

SUMMARY OF METHODS AND FINDINGS

INVESTIGATION OF CANCER INCIDENCE IN THE NEWPORT AREA, WEST CANADA VALLEY SCHOOL DISTRICT, HERKIMER COUNTY, NEW YORK, 2001-2012

In August 2013, a resident of Newport, Herkimer County, contacted the New York State Department of Health (NYSDOH) to report what she believed to be an unusual occurrence of lymphoma among children and teenagers. The children and teenagers lived in the Town of Newport and the nearby Village of Norway, and were reportedly diagnosed with two different types of lymphoma within the past three years. Environmental concerns included a landfill in the area (Middleville Tannery), an Air Force research installation, an inactive hazardous waste site on Rose Valley Road, and the West Canada Valley schools. An initial review confirmed an unusual number of people under the age of 20 who had been diagnosed since 2011 with some form of lymphoma.

Further evaluation of information about cancer in the community confirmed an unusual pattern of childhood lymphomas in the West Canada Valley school district and neighboring areas. A review of environmental information available at the time did not identify the potential for any unusual exposures to environmental contaminants from the hazardous waste site, landfill, or school campus. It also did not identify any other inactive hazardous waste sites in the area or facilities with the potential to release hazardous substances into the environment. Based on the findings of the cancer evaluation, it was decided that further investigation of childhood cancers and potential environmental exposures was indicated.

METHODS

- To determine whether the occurrence of lymphoma in the area of concern was part of a larger pattern, the files of the New York State Cancer Registry were searched for 1) all cases of cancer in children since 2001, and 2) cases of lymphoma and leukemia in people of all ages since 2001. The area studied approximates the West Canada Valley School District.
- To learn more about individual risk factors or any common exposures, staff reviewed medical records and birth certificates of the children and teenagers with lymphoma.
- To identify potential sources of unusual exposures, staff reviewed additional available information and newly collected information on the public water supplies and the environmental sites of concern.

FINDINGS

Search for other unusual patterns in children

- For 2001-2010, the ten years prior to the first reported lymphoma diagnosis, fewer than six childhood cancers were identified in the study area, and four cancers were expected. (To protect patient confidentiality, for cancer types with fewer than six observed cases, the specific numbers of observed cases are not shown.) The difference between the observed and expected numbers of cases was not statistically significant, meaning it could easily have occurred by chance. None of the cancers were lymphoma. When 12 types of childhood cancers were examined separately, there were no statistically significant excesses or deficits in any type.
- For 2011 to 2013, when the reported lymphoma diagnoses occurred, fewer than six childhood cancers were identified. The actual number of total cancers was significantly greater than the about one cancer expected. The excess number of cases was accounted for by the lymphomas diagnosed

in this time period. There were no children with lymphoma other than the children reported by the requestor, and there were no statistically significant excesses or deficits in any other type of cancer.

- For the entire time period 2001-2013, there were nine cases of childhood cancer identified, and about five cases of childhood cancer were expected. This difference was not statistically significant. The number of lymphomas identified over the entire time period was significantly greater than the just under one case of lymphoma expected. There were three types of childhood cancer diagnosed overall - leukemia, lymphoma, and brain and central nervous system tumors. These cancers are the most common cancers diagnosed in children.
- Childhood cancers were also examined separately for each town in the study area (Norway, Fairfield, Newport, and parts of Schuyler and Herkimer combined). The numbers of childhood cancers in each town were small (each with fewer than six observed cases). The children and teenagers with lymphoma lived in towns throughout the study area.
- Most cases of childhood cancer are now reported to the Cancer Registry within three months of their diagnosis. A check of reports of childhood cancers did not show any additional cases of childhood cancer in the study area since 2013.

Search for unusual patterns of lymphoma and leukemia in all residents

- Between 2001 and 2012, a total of 51 people (27 males and 24 females) in the study area were diagnosed with Hodgkin lymphoma, non-Hodgkin lymphoma or leukemia. The totals were not statistically significantly different from the numbers of cases expected (25 males and 19 females). When the three types of cancer were examined separately, a statistically significant excess was found in the number of females diagnosed with non-Hodgkin lymphoma.
- When cases of Hodgkin lymphoma, non-Hodgkin lymphoma, and leukemia were examined separately for each town, there were no statistically significant differences in any single town for males. In females, there was a statistically significant excess in the number of females diagnosed with non-Hodgkin lymphoma in the Town of Newport (8 observed, 3 expected).
 - A majority of the women were diagnosed after the age of 60, when most cases of non-Hodgkin lymphoma typically occur. None of the subtypes of non-Hodgkin lymphoma in the women were the same as those diagnosed in the children and teenagers reported by the requestor.

Medical record review

Medical records were reviewed for all of the children and teenagers who were reported by the requestor to have been diagnosed with lymphoma. Records were also reviewed for the females and males in the Town of Newport who were diagnosed with non-Hodgkin lymphoma.

- For the children and teenagers, very little information was available on their medical histories. None of them appeared to have a weakened immune system, or infections that have been linked with lymphoma. Some of the children were reported to have a family history of lymphoma. None of the records mentioned how long any of the children had lived in the study area. All of the children, however, had been born in the general Herkimer/Oneida County area.
- For residents of the Town of Newport who were diagnosed with non-Hodgkin lymphoma, none of the records mentioned specifically whether any of them had any exposure to chemicals that have been possibly linked to the disease. A small number of the residents with non-Hodgkin lymphoma had occupations where exposures to these chemicals were possible. There was a small number of patients who had a medical condition that is a strong risk factor for non-

Hodgkin lymphoma. None of the records mentioned how long any of these residents had lived in the area.

Environmental review

- Public water supplies exist for the Villages of Middleville, Newport, and Poland. These are all tested routinely in accordance with federal and state requirements. In addition, the West Canada Valley School campus uses an on-site well, which is also subject to regulatory testing. Routine and supplemental testing over many years has never shown any of these water supplies to have unusual levels of any chemical contaminants.
- The Rose Valley Landfill is an inactive landfill located on Rose Valley Road in the Town of Russia, just over the border with the Town of Newport. Shallow groundwater at the site has been contaminated by volatile organic compounds (VOCs). Sampling of over 20 private wells near the landfill showed that only a single well, the well serving the landfill office, had been impacted by this contamination. Exposure to the contamination has been eliminated by the drilling of a new well into a deeper, uncontaminated water source.
- The Middleville Tannery Dumpsite, located in a remote wooded area on a seasonal road in the Town of Norway, was used to dispose of wastes from the Middleville Tannery and the Village of Middleville until the 1960s. Leather hides and tannery wastes have been found on the property. A small cabin for seasonal use was built there in 2008. The groundwater at the property is contaminated, but there is no evidence that contamination extends beyond the property. Recent testing has confirmed that soil in a few small areas of the property is contaminated with metals, including arsenic, lead, mercury and chromium. There is no evidence to suggest that contaminants in soil are moving off the property.
- The Newport Antenna Measurement Facility, operated by the Air Force Research Laboratory, is a set of outdoor test ranges located on Irish Hill and Tanner Hill in the Town of Newport. The facility is used to measure patterns of radiofrequency electromagnetic radiation associated with aircraft antennas. A survey conducted by the Air Force and reviewed by NYSDOH staff showed that the power emitted by Facility antennas was well below FCC standards for the general population, and much less than the power typically emitted by radio and television broadcast antennas.

DISCUSSION

Cancer in children is much less common than in adults, and childhood cancers account for less than 1% of all cancers diagnosed. Lymphoma is one of the most frequently diagnosed cancers in children, and the most common cancer in teenagers 15-19 years. Other frequently diagnosed childhood cancers include leukemia and brain and central nervous system tumors.

Lymphomas develop in the lymphatic system, a part of the body's immune system. Lymphomas are often divided into two groups: Hodgkin lymphoma and the non-Hodgkin lymphomas. These are distinguished by the way the cancer cells look under the microscope.

- Although lymphomas are one of the most frequently diagnosed cancers in children, most cases of non-Hodgkin lymphoma occur in people age 60 years and older. Men are more likely than women to be diagnosed with this disease. Other risk factors include having a weakened immune system (e.g. organ transplant recipients, people with HIV or congenital immune deficiency syndromes), certain chemical exposures (e.g. pesticides, some VOCs), autoimmune diseases (e.g. rheumatoid arthritis, lupus), certain infections (e.g. Epstein-Barr virus [the infection that causes mononucleosis], hepatitis C virus), and a family history of the disease.

- Hodgkin lymphoma occurs more often in men than in women and is most often seen in people 15 to 40 years of age and in those 55 years of age and older. Other risk factors include certain infections (HIV, mononucleosis), a family history of the disease, and higher socioeconomic status.
- Neither Hodgkin lymphoma nor non-Hodgkin lymphoma has been associated with exposure to any of the metals found at the Middleville Tannery Dump Site or to radiofrequency electromagnetic radiation in humans.

For any substance to have an effect on human health, people have to come into contact with it. This is known as exposure. People may be exposed to a chemical substance by breathing it in, consuming it in food or water, or getting it on their skin.

- People could have been exposed to contaminants from the Rose Valley Landfill if they drank water from the well serving the landfill office before the contamination was discovered. People could have been exposed and could still be exposed to contaminants from the Middleville Tannery Dumpsite if they come into contact with waste on the property. It is not known whether any of the people with cancer came into contact with any contaminants associated with the landfill or tannery sites.
- There is no evidence of exposure to unusual levels of chemical contaminants in any of the public water supplies in the area, or in the West Canada Valley School water supply. Measurements indicate that operations at the Newport Antenna Measurement Facility produce only very low levels of radiofrequency electromagnetic radiation in the surrounding community, well within FCC standards and far below those produced by television and radio transmitters.

CONCLUSIONS

This study was conducted due to the finding that an unusual number of children and teenagers in the West Canada Valley School District and neighboring areas had been diagnosed with lymphoma in the three-year time period 2011-2013. The study found that in the ten years prior to the first lymphoma diagnosis, the number of children in the study area who had been diagnosed with any type of cancer or all types of cancer combined was similar to the number expected. In the years 2011-2013, the number of children diagnosed with cancers other than lymphomas was not unusual. More recently, preliminary data indicate that there were no other cases of lymphoma and no cases of other childhood cancers diagnosed in the study area. The children and teenagers confirmed to have lymphoma thus do not appear to be part of a larger pattern of childhood cancers. Medical records suggest that a family history of lymphoma may have contributed to some of the childhood lymphoma diagnoses.

This study also found an excess number of cases of non-Hodgkin lymphoma in females. This excess was confined to females living in the Town of Newport. It is possible that individual characteristics may have played a role in a small number of the diagnoses.

The potential for exposure to contaminants associated with the Rose Valley Landfill or the Middleville Tannery Dumpsite appears to be quite limited, and it is not known whether any of the people with cancer actually came into contact with these contaminants. There is no evidence of unusual exposures associated with public drinking water supplies in the area or the Newport Antenna Measurement Facility. The information does not suggest any single cause that might account for all of the lymphoma diagnoses. Although the diagnoses may be related to factors it has not been possible to identify, it is also possible that the elevated number occurred by chance.

For more information on this investigation or on cancer in general, please contact Ms. Aura Weinstein, Director, Cancer Surveillance Program, New York State Department of Health, at (518) 473-7817.

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WEST CANADA VALLEY SCHOOL DISTRICT
HERKIMER COUNTY, NEW YORK, 2001-2012**

Background

In August 2013, a resident of Newport, Herkimer County, New York, first contacted the New York State Department of Health (NYSDOH) with reports of what the resident believed to be an unusual number of children and teenagers in the Town of Newport and the nearby Village of Norway who had recently been diagnosed with lymphoma. The reported cases included anaplastic large-cell lymphoma (ALCL) and another type of non-Hodgkin lymphoma, diagnosed within the past three years. The resident also expressed concerns about a landfill in the area (Middleville Tannery), and an Air Force research installation. In later conversations, concerns were raised about an inactive hazardous waste site on Rose Valley Road, and conditions at the West Canada Valley schools, which share a campus in the Town of Newport. An initial review by NYSDOH confirmed an unusual number of people under the age of 20 who had been diagnosed since 2011 with some type of lymphoma, including ALCL and Hodgkin lymphoma (also called Hodgkin's disease). (The exact number of people confirmed is not provided to protect patient confidentiality.) All of the children and teenagers lived within or near the West Canada Valley school district. Findings of the initial review were provided to the resident, and in October 2013 the resident requested an investigation.

The resident's request was then evaluated to determine whether further investigation was warranted. The evaluation concentrated on what was known about potential environmental exposures in the area, including the type, level, and duration of any exposures and the size of the population exposed, and whether there was an unusual pattern in cancer diagnoses. In the environmental evaluation, available information about the Rose Valley Landfill, the Middleville Tannery Dump site, and public water supplies in the area, including the water supply at the West Canada Valley schools, was reviewed. At that time, the review did not identify the potential for any unusual exposures to environmental contaminants from these sources. It also did not identify any other inactive hazardous waste sites in the area or facilities with the potential to release hazardous substances into the environment and result in unusual exposures. In the cancer evaluation, the findings of the initial confirmation of reported childhood cancers and the findings of previous studies of childhood cancer in the West Canada Valley school district area were reviewed. An unusual pattern of childhood lymphomas in the West Canada Valley school district and neighboring areas was confirmed. Based on the findings of the cancer evaluation, it was decided that further investigation of childhood cancers and further evaluation of potential environmental exposures were indicated.

Findings of the evaluation were provided to the requestor in August 2014. Due to the interest that had arisen in the community, a public meeting was held in October 2014 to discuss the work that had been completed so far and plans for further investigation. At that meeting, attendees shared concerns they had about health and environmental issues in the community. A second meeting with a small group of interested community members was then held in November 2014 to obtain input on specific aspects of the design of the study that was to be conducted. These included the ages of the people and types of cancer to be included, and the time period and geographic areas to be studied. At this meeting, community members also expressed concerns over birth defects in the area, and it was agreed to conduct a study of birth defects. NYSDOH later became aware of continuing concerns over potential health effects of electromagnetic radiation generated by the Air Force Research Laboratory's Newport Antenna Measurement Facility, and it was decided to include that site as well in the environmental review.

This report describes the methods and findings of the cancer investigation that was conducted according to the plan developed with input from community members. The investigation contains three parts: 1) a search of the New York State Cancer Registry to determine whether the initial finding was part of a larger pattern; 2) a review of medical records of children and teenagers with lymphoma to look for any common exposures or risk factors; and 3) an environmental review. The investigation of birth defects will be presented in a separate report once it is complete.

Search for other unusual cancer patterns

Methods The search for other unusual cancer patterns in the study area focused on 1) all childhood cancers, and 2) lymphoma and leukemia diagnosed at any age. In order to determine whether there were any unusual cancer patterns, the number of cancer cases actually diagnosed among each of the two groups was compared with the number of cases of cancer one would expect to find, if cancer rates in the study area were the same as in similar areas of the state.

Study Area and Time Period The children and teenagers that the requestor reported lived within or near the West Canada Valley school district, therefore, the study area selected approximates the West Canada Valley School District. It consists of year 2010 Census Tracts 114.00 (block groups 1, 2, 3, 4, and 5); 113.01 (block group 1); and 113.02 (block groups 1 and 3), all located in ZIP Codes 13416, 13431, 13406, 13324 (part), 13502 (part), 13340 (part), 13350 (part), 13365 (part), Herkimer County (see attached map). Cases of childhood cancer were examined for the ten years prior to the first reported diagnosis, and for the time period when the reported diagnoses occurred. At the time this investigation began in December 2014, cancer incidence data were official through 2011, meaning that cancer reports for this year and previous years were essentially complete and the data had passed all quality assurance checks. Cancer

incidence data have since become official through 2012. Therefore the time period for the investigation of lymphoma and leukemia in all residents was selected as 2001 through 2012. The time periods for the investigation of childhood cancer incidence were selected as 2001-2010, the 10 years prior to the children and teenagers reported by the requestor, and 2011-2013, the three years during which the reported lymphomas occurred.

Identification of Observed Incident Cancers In order to proceed with the investigation, it was necessary to identify 1) all cases of cancer diagnosed in children in the study area during the time period of the study, and 2) all cases of lymphoma and leukemia diagnosed in people of any age in the study area during the time period of the study. The source for these data was the New York State Cancer Registry. The Cancer Registry contains information on all cases of cancer diagnosed or treated in New York State, as mandated by law. Reporting sources, including hospitals, laboratories and physicians, have up to six months to report cases under their care to the Cancer Registry. Most cases of cancer in children, however, are now reported within three months of their diagnosis.

One person can be hospitalized many times, at different hospitals, over a period of years for the same cancer. Each separate hospital admission is reportable to the Cancer Registry. As multiple reports on the same cancer are received, they are combined with existing information to continuously update Cancer Registry files to reflect the fullest and most accurate information available. Information on the individuals in the study area who were diagnosed with cancer during the time period of the study has been updated through May 2015. Information on children in the study area who had been diagnosed with cancer after 2013 was again updated in September 2016.

Variation in cancer incidence among different geographic areas reflects not only true differences in cancer incidence, but also differences in how cancer is diagnosed, treated, and recorded in different areas of the state. The completeness and accuracy of the Cancer Registry depend upon reporting from hospitals, laboratories, managed care organizations and other sources. The Cancer Registry has been certified as more than 95 percent complete by the North American Association of Central Cancer Registries. In addition, the Cancer Registry has received gold certification from the Association since 2000 (data year 1996), the highest certification given to central cancer registries (1).

To identify all cancers diagnosed among children in the study area, as well as cases of lymphoma and leukemia that were diagnosed among all residents, Cancer Registry data were obtained for year 2010 census tracts 114.00 (block groups 1, 2, 3, 4, and 5), 113.01 (block group 1), and 113.02 (block groups 1 and 3), all in Herkimer County. Records were searched for people who lived in these census block groups of their respective census tracts at the time of their cancer

diagnosis. Cancer in the study area was also examined by town for each town in the study area, including the Towns of Norway, Fairfield, and Newport, and parts of Schuyler and Herkimer combined (see attached map). These cases were then grouped by age, sex and type of cancer and are referred to as "observed" cases.

Calculation of Expected Incident Cancers To determine whether the number of observed cases of cancer was unusual, it was necessary to calculate the number of cases of cancer that would be expected in the study area. This calculation takes into account the population size and the age and sex distribution of the study area. The number of cancers that would be expected in the study area was calculated by applying cancer incidence rates by age and sex for a reference area to the estimated population of the study area by age and sex. The reference area selected for this investigation was New York State, exclusive of New York City. The population for the study area was estimated using data from the United States Census for 2000 and 2010.

Types of Cancer (Anatomic Sites) Studied Twelve groups of cancers were examined among all children residing in the study area who were 19 years old or younger at the time of their diagnosis. Cancer groups were based on the International Classification of Childhood Cancer (ICCC), which is based on tumor cell type rather than location in the body. Groups of cancers examined include leukemias, lymphomas, brain and central nervous system tumors, neuroblastomas and other sympathetic nervous system tumors, retinoblastoma, kidney tumors including Wilms tumor, liver tumors, malignant bone tumors, soft-tissue sarcomas, gonadal and germ-cell tumors, carcinomas including malignant melanoma of the skin and thyroid cancers, and all other malignant tumors. Two types of cancers, lymphomas and leukemias, were examined among all residents of the study area who were of any age at the time of their diagnosis.

Statistical Testing The probability that chance alone could explain an increase or decrease in the observed number of cancer cases compared to the expected number was evaluated based on the Poisson distribution (2). (In statistics, the Poisson distribution describes a process where a rare event occurs in a large population.) If the probability of observing an excess or deficit was 0.025 or less for any cancer site, the result was considered to be statistically significant. Non-significant excesses or deficits were considered to represent random variations in observed patterns of disease.

Results - Childhood Cancers Between 2001 and 2010, fewer than six childhood cancers were observed in the study area. (To protect patient confidentiality, the specific number of observed cases has not been indicated.) A total of four cancers was expected. The difference between the observed and the expected numbers of cases was not statistically significant. There were no cases of lymphoma diagnosed in children and teenagers in the study area during these years. There were only a few cases of other common childhood cancers, including leukemia, and brain

and central nervous system tumors. There were no statistically significant excesses or deficits in any of the 12 groups of cancers examined.

Between 2011 and 2013, fewer than six childhood cancers were observed in the study area, with a total of about one cancer expected. The difference between observed and expected numbers of cases was statistically significant. There were two types of cancer observed – lymphoma and leukemia. There was a statistically significant excess in the number of lymphomas diagnosed in the study area. This was due to the children and teenagers that were reported by the requestor. No other lymphomas were diagnosed in the study area during this time. There were no statistically significant excesses or deficits in any of the other groups of cancers.

Cases of childhood cancer were also examined for both time periods combined, 2001-2013. During this time period, a total of nine cancers was observed in the study area. A total of five childhood cancers was expected, a difference that is not statistically significant. The three types of cancer observed, lymphoma, leukemia, and brain and central nervous system, are the most common cancers diagnosed in children nationwide. There was a statistically significant excess in the number of lymphomas diagnosed in the study area. This was accounted for by the statistically significant excess during the time period 2011-2013. No other statistically significant differences in any of the other groups of cancers were found.

Childhood cancer was also examined by town for each town in the study area. The numbers of childhood cancers observed in each town were small (each town had fewer than six total observed cases for the entire time period 2001-2013). The children who were diagnosed with lymphoma lived in towns throughout the study area.

Cancer Registry data were reviewed in September 2016 to identify any additional children in the study area who had been diagnosed with cancer since 2013. No additional cases of childhood lymphoma or any other type of cancer were identified.

Results – Lymphoma and Leukemia (all ages) A total of 51 cases of lymphoma and leukemia were identified among all males and females residing in the study area between 2001 and 2012 (see attached table). In comparison, 43 cases of lymphoma and leukemia were expected. The difference between the observed and expected numbers of cancers was not statistically significant. When males and females were looked at separately, 27 cases of lymphoma and leukemia were observed in males, compared with 25 cases expected. Among females, 24 cases of lymphoma and leukemia were observed and 19 cases were expected. Neither of these differences was statistically significant.

The numbers of cases of Hodgkin lymphoma, non-Hodgkin lymphoma, and leukemia were then examined separately for males and females. (Numbers of cases of Hodgkin and non-Hodgkin lymphoma and among males and females are combined in the table to protect patient confidentiality.) Among males, none of the individual cancer sites showed a statistically significant difference from expected. A statistically significant excess was observed in the number of females diagnosed with non-Hodgkin lymphoma (19 observed, 10.5 expected). The number of males diagnosed with non-Hodgkin lymphoma was close to the number expected. There were no statistically significant differences in the numbers of cases of Hodgkin lymphoma or leukemia among females.

Cases of lymphoma and leukemia were also examined by town for each town in the study area. Numbers of cases of lymphoma and leukemia combined were small (less than six) in males and/or females in most of the individual towns. Among males, there were no statistically significant differences in the numbers of cancers observed for any of the three cancer sites examined individually, or for all three combined, by town. Among females there was a statistically significant excess in the total number of these cancers in the Town of Newport. When the three cancer sites were examined separately, there was a statistically significant excess in the number of cases of non-Hodgkin lymphoma among females in the Town of Newport (8 observed, 3 expected). The number of males diagnosed with non-Hodgkin lymphoma in the Town of Newport was not statistically significant (fewer than 6 observed, 4 expected).

Characteristics of the females diagnosed with non-Hodgkin lymphoma in the Town of Newport were examined more closely. The age at diagnosis of these eight women ranged from the late 20s to the 80s, with most of them being over the age of 60, when most cases of non-Hodgkin lymphoma typically occur. There were four different types of non-Hodgkin lymphoma observed, none of which is rare. The types of non-Hodgkin lymphoma did not include ALCL. Over the years of the study, 2001 to 2012, there were no more than two cases diagnosed in any one year, and cases were fairly spread out over the time period of the study.

The street address at the time of diagnosis for each of these females was plotted on a map of the study area. Most of the addresses were located in or around the Village of Newport, a more populated part of the Town of Newport.

Medical Records Review

Methods To further confirm the diagnoses and to gain some additional information about each diagnosis, medical records were obtained from hospitals and physicians' offices and then reviewed for all of the children in the study area who were reported by the requestor to have been

diagnosed with lymphoma. Copies of birth certificates for the children were also obtained from NYSDOH Vital Records and reviewed. Medical records were also reviewed for people who were diagnosed with non-Hodgkin lymphoma while residing in the Town of Newport. Information sought from the records included a record of a weakened immune system (e.g. organ transplant recipients, infection with HIV, congenital immune deficiency syndromes), exposure to chemicals such as benzene or certain herbicides and insecticides, autoimmune diseases (e.g. rheumatoid arthritis, systemic lupus erythematosus), certain infections (e.g. Epstein-Barr virus [EBV], helicobacter pylori, hepatitis C virus), a family history of lymphoma, and for children, having a mother who was older at the time of their delivery. These are all risk factors that may increase one's chance of being diagnosed with lymphoma.

Findings *Lymphoma in children* Very little information was available regarding the children's medical histories. None of them appeared to have a weakened immune system, EBV or HIV infection. Birth certificates showed that the age of the mother at delivery was not unusual for any of the cases. Some of the children were reported to have a family history of lymphoma, including some relatives with the same type of lymphoma (Hodgkin or non-Hodgkin) as the child. The medical records did not mention how long any of the children had lived in the area. However, the birth certificates verified that they were all born in the general Herkimer and Oneida County area.

Findings *Non-Hodgkin lymphoma in the Town of Newport* None of the medical records reviewed mentioned specifically whether any of the women or men in the town of Newport who had been diagnosed with non-Hodgkin lymphoma had any exposure to chemicals such as benzene or certain herbicides and insecticides. An occupation or place of employment was listed for most people; a small number of the occupations listed, in general, have possible exposure to chemicals. It was not possible to determine what some of the other individuals specifically did for employment, therefore it is difficult to determine what, if anything, they could have been exposed to or for how long. There was a small number of people who did have a medical condition that is a strong individual risk factor for non-Hodgkin lymphoma. The medical records did not mention for any of the people how long they had lived in the area. Some of the people had a family history that included a variety of cancers (e.g. breast, prostate, lung, colon, and leukemia). Some of the people had a previous cancer (e.g. prostate, cervical, and breast). Given what was found in the medical records, individual characteristics may have played a role in a small number of the diagnoses.

Environmental Review

Public water supplies Public water supplies exist for the Villages of Middleville, Newport, and Poland. The Middleville public water system serves the Village of Middleville and gets its water from wells. The Newport public water system serves the Village of Newport and gets its water from a set of springs. The springs have been determined to be under the influence of surface water, and in 2015 the village water treatment plant was upgraded to ensure that water users are not affected by harmful bacteria or parasites that may have come from surface water. The Poland public water supply serves the Village of Poland, part of which extends into the Town of Newport, and gets its water from wells. In addition, the West Canada Valley School campus utilizes an on-site well, which is also subject to regulatory testing.

The regulated public water supplies in the study area have been sampled over many years. Each water supply demonstrated substantial compliance with NYSDOH Public Drinking Water Supply Standards (Part 5-1). Occasional bacteriological quality issues were rectified by developing a new source (Middleville) or by system disinfection. Due to the detection of coliform bacteria in the West Canada Valley Schools' water supply, a permanent water treatment system was installed. Expected water disinfection by-products have been detected in the schools' water supply as well as the supplies of the three villages. No exceedances of New York State Public Drinking Water Supply Standards (Part 5-1) or unusual chemical contamination were reported. Due to the small populations served by the different water supplies, none were sampled as part of the third Unregulated Contaminants Monitoring Rule.

Private wells In addition to the extensive sampling conducted in conjunction with the investigation of the Rose Valley Landfill (see below), NYSDOH's Herkimer District office staff sampled two private residences in the Town of Newport. The homes were sampled in response to citizen requests received at the conclusion of the October 2014 public meeting. Results of the sampling did not detect contaminants and the water supplies met the New York State drinking water standards for the tests performed. Even though the public drinking water standards do not govern private water supplies, they are used as guidance values for private water supplies. The standards are designed to protect against possible adverse health effects from long-term exposures to chemical contaminants. No actions were necessary to address exposures.

Rose Valley Landfill The Rose Valley Landfill is an inactive landfill located on Rose Valley Road in the Town of Russia, just over the border with the Town of Newport. The landfill was active between 1963 and 1985, and served as the municipal landfill for the Villages of Poland and Cold Brook. Sampling of the landfill conducted by the NYSDOH has shown that the landfill contains contaminants typical of municipal and industrial waste.

Various activities were conducted to characterize the nature and extent of contamination associated with this site. As part of the New York State Department of Environmental Conservation's (NYSDEC) remedial investigation process, groundwater containing volatile organic compounds (VOCs) was identified in shallow groundwater on-site. Beginning in the early 1980's and occurring periodically over many years, NYSDOH staff collected water samples from over 20 private water supplies near the landfill; many of the homes located closest to the landfill were sampled several times. The sampling showed that a single well had been impacted by the contamination. That well served the trailer that was previously used as the landfill's office. A water treatment system was eventually installed and ongoing periodic water sampling was provided at this location to ensure the treatment system was eliminating the potential exposures. As part of the final remedy for the site, a new well for the residence was drilled into the deeper, uncontaminated aquifer. Sample results from the new well confirm that exposure to the contaminated groundwater at this single residence has been eliminated.

Contaminated soil was also identified at the Rose Valley Landfill. It was consolidated with other refuse and placed in an on-site landfill. The on-site landfill was capped and fenced. A monitoring program was included as part of the final remedy.

The full results of the NYSDEC's remedial investigation are contained in documents available to the public at the document repository located at the Poland Public Library.

Middleville Tannery Dumpsite The Middleville Tannery Dumpsite, located in a remote wooded area on a seasonal road in the town of Norway, is a former waste disposal site that has been inactive since the 1960s. The property was used to dispose of wastes from the Middleville Tannery and the Village of Middleville. Chromium-containing wastes have been found on the property. A small cabin for seasonal use was built there in 2008.

The property has been the subject of extensive testing carried out by NYSDOH and NYSDEC. Past efforts have demonstrated the presence of leather hides and tannery waste. This would allow people on the property, including the residents, their guests, and trespassers, to come into contact with contaminants. There was no evidence of contamination off site.

Testing has shown the presence of contaminated groundwater on the Tannery Dumpsite. There is no evidence that the contaminated groundwater is moving off the property. People would, however, come into contact with contaminated groundwater if the property owners drilled a private drinking water well.

In August 2014, surface and subsurface soil samples were collected at 17 locations on the property. It was found that the soil at some of the locations was contaminated with metals,

including arsenic, lead, mercury, and total chromium, at concentrations higher than residential soil cleanup objectives. There was still, however, no evidence that suggested that the soil contamination encountered on the property is migrating off the site. It is not expected that an individual would come into contact with the contaminated soil unless they were guests of the property owner or trespassing on the property.

Air Force Research Laboratory Newport Antenna Measurement Facility The Newport Antenna Measurement Facility, operated by the Air Force Research Laboratory in Rome, New York, is a set of outdoor test ranges used to measure patterns of electromagnetic radiation associated with aircraft antennas. The facility is configured into eight measurement ranges located on Irish Hill and Tanner Hill in the Town of Newport. Operations take place five days a week during normal business hours. Average power output from the transmitting antennas is 1W, at frequencies in the radio to microwave range (50 MHz to 60 GHz).

In May 2015, NYSDOH staff conducted a site visit to observe a health risk assessment performed by staff from the Air Force School of Aerospace Medicine's Occupational and Environmental Health Department. The assessment was intended to verify safe levels of exposure to electromagnetic radiation. As part of the assessment, levels were measured directly in front of two transmitting antennas on Tanner Hill. The measured power density from the two antennas corresponded to an average of 0.13 Watts (W) per square meter at 100 meters (about 100 yards). This is well below the FCC limits of 10 W per square meter for maximum permissible exposure for the general population. In comparison, at 800 meters (about a half mile), television broadcast antennas generate about nine times the power density produced by facility antennas, and radio broadcasting antennas about 1000 times. The assessment concluded that engineering and administrative controls were consistent with Air Force requirements and provided sufficient safety for personnel at or near the facility. The assessment also stated that any changes to the layout or procedures at the Newport facility would require a new survey. Based on observations at the site visit, NYSDOH staff did not see anything that would conflict with this conclusion.

Discussion

Findings This study found that the total number of cancers diagnosed among children residing in the study area in 2001-2010 was similar to the total number of cancers expected. In 2011-2013, the total number of cancers diagnosed was statistically significantly more than the total number of cancers expected. There were three types of cancers observed in both time periods - lymphoma, leukemia, and brain and central nervous system. These three types of cancers are the most frequently diagnosed cancers in children nationwide. When the 12 groups of childhood cancers were examined separately no statistically significant differences between observed and

expected numbers of cases were found in 2001-2010, however there was a statistically significant excess in the number of lymphomas diagnosed in 2011-2013.

When cases of childhood cancer were examined by town, there were no towns that had unusual numbers of total cancers. The children and teenagers diagnosed in 2011-2013 lived in towns throughout the study area. No additional cases of childhood cancer other than what was reported by the requestor were found in 2013 or later.

All of the children and teenagers who were reported by the requestor had been born in the general Herkimer and Oneida County area. A review of their medical histories found that some of the children had a family history of lymphoma. As noted below, a family history of lymphoma is an established risk factor for both Hodgkin lymphoma and the non-Hodgkin lymphomas. There was no mention of any of the other risk factors that were looked for. It is possible that the child's family history contributed to some of the cases of childhood lymphoma.

When cases of leukemias and lymphomas in people of all ages were examined, a statistically significant excess was found in the number of females diagnosed with non-Hodgkin lymphoma. This excess was accounted for by a statistically significant excess in the number of females diagnosed with non-Hodgkin lymphoma in the Town of Newport. The ages of these women ranged from the late 20s to the 80s, with most of them being over age 60, when most cases of non-Hodgkin lymphoma typically occur. There were four different types of non-Hodgkin lymphoma observed, none of which are rare, and none were the same type as those reported by the requestor. The cases were diagnosed over the entire time period of the study.

A review of these patients' medical histories found a small number who may have had occupational exposure to chemicals. There was also a small number of people who had a medical condition that is a strong individual risk factor for non-Hodgkin lymphoma. Given what was found in the medical records, individual characteristics may have played a role in a small number of the diagnoses of non-Hodgkin lymphoma in females in the Town of Newport.

Childhood cancers Childhood cancers are rare, making up less than 1 percent of all cancers. The types of cancers that occur in children differ greatly from those seen in adults. The most common childhood cancers include leukemia (specifically acute lymphocytic leukemia), brain and central nervous system, and lymphoma. Lymphoma is also the most common cancer diagnosed in teenagers 15-19 years. This includes both Hodgkin and non-Hodgkin lymphoma.

Lymphomas Lymphoma is the name for cancers that develop in the lymphatic system, a part of the body's immune system. The lymphatic system helps the body fight infection and diseases. It is made up of thin tubes, similar to blood vessels, that branch into tissue throughout the body.

These tubes carry a watery, colorless fluid, called lymph, which contains infection-fighting cells called lymphocytes. Along the network of tubes are small, oval-shaped organs called lymph nodes. Groups of lymph nodes are found in the armpits, neck, chest, abdomen and groin. Other parts of the lymphatic system are the thymus, spleen, tonsils and bone marrow. Lymphatic tissue is also found in the stomach, skin and intestines and other body parts.

Lymphomas are often divided in two groups: Hodgkin lymphoma and non-Hodgkin lymphoma. Hodgkin lymphoma is distinguished from non-Hodgkin lymphoma by the presence of the Reed-Steinberg cell. If the Reed-Sternberg cell is detected, the lymphoma is classified as Hodgkin. If it is not detected then the lymphoma is classified as non-Hodgkin.

There are many different types of non-Hodgkin and Hodgkin lymphoma, some of which are more common than others. The most common types of lymphoma in children are different from those in adults. ALCL, which was of concern to the requestor, is a type of large cell lymphoma and is more common in young people than in older adults. ALCL represents about 11 percent of childhood non-Hodgkin lymphomas. Non-Hodgkin lymphoma occurs more frequently in men than women. It also occurs more frequently in whites than in African-Americans. Although children can get non-Hodgkin lymphoma, it is most often seen in people age 60 years and older. Hodgkin lymphoma occurs slightly more often in males than in females. It can occur in both children and adults and is most common in early adulthood (ages 15 to 40 years) and in late adulthood (after age 55). It is rare before the age of five. Approximately 10-15 percent of cases are diagnosed in children and teens.

People with depressed immune systems, such as those who have had organ transplants and individuals with HIV/AIDS, have an increased risk of non-Hodgkin lymphoma. Research studies suggest that occupational exposure to herbicides, pesticides and certain other chemicals, including some VOCs such as perchloroethylene (PCE) and trichloroethylene (TCE), may be associated with the development of non-Hodgkin lymphoma. Having a family history of non-Hodgkin lymphoma is another risk factor. Risk factors associated with Hodgkin lymphoma include having had infectious mononucleosis, a family history of Hodgkin lymphoma and having a higher socioeconomic background (3, 4). Neither Hodgkin lymphoma nor non-Hodgkin lymphoma has been associated with exposure to any of the metals found at the Middleville Tannery Dump Site or to radiofrequency electromagnetic radiation in humans (5, 6).

Environmental Considerations For any substance to have an effect on human health, people have to come into contact with it. This is what is known as exposure. People may be exposed to a chemical substance by breathing it in (inhalation), consuming it in food or water (ingestion), or getting it on their skin (dermal exposure). Even with exposure, not all hazardous substances cause cancer. The risk of developing cancer upon exposure to a cancer-causing substance

depends on the amount of the substance people are exposed to, the length of time they are exposed to it, and how often they are exposed to it.

Electromagnetic radiation consists of photon particles traveling through space in a wave-like pattern at the speed of light. An electromagnetic wave has both electric and magnetic field components. Each photon carries a certain amount of energy, and the amount of energy determines the type of radiation. Waves in the radiofrequency range (about 0.1 MHz to 3 GHz) have photons with low energy, while gamma rays have the most energetic photons. At the high-energy end of the electromagnetic spectrum, radiation such as gamma rays and X-rays has enough energy to remove electrons from atoms. This type of radiation is called ionizing radiation and can cause health effects by breaking chemical bonds and damaging DNA. Lower-energy radiation, including radio waves and microwaves, does not have enough energy to remove electrons from atoms and is called nonionizing radiation. Nonionizing radiation may affect health by its thermal, or heating, effects. Standards have been established to protect people from the thermal effects of nonionizing radiation. The non-thermal effects of nonionizing radiation are still under investigation, and no standards have been established.

Environmental information was reviewed to assess the potential for exposure to known chemical contaminants and electromagnetic radiation. This information showed that people in the surrounding community had not been exposed to contaminants associated with the Rose Valley Landfill or the Middleville Tannery site. People could have been exposed to contaminants from the Rose Valley Landfill if they drank water from the well serving the landfill office before the water treatment system was installed. People could have been and could still be exposed to contaminants from the Middleville Tannery site if they came into contact with waste on the site, or if the current owners drill a well that reaches contaminated groundwater. No unusual chemical contamination has ever been found in any of the public water supplies in the area, however prior to the installation of the new Village of Newport water treatment system in 2015 there was a potential for exposure to disease-causing organisms. Measurements taken at the facility indicate that operations of the Newport Antenna Measurement Facility do not expose workers at the facility or people in the surrounding community to levels of radiofrequency electromagnetic radiation even approaching the standards set to protect against thermal effects. These levels are much lower than the levels produced by television or radio broadcasting antennas.

Study limitations In drawing conclusions from these data, several aspects of the methodology need to be addressed. First, since there were 30 individual tests of significance for the entire study area (3 among males, 3 among females, and 12 among children in two time periods), it was anticipated that one or two results might appear statistically significant due entirely to random fluctuations in the data. Thus the non-Hodgkin lymphoma finding in women could be due to chance.

The second aspect is the power of the statistical test, that is, the probability that a true departure from the expected number can be detected by significance testing. The power of a significance test varies with the number of expected cases. For example, using the statistical test described above, the probability of detecting a true doubling in cancer incidence over the expected value will be 80 percent or higher when the expected number is at least 12. For this investigation, the power of detecting a doubling, if one were present, was sufficient for total cancers in males and in females, and in one individual cancer site in males. Statistical power to detect a doubling was low for all of the other individual cancer sites in males and females, and for the total number of cancer cases in children as well as for all of the childhood cancer groups.

An additional limitation is that migration, that is, movement of people in or out of the study area, could not be taken into account. 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.

General cancer information Cancer, unfortunately, is a common disease. One of every two men and one of every three women will develop cancer during his/her lifetime (7). Cancer occurs at all ages, but most often in middle-aged and older people. The number of people diagnosed with cancer is increasing in most communities. Most of this is because more people are living to the older ages, where cancer is more common.

Different cancers have different causes, and there are many factors that affect a person's chance of getting different types of cancer. Personal habits and lifestyle may contribute to the development of cancer. Scientists have estimated that at least 30 percent of cancer deaths are due to tobacco (8), and between 25-30 percent of cancer deaths may be due to inadequate physical activity, obesity and an unhealthy diet (9). A family history of cancer can also affect someone's risk. Scientists agree that people can get cancer through repeated long-term contact with carcinogens. These include tobacco, sunlight, x-rays, and certain chemicals that may be found in the air, water, food, drugs, and workplace.

Most cancers develop slowly in people. In adults, they usually appear between five to 40 years after exposure to a carcinogen. For example, lung cancer may not occur until 30 years after a person starts smoking. This long latency period is one of the reasons it is difficult to determine what causes cancer in humans.

Interpretation

This study was requested due to concerns over the number of children and teenagers in the Town of Newport and the nearby Village of Norway who had recently been diagnosed with lymphoma. The study found no unusual numbers or types of childhood cancers in the study area in the ten years prior to the diagnosis of the children and teenagers reported by the requestor. There were no unusual numbers or types of childhood cancers in the study area in the time since the diagnosis of the children and teenagers reported by the requestor other than the lymphomas reported by the requestor. It therefore does not appear that the unusual number of lymphomas confirmed in children and teenagers during the years 2011-2013 is part of any larger pattern.

No common exposures or risk factors were identified for the children and teenagers with lymphoma, other than all of them having been born in the general area. It is possible that a family history of lymphoma contributed to the lymphoma diagnosis for some of the children.

The study found a statistically significant excess in the number of females diagnosed with non-Hodgkin lymphoma in the Town of Newport. Among these women, the characteristics of the cancers and the ages at which they were diagnosed were not unusual. Given what was found in the medical records, individual characteristics may have played a role in a small number of the diagnoses for these women.

It is important to realize that this study cannot prove cause and effect. For any substance to have an effect on human health, people have to come into contact with it. There was no evidence of unusual levels of chemical contamination in public drinking water, and potential exposures to radiofrequency electromagnetic radiation from the Newport Antenna Measurement Facility are well within allowable limits for the general public and much less than those associated with other sources. This type of study cannot determine whether any of the people with cancer came into contact with contaminants associated with the landfill or tannery sites. Also, most cancers, including lymphoma, have more than one possible cause, and in this study it was not possible to identify all other possible causes. Finally, it is never possible to completely rule out that the findings were due to chance.

Table Observed and Expected Numbers of Leukemia and Lymphoma Cases, Persons of All Ages, Newport Study Area, Herkimer County, 2001-2012 (2010) Census Tract 114.00 Block Groups 1, 2, 3, 4 and 5, Census Tract 113.01 Block Group 1, and Census Tract 113.02 Block Groups 1 and 3 New York State Exclusive of New York City Standard 2001-2012		
Site	Observed^a	Expected^b
Total	51	43
Lymphomas (includes Hodgkin lymphoma and non-Hodgkin lymphomas)	35 ^{1.}	26
Leukemia	16	17

^aData were obtained from the New York State Cancer Registry.

^bExpected values are based on 2001-2012 standard rates for New York State, exclusive of New York City, and population estimates from the 2000 and 2010 US Censuses.

Total Population over 12 years: 45,063 Males and 46,241 Females

^{1.} Statistically significant excess of non-Hodgkin lymphoma in females only (19 observed/10 expected)

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NEWPORT STUDY AREA HERKIMER COUNTY, NEW YORK

