 males and females in Northport Middle School, and 67,245 males and females in East Northport Middle School) to obtain expected numbers of cases.