Elmira High School Health Survey:

Summary and Evaluation

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Introduction

This report presents a summary and evaluation of information provided by participants in a voluntary health survey of current and former teachers and staff of Elmira High School, Chemung County. The survey was conducted in response to health concerns expressed by teachers and staff during 2017-2018. The report also includes historical background on the environmental investigations and remedial actions that began in the late 1990s as well as the methods and findings of multiple cancer investigations. The main body of the report describes the recently conducted health survey's methods and results.

Environmental Investigations and Remedial Actions

Elmira High School (formerly Southside High School) is on South Main Street in the City of Elmira and the Village of Southport, Chemung County. Prior to the school's construction in the late 1970s, the property was used by various industrial facilities dating back to the 1880s, including Remington Rand, which manufactured typewriter parts from 1936 until the facility closed in 1972. In 1995, fuel oil contamination was discovered east of the high school at Miller Pond. Investigations by the New York State Department of Environmental Conservation found that the petroleum contamination extended from underneath the high school toward Miller Pond. The contamination was shown to be at a depth of about 15 feet below the ground surface on the school property. New York State Department of Environmental Conservation began using a technique called bioremediation (oxygen injection wells) to address the fuel oil contamination.

In 1997, 2000, and 2009, New York State Department of Environmental Conservation and the New York State Department of Health conducted indoor air investigations at the school to evaluate whether the subsurface environmental contaminants were affecting indoor air quality due to soil vapor intrusion. Some compounds were identified in indoor air at concentrations slightly higher than typical background. However, the presence of these chemicals was not unusual and exposure at the reported levels was not expected to pose a health risk. Soil samples, outdoor air samples, and sub-slab air samples were collected and evaluated in 2000. The investigation showed that metals, PCBs, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) did not exceed public health screening values in surface soil. However, contaminant levels in subsurface soils were at levels that would be an exposure concern if people came into contact with subsurface soil. Sampling of sub-slab soil vapor beneath the school showed elevated levels of freon and chlorinated solvents. The indoor air results in 2000 did not show elevated levels of contaminants and were consistent with air quality in other schools. This finding confirmed that the building's pressure field was not actively pulling in contaminated air from beneath the building.

New York State Department of Health worked together with the federal Agency for Toxic Substances and Disease Registry on a report that summarized the agencies' evaluations of the public health implications of potential exposures to surface soil and indoor air and provided recommendations for additional actions. The findings were published in 2003 in a report called a Health Consultation. The agencies concluded that the top one foot of soil was generally topsoil and did not exceed public health comparison values. The Health Consultation recommended that a written soil management plan be developed and that the school district consider developing an indoor air action plan, including monitoring of air quality and building pressure.
https://www.atsdr.cdc.gov/HAC/pha/SouthsideHighSchool/Southside%20High%20School_HC_Sept%202003_508.pdf

New York State Department of Health and Agency for Toxic Substances and Disease Registry conducted additional reviews in 2010 and again concluded that breathing VOCs at the levels found in the indoor air at the school were not expected to harm people's health, and that indoor air testing did not show a problem with chemical contamination in the school's air. However, the agencies recommended that additional actions to be taken to ensure that adequate measures remain in place to address the potential for exposure at the school.
https://www.atsdr.cdc.gov/HAC/pha/SouthsideHighSchoolSoilVapor/SouthsideHighSchoolSoilVapor342010.pdf

https://www.atsdr.cdc.gov/HAC/pha/SouthsideHighSchoolEnvironmentalManagementPlan/SouthsideHighSchool342010.pdf

New York State Department of Health, New York State Department of Environmental Conservation, and the Unisys Corporation (the company responsible for the recent contamination) continue to work with the Elmira City School District to clean up the school property and prevent people from contacting contamination that exists in subsurface soils.

Recent actions have included the installation of sub-slab depressurization systems within the school, improving contaminant cover systems on the school property, and monitoring air quality. https://www.dec.ny.gov/chemical/102390.html

Previous Cancer Investigations

In 2000, parents and community members, including the Elmira School Board, expressed concerns about cancers occurring among Elmira High School students during the 1999-2000 school year. A series of investigations was conducted in response to these concerns, with three separate written reports released in September 2000, August 2001, and November 2003.

September 2000 Report

Case Confirmation: The first investigation evaluated cases of cancer diagnosed in the mid-1980s through 2000 among young people who had attended the school prior to their cancer diagnoses. These cases were reported to the New York State Department of Health's Cancer Surveillance Program by parents and community members. Ages of the people diagnosed with cancer ranged from mid-teens to mid-30s, with individuals diagnosed up to 15 years after they had left high school. The number of people diagnosed with cancer was less than the number of people expected to have been diagnosed with cancer during this timeframe. The types of cancer expected to occur most frequently in this relatively young age group were lymphomas, female breast cancer, and testicular cancer.

Geographic Study: The second investigation examined cancer incidence among children living in the geographic area served by the high school. Physicians, laboratories, and other health care providers are required to report all cases of cancer to the New York State Cancer Registry, so this evaluation would include people diagnosed with cancer while living in the area served by the school who may have been missed in the prior investigation, which relied on reports from the community. Cancers were evaluated for all children ages 0-19 and for the sub-group ages 15-19 between 1980 and 1998 who lived in ZIP Codes 14904, 14871 and 14894. No particular type of cancer among males or females showed a statistically significant difference between the observed and expected number of cases.

Cancer Incidence since 1997: Community members had expressed particular concern about the number of cases of cancer diagnosed among students attending the high school since 1997. To address this, information from the case confirmation and the geographic studies were combined for people ages 15-19 diagnosed with cancer from 1997 through the first half of 2000. The case confirmation information was used to identify the most recent cancer diagnoses that had not yet been reported to the Cancer Registry. The total number of children ages 15-19 living in the three ZIP Code area who were diagnosed with any type of cancer from 1997 through the first half of 2000 was less than six, but greater than the approximately one case expected. (To protect patient confidentiality, the exact number of individuals with cancer were not provided when these numbers were fewer than six). This elevation was not statistically

significant. Looking at specific types of cancer, the number of cases of testicular cancer was less than six, but statistically significantly greater than the number of cases expected.

The report pointed out, however, that there are a number of statistical issues that should be taken into account when interpreting the results of the study. First, the statistical tests do not take into account that the time period from 1997 on was considered separately due to reports of an unusual number of students with cancer in this time frame. This prior knowledge would have created a tendency toward finding a statistically significant difference in the short time frame. When the entire twenty-year period from the opening of the school was examined as a whole, the number of testicular cancer cases was not unusual.

Another consideration was that statistical significance is a tool for detecting unusual patterns of cases. It cannot tell us whether the cases truly have something in common or are linked to an environmental cause. Finally, even though the excess in the number of cases of testicular cancer was statistically significant, the finding was based on a small number of cases. This makes the findings somewhat uncertain, as adding or subtracting one case could dramatically affect the statistical significance of the findings. The report stated that, for all these reasons, the finding of statistical significance for testicular cancer should be interpreted with caution. https://apps.health.ny.gov/statistics/environmental/public_health_tracking/tracker/rest/getFilePDF/ca_southside_report.pdf

August 2001 Report

Testicular Cancer Medical Record Review: To follow up on the testicular cancer finding for the 3.5 year period, 1997 through the first half of 2000, this investigation examined medical records of the young men diagnosed with testicular cancer in that timeframe. This review looked for any individual risk factors or other factors the young men had in common that might have played a role in their diagnoses. A variety of factors including the mothers' reproductive history and course of pregnancy, and family and individual medical histories were reviewed. The report stated that none of the cases had any of the established risk factors for testicular cancer, such as an undescended testis or family history of testicular cancer. Some of the cases had indications of one or more conditions suspected of increasing risk for testicular cancer. For the most part, however, these were common conditions of pregnancy and childhood.

Testicular Cancer Among Men Ages 20-34: To follow up on the testicular cancer finding and supplement the first reports geographic study of children ages 0-19, this investigation evaluated the incidence of testicular cancer among young men in the next age group, ages 20-34. The same three ZIP Codes (14904, 14871, and 14893) were evaluated, and the timeframe analyzed was 1980-1998. This included the most recent year for which cancer reporting was considered complete for analysis within small geographic areas at the time work on the study was initiated. Testicular cancer incidence was evaluated for the full age range as well as for five-year age groups and for the entire timeframe as well as for five-year time periods. No

combination of age group and time period showed a statistically significant elevation of the number of testicular cancer cases observed compared to the number expected.
https://apps.health.ny.gov/statistics/environmental/public_health_tracking/tracker/rest/getFilePDF/ca_southside2_report.pdf

November 2003 Report

Alumni Survey: There was ongoing concern that the prior investigations had not included students who moved out of the study area and who may have developed cancer. In response, a survey of high school alumni was conducted to supplement the information available from the New York State Cancer Registry. The mailed survey was a joint effort with the New York State Department of Health and Elmira City School District. The survey asked about cancers diagnosed after beginning attending the high school, from 1980 to the first half of 2002. The numbers of cancers reported and confirmed were compared to the numbers expected and neither the total cancers, nor any individual cancer types were statistically significantly elevated. In this age group, lymphomas, female breast cancer, and testicular cancer would be the types expected to occur most frequently. The observed cases most frequently reported and confirmed in the study population were cancers of the cervix, lymphomas, and leukemias. Regarding testicular cancer, the total number of testicular cancers diagnosed among men of all ages or men in any other age group or time period was not statistically significantly greater than the number expected.
However, there was a statistically significant elevation of testicular cancer among men ages 15-19 diagnosed from 1995 through the first half of 2002.
https://apps.health.ny.gov/statistics/environmental/public_health_tracking/tracker/rest/getFilePDF/ca_southside3_report.pdf

Summary of Findings from Previous Cancer Investigations

A variety of methods were used to evaluate cancers occurring among students and young adults attending Southside High School or living in the area served by the school. The studies covered the timeframe 1980 through the beginning of 2002. With the exception of testicular cancer, none of the investigations showed any statistically significant elevations for any type of cancer. A statistically significant elevation of testicular cancer was observed when evaluating the 3.5 year timeframe 1997 through the first half of 2000 (September 2000 report above), and the 7.5 year timeframe 1995 through the first half of 2002 (November 2003 report above). Testicular cancer was not elevated for any other age group or in any other time period in any of the studies.

As pointed out in the prior cancer reports, and summarized previously, the finding of statistical significance for testicular cancer should be interpreted with caution due to study limitations.
https://apps.health.ny.gov/statistics/environmental/public_health_tracking/tracker/rest/getFilePDF/ca_southside_report.pdf

The cancers that occur most frequently among young people through age 19 in the general population, leukemias, brain and other nervous system cancers, and lymphomas, were not statistically elevated in any of the investigations. For young adults ages 20 to 34 in the general population, the most frequently occurring cancers are lymphomas, breast cancer in females, and testicular cancer in males. The statistically significant elevation of testicular cancer was observed among males ages 15 to 19, not in the young adult age range of 20 to 34, nor in any other age group.

Health Survey of Current and Former Teachers and Staff

Background

During 2017 and 2018, members of the school community and other stakeholders raised concerns about health outcomes among teachers and staff that could be related to contaminants present on the school grounds. As described above, environmental investigations that began in the 1990s and continued in 2000 and 2010 showed some volatile organic compounds in indoor air samples, but the presence of chemicals at the reported levels was not expected to increase risks for health effects. Similarly, surface soil sampling did not show levels of contaminants that exceeded public health screening levels. However, contaminant levels in subsurface soils were at levels that would be a concern if people came into contact with subsurface soil. As part of previous environmental investigations, New York State Department of Health had recommended actions be taken to ensure potential exposures were being adequately addressed. These additional actions, which have been taken, include the installation of sub-slab depressurization systems to reduce potential soil vapor intrusion into the school, improving the cover systems to reduce potential exposures to subsurface soil, and ongoing monitoring of air quality.

When determining the need and feasibility of a health outcome study in response to environmental concerns, New York State Department of Health first considers whether unusual environmental exposures have occurred, and if so, the timeframe and population that experienced the exposures. These factors allow for an exposed population to be defined so that it can be studied appropriately. As described above, environmental investigations that began in the late 1990s did not show that unusual exposures had occurred to teachers, staff, or students on the school property.

In addition, the studies of testicular cancer among students conducted previously showed an elevation in a relatively short-time frame only (1995 through the first half of 2002, which includes the originally investigated timeframe of 1997 through the first half of 2000) with multiple additional investigations showing no elevations for longer time periods, different age groups, or different types of cancer. (See prior section, “Prior Cancer Investigations”.) These considerations were discussed with current teachers, staff, and school administration, but the concerns about health problems that might be associated with the school remained. In response to these concerns New York State Department of Health began meeting with a small group of school representatives and a workgroup was formed to discuss next steps.

Survey Methods

The workgroup developed plans for conducting a health survey of current and former high school teachers and staff. Given the lack of specific exposure information for defining an exposed population, the survey would be a screening tool rather than a full health outcome study. It would provide information on the health problems that were the focus of concern among teachers and staff. Both current and former teachers and staff would be invited to fill out surveys to report their health concerns. New York State Department of Health would review the results and evaluate whether the types, numbers, or patterns of reported health problems appeared to be unusual. Unlike the prior cancer incidence studies that evaluated medically confirmed cancer diagnoses among a defined population for which census data could provide basic demographics, this screening survey project would rely on a more qualitative review of types, numbers, and patterns of health problems reported.

As stated above, the survey was offered on a voluntary basis to current and former teachers and staff. A school mailing list was used to invite 330 current and former staff and teachers via mail. A list of approximately 1,000 email addresses was also used to notify the larger community about the survey. Demographic data for this entire group was not readily available, so demographic details about the invited participants are not known. Additionally, the survey link was shared beyond the initially invited group, so it was not possible to know the size or demographics for the full population from which the survey participants were drawn. As a result, the expected numbers of various types of health outcomes among the population invited to participate in the survey could not be precisely estimated. New York State Department of Health was able, however, to use information on sex and age from participant questionnaires to broadly estimate a range of expected numbers for some types of health outcomes among the participants, including cancer and birth defects.

The survey workgroup and school administration played a key role in creating and distributing the health outcome survey. New York State Department of Health provided technical assistance, particularly with developing the survey wording and conducting it using the online Survey Monkey application. The Survey Monkey application had security features that protected confidential and individual health information during transmission and storage of responses. New York State Department of Health received the survey responses, organized the incoming information, and reviewed and evaluated the results. The workgroup reviewed preliminary results and provided input on information to be included in this report.

The survey was provided to 330 current and former Elmira High School staff and 1,000 people on the school's email list in November 2019. Information about the survey was also shared with the larger community via email, social media, and traditional media. Survey responses were received by New York State Department of Health via the Survey Monkey online application, by mail, email, and telephone through the end of December 2019.

Survey Results

As stated previously, the survey was designed as a screening tool to evaluate whether there were indications of unusual patterns of health conditions among the participants that warranted additional follow-up. The survey results for cancer, birth outcomes and other reported health problems were reviewed by New York State Department of Health early in 2020. Later in 2020 New York State Department of Health reported back to the Workgroup and broader community (during public availability events) that the health outcome results did not show any obviously unusual numbers or patterns. New York State Department of Health shared draft versions of a report summarizing the survey results with the workgroup in February and April 2020. The workgroup was interested in learning more details about the results, and an in-person meeting to accomplish this was held in July 2021, following the return of most New York State Department of Health staff from COVID-19 deployments.

At the July 2021 meeting, New York State Department of Health provided additional details about the survey results. At that meeting, the workgroup asked that New York State Department of Health provide more details on the expected numbers of health outcomes that were used to draw conclusions about the results. New York State Department of Health agreed to develop this additional information for inclusion in this report on the survey results.

In the following sections we provide information about the characteristics of the current and former teachers and staff who participated in the survey, and then summarize and evaluate the survey responses about cancer diagnoses, birth defects, and chronic health problems.

Survey Participant Demographic and Occupational Characteristics

Survey responses were received for 191 individuals, 169 via the online Survey Monkey application, and 22 via mail, email and telephone. Twenty responses were received from individuals who had been students at the high school but had not worked there. Those responses are not included in this summary. This brings the total number of individual surveys for evaluation to 171. Some completed surveys were from people who had been students and later became teachers or staff, and these are included. Information was received for five people who were deceased at the time of the survey, and these individuals are included in this evaluation. Each survey question was completely voluntary and 21 people chose to not provide their full names. There were 30 respondents who were missing age. The original survey did not ask for participant sex. New York State Department of Health staff filled in the likely sex where possible based on information provided by the respondent (name and/or diagnoses) after surveys were returned.

Table 1 shows the age and sex distribution for the survey respondents. As shown in the table, most of the participants were females. The participants' ages at the time of the survey ranged from 27 years to 86 years, with an overall average age of 57. Forty-three percent of the respondents were age 61 or older at the time of the survey in 2019. Birth years for the five deceased individuals for whom others reported health outcomes ranged from 1933 to 1959. Years at death ranged from 1987 to 2018, and ages at death ranged from 49 years to 70 years.

Table 1: Elmira High School Faculty and Staff Survey Participants: Age and Sex				
Age Group	**Number (%)**	**Females**	**Males**	**Sex not known**
25-30	6 (4%)	4	2	0
31-40	15 (10%)	11	2	2
41-50	25 (17%)	17	5	3
51-60	37 (25%)	25	9	3
61-70	41 (28%)	26	13	2
71-80	18 (12%)	10	7	1
81+	4 (3%)	0	4	0
Total for age reported	**146**	**93**	**42**	**11**
Age not reported	**20**	**7**	**3**	**10**
Total	**166**	**100**	**45**	**21**
Deceased	**5**	**2**	**2**	**1**
Overall Total	***171***	***102***	***47***	***22***
Source: Elmira School Survey				

Table 2 shows the distribution of the number of years individuals reported being employed at the school. Only three people did not provide this information. The table shows that about one half of participants (48%) worked at the school fewer than 10 years and 26% worked there for more than 20 years.

Table 2: Elmira High School Faculty and Staff Survey Participants: Employment Duration				
Duration in Years	**Number**	**Females**	**Males**	**Sex not reported**
Less than 5 years	42 (25%)	31	5	6
5-9	40 (23%)	22	15	3
10-14	27 (16%)	16	8	3
15-19	15 (9%)	12	3	0
20-24	22 (13%)	10	7	5
25-29	12 (7%)	3	5	4
30-34	5 (3%)	3	1	1
35-41	5 (3%)	2	3	0
Not reported	3(2%)	3	0	0
Total	*171*	*102*	*47*	*22*
Source: Elmira School Survey				

Table 3 shows that 73% of the participants were teachers, counselors or school health providers.

Table 3: Elmira High School Faculty and Staff Survey Participants: Occupational Groups						
Occupational Group	Number	Percent	Females	Males	Age range	Average Age
Instructional[a]	125	73%	77	32	28-82	52
Administration[b]	15	9%	8	3	44-86	65
Cafeteria	11	6%	9	1	37-79	59
Custodial	10	6%	1	7	44-68	61
Athletics only[c]	4	3%	1	3	27-68	52
Not provided	6	3%				

Notes:

a. Instructional includes teachers, counselors and school health staff.
b. Administration includes administrators and administrative support.
c. Athletics only: If someone reported working as a teacher and a coach, they were included in the Instructional category rather than here.

Source: Elmira School Survey

Reported Health Conditions

Seventy-one survey participants (41%) reported no health problems, and 100 (58%) reported health problems of various types. Of these 100, 31 reported being diagnosed with some type of cancer. A total of 79 people reported a non-cancer health problem. Of these 79, 34 people reported one health problem only, 23 reported two health problems, 15 reported three, and 7 people reported four or more health problems. Four females and one male reported having children with birth defects. Detailed evaluations are provided here for cancer, birth defects and other health conditions. To protect the confidentiality of some respondents who reported relatively rare health outcomes, we have limited the amount of information we provide about their answers. In particular, we limited information about health conditions reported by only one or two respondents. The health conditions discussed this report were self-reported by survey respondents, with record confirmations attempted by New York State Department of Health only for cancers and birth defects. The questionnaire did not provide restrictions on the types or timing of health conditions participants reported. Participants may have reported conditions that they did not think were associated with employment at the school.

Cancer Evaluation

New York State Department of Health sought to confirm the reported cancers and gather more details by matching the cancer diagnoses reported by survey participants to information in the New York State Cancer Registry (Registry) where possible. Providers are required by law to report cancers as explained on the Department of Health Website: Cancer Reporting (ny.gov). The Registry collects information on all cases of reportable cancers among New York State residents. At the time this investigation was underway, cancer data were considered official through 2019, meaning that cancer reports for this year and previous years were essentially

complete and data had passed all quality assurance checks. The Registry has been certified as more than 95% complete by the North American Association of Central Cancer Registries. In addition, the Registry has received gold certification from the Association since 2001, the highest certification given to central cancer registries https://www.naaccr.org/certified-registries/.

For survey respondents who reported tumors, information on full name, date of birth, age at diagnosis, cancer diagnosis, and date of diagnosis was used to search the Registry database for matching records. For records not initially found, matching criteria were relaxed to enable findings of likely matches, e.g., cases with marital name changes, ambiguous cancer information, and inexact diagnoses, or years of diagnosis. We attempted to find records for all persons who reported tumors except those with insufficient information for identification (i.e., respondents who didn't provide names). For all individuals who were found in the Registry, we attempted to confirm tumors by comparing type and year of diagnosis. For some survey responses either the individual was not found in the Registry or a specific tumor they reported was not found. In those cases, we searched for respondents' residential history using the commercial LexisNexis database to determine whether those individuals may have resided outside of New York State at the time of their diagnosis.

Thirty-one survey respondents reported being diagnosed with 39 tumors. Matching with the Registry, we found 18 individuals with a total of 21 tumors. Among the tumors reported by survey respondents but not found in the Registry were five reported by individuals who did not give full names and birth dates and two that were likely to have been diagnosed when the person lived in another state (i.e., out of state cases). Some cancers not confirmed were types not required to be reported to the Registry. Cancers not required to be reported include some specific types (e.g., squamous or basal skin cancers) and metastatic cancers (also known as a secondary malignant growth, or recurrent cancers) https://www.health.ny.gov/professionals/reportable_conditions/cancer/docs/nyscr_manual.pdf. Twenty-one primary invasive malignant tumors, referred to as confirmed cancers, among 18 individuals were used in statistical comparisons below.

These 21 confirmed cancers were diagnosed over a period of 33 years, from 1987 through 2019. The average age at diagnosis was 55 years. Some of the people with confirmed cancers began working at the school relatively recently, while others had worked there in the late 1970s when the school first opened. The total number of years people worked at the school ranged from two to 35, with an average of 14 years. While we had information about the number of years participants worked at the school, in most cases we did not have information about the specific years they worked at the school. For the seven people diagnosed with cancer for whom we had timeframes of employment, the year employment began ranged from the 1970s to the 2000s, with employment ending for some in the 1980s, 1990s, and 2000s while some were current employees.

The 18 people with confirmed cancer diagnoses represented the various occupational groups employed at the school. Teachers or other instructional staff made up 75% of the participants

with confirmed cancer diagnoses, very similar to the 73% of participants overall in this group (see Table 3). The next largest group of participants with confirmed cancer diagnoses worked in the cafeteria. Teachers' subject areas included the range of high school subjects, including English, Music, Art, Social Studies, and Physical Education, and there were no more than two participants with cancer diagnoses in any one subject area. A few teachers did not provide information about the subject they taught, but all provided some information about their classroom locations. Locations included both the 1st and 2nd floors.

Fourteen types of cancer are included in the total number of 21 confirmed cancers. There were no multiple reports of any rare type of cancer. The most frequently diagnosed cancers in the general adult population are lung, breast, colorectal and prostate. This pattern was reflected in the cancers reported by the participants and confirmed by the Registry.

As described previously in this report, the survey was offered on a voluntary basis, and eligibility was not confined to people who had received formal invitations. As a result, some people participated who were not among the 330 contacted by mail for the survey. It is not possible to precisely quantify the number of cancers expected among the people who chose to participate in the survey. Voluntary surveys are known to be affected by a tendency for people with health problems like cancer to be more likely to participate than people without health problems. Keeping this in mind, we estimated the number of cancer diagnoses that would be expected among the 171 survey participants. We also calculated an estimate of expected cases among the larger group of 330 people who were invited to participate by mail. This larger estimate is meant to demonstrate how the number would change depending on the total number of persons eligible to participate in the survey, which was not known.

The Surveillance, Epidemiology, and End Results Program (SEER) of the National Cancer Institute provides information on cancer statistics to support efforts to reduce the cancer burden among the U.S. population. The SEER*Explorer web application provides statistics on the cumulative lifetime risk of being diagnosed with cancer in an individual in the general population from birth to a series of ages. The expected numbers of cancer diagnoses for this Elmira survey evaluation were calculated using this widely-used tool (SEER, Risk of Being Diagnosed with Cancer, 2016-2018. https://seer.cancer.gov/statistics-network/explorer/). The tool uses cross-sectional counts of incident cases from the standard areas of the Surveillance, Epidemiology, and End Results (SEER) Program conducted by the National Cancer Institute, and mortality counts for the same areas from data collected by the National Center for Health Statistics, and uses them to calculate incidence and mortality rates using population estimates from census data for these areas. Statistical models are used to compute the probability of being diagnosed or dying of cancer from birth or conditional on a certain age (Fay, M.P., 2004). For this evaluation, that age was the participant's age in 2019, the year the surveys were completed. The SEER*Explorer application presents statistics calculated from data submitted by cancer registries covering 48 percent of the U.S. population.

SEER*Explorer cancer risk estimates were applied to the number of Elmira survey respondents in each age and sex category. Using this approach, we estimated the expected number of

cancer cases for the group of 171 participants who completed the survey and for the 330 people who were mailed invitations. Table 4 shows the two estimates for expected numbers of cancers for all types of cancers: 18.7 among the 171 participants and 36.2 among the survey mailing list. These estimates provide a range that offers perspective on the 22 cases confirmed among the participants.

Table 4 shows that the observed number of cancer cases is within the range of expected numbers. This total excludes cancers that were confirmed to be or were most likely, based on the information provided, non-primary invasive malignant tumors.

Table 4: Elmira High School Faculty and Staff – Expected and Confirmed Cancer Diagnoses among Survey Participants

	Expected Cancer Diagnoses among Survey Participants	Expected Cancer Diagnoses among Mailing List Invitees and Survey Participants	Confirmed Primary Invasive Malignant Tumors among Survey Participants
All types of cancer	18.7	36.2	21
Females	11.7	22.7	14
Males	7.0	13.5	7
Specific types:			
Breast	4.3	8.2	6

Cancer Evaluation Conclusion:

We estimated that the number of cancers expected to be reported by the Elmira School Survey respondents would be approximately 18 and among those invited by letter would be approximately 36. The expected number of cancers could possibly be higher since eligible individuals that did not receive a letter may have received a link to participate through social media, email or word of mouth. There were 21 confirmed cancer diagnoses among 18 survey respondents, and this total is within estimates of expected cancers for this survey.

The reason for considering how many eligible persons may have received notice of the survey is that people who have had cancer are more likely to participate in the survey than people who have not had a cancer diagnosis. Given this tendency, known as volunteer bias, a type of selection bias (Nathan 2005; Keiding 2016; Burke 2011), a large proportion of the actual number of cancers occurring among eligible individuals might have been reported in the survey. Information about the survey was mailed to 330 individuals, sent to 1,000 people via email, and additional people learned of the survey by word of mouth and media coverage. Because the number of teachers and staff is unknown to us, the number of eligible persons could be much larger than the 330 people invited by mail to participate. The people who provided information for deceased individuals reported cancer for all of them and no other health problems. This

suggests that a diagnosis of cancer motivated returning a health survey for a deceased individual. Similarly, we expect that a diagnosis of cancer motivated individuals to participate in the survey.

Survey response could also have been decreased due to individuals or their families not able to respond to the survey. Of particular concern are those eligible former staff who may have died after cancer diagnoses since a small number of missing responses could have a large impact on study conclusions. We would be unable to capture those diagnoses among the list of observed cancers.

The Centers for Disease Control and Prevention defines a cancer cluster as "a greater than expected number of the same or etiologically related cancer cases that occurs within a group of people in a geographic area over a defined period of time." (Foster 2022) This study looks at the possibility that this definition may have been met for current and former staff, the group of people, at the Elmira High School, the defined geography. The time period for this study includes the time from when the employees started working at Elmira High School to the end of 2019, the most recent official data when the study was underway. The available data in this evaluation do not suggest an overall greater than expected number of diagnosed cancer cases. In addition, the types of cancers diagnosed among survey respondents are consistent with the patterns seen in the general population.

Birth Defects Evaluation

Three female participants and one male participant reported six children with birth defects. New York State Department of Health sought to confirm the reported birth defect cases by matching to the New York State Birth Defects Registry. The New York State Birth Defects Registry contains case reports of children born or residing in New York State and diagnosed before the age of two with any major structural, functional, or biochemical abnormality determined genetically or induced during gestation and not due to birthing events. Hospitals and physicians throughout the state are required to report children with major birth defects who have been diagnosed before the age of two (Source: New York State Birth Defects Registry (https://www.health.ny.gov/diseases/birth_defects/) accessed 8/6/2024).

There is a wide range of type and severity of birth defects, and some minor conditions labeled as birth defects by health care providers are not mandated to be reported to the New York State Birth Defects Registry. Birth defects surveillance typically focuses on major structural anomalies which are defined as structural changes that have significant medical, social, or cosmetic consequences for the affected individual, and typically require medical intervention. Major structural anomalies account for most of the deaths, morbidity, and disability related to birth defects (CDC (Birth Defects | Birth Defects | CDC) accessed 8/6/2024).

The New York State Birth Defects Registry monitors trends and patterns of prevalence of major birth defects in New York State, making it possible to compare observed numbers to expected numbers of major birth defects for a geographic area or defined population group. While minor

birth defects are sometimes reported to the Registry, they are not consistently or comprehensively reported, so expected numbers for minor defects cannot be calculated.

The New York State Department of Health used demographic information provided by survey participants to match reported birth defect cases to Birth Defects Registry records. As described previously, the level of detail available for each participant varied, and respondents were not asked to provide identifying details about their children, limiting New York State Department of Health's ability to confirm all cases. As information was available, New York State Department of Health searched the Birth Defects Registry records based on maternal and/or paternal first name, last name, and date of birth. For select cases, staff also manually reviewed case reports among children born in Chemung County to attempt to identify additional matches.

Survey participants reported the following birth defects (in order to protect confidentiality, specific types of defects are not provided here):

- One female participant reported having a child with a type of minor defect that is not reportable to the Registry.
- Another female participant reported their child was born with a birth defect that was confirmed in the Registry. This particular birth defect can range from mild to severe and is detectable by external examination at birth.
- A third female participant reported a child with a birth defect that can range widely in severity and age at diagnosis; this defect was not able to be confirmed in the Registry. This type of defect may not be detected until after age 2, so it may not have been reported to the Registry.
- One female participant reported two infants born preterm (before 37 gestational weeks) with major birth defects. Neither of these cases could be confirmed in the Registry. Cases of the reported defect can be asymptomatic at birth. If these cases were diagnosed after age 2, they may not have been reported to the Registry.
- One male participant reported a child born with a major defect, but this defect was not able to be confirmed in the Registry. Father's information is not often included in birth defect records reported to the Registry, limiting our ability to match this case to Registry records.

The defects reported by participants covered a wide spectrum in terms of how frequently they tend to occur in the general population. The defect listed above that was not a reportable condition occurs relatively frequently, in about one of every seven boys. For the defects that are reportable to the Registry, the frequency in the general population varies from about one in 200 male births for one reported defect to about one in 3000 male and female births combined for the type of defect that occurs least frequently.

All of the parents who reported birth defects had worked at the school formerly, not currently at the time of the survey, and they had worked at the school for a range of years from one year

to 10 years total. Only one of the four had worked at the school for more than five years. Work locations varied, with each participant who reported a child with a birth defect having worked in a different building location and/or teaching a different subject. Work locations included the first and second floors, and one participant worked throughout the building.

In the U.S., 3% of live births (1 per 33) have a major structural or genetic birth defect (Data and Statistics on Birth Defects | Birth Defects | CDC) accessed 8/6/2024). The rate is similar in New York State and in Chemung County. For minor defects, which as described above are not mandated to be reported, there is much less certainty about prevalence. This evaluation aimed to compare the number of birth defects reported by survey participants to the expected number of birth defects among a group of similar size, age, and timespan, using the birth defect rates for the general population of Chemung County and New York State (excluding New York City).

The estimation of an expected number of birth defects uses the number of births that have occurred among the group being studied. The questionnaire did not collect information on the number of births among participants, so we used information from the survey on participants' age (date of birth and/or age at time of the survey) along with birth rates by age in Chemung County to estimate the number of births that would have occurred from the start of employment at the school to the time of the survey. Birth rates are generally calculated among females, but our survey included both female and male participants who reported birth defects. The age distribution of male participants was similar to that of females, so we used the expected number of birth defects calculated for females along with the number of female versus male participants to estimate the number of birth defects expected among male participants' children.

Because of uncertainty about participants' ages at the time employment at the school began, we used varied distributions for age when first employed at the school to create a range of expected number of births. The ages at which women started employment are important because birth rates for women vary greatly by age, with the highest rates for ages 20-30, then declining substantially. We estimated the number of infants expected to be born to teachers and staff from the time period of first employment at the school to the time of the survey, whether they were still employed at the school or not. We applied fertility rates (births per female population) for Chemung County for the year 2000 to five-year age ranges using varied estimates of the numbers of female teachers and staff in each age range.

We used a range of assumptions about what proportion of staff began employment before age 25, age 25-29, 30-34, 35+, to estimate numbers of staff and their cumulative years since first employed at the school in each of these age groups (fertility years). We applied the age-specific fertility years to age-specific fertility rates for Chemung County for the year 2000 to estimate the number of infants born to female survey participants. We used the year 2000 because it is about midway in the timeframe of employment for the participants.

For a relatively low-end estimate of infants born to female survey participants, we assumed 25% started employment at the school at age 23, 25% at age 25, 25% age 30, 25% age 35. For a higher-end number of infants born to staff and former staff we assumed 33% started employment at the school at age 23, 33% age 25, and 33% age 30. The range of births for these two estimates was from 88 to 100. There were about half as many men as women who participated in the survey, and their age distribution was similar to that of the women, so a rough estimate of the estimated number of births among male participants is 44 to 50.

We then used Chemung County birth defect rates to estimate that approximately two to three major birth defects would have been expected among the children of female survey participants. More specifically, the estimates of 88 to 100 births applied to Chemung County birth defect rates resulted in an estimated 1.95 to 2.21 expected birth defects. There were about half as many men as women who participated in the survey, and their age distribution was similar to that of the women, so a rough estimate of the number of major birth defects expected among children of male participants is one to two major birth defects.

Birth Defects Evaluation Conclusion: Of the six birth defects that were reported by survey participants, five are considered major birth defects that are reportable to the New York State Birth Defects Registry. Given our assumptions about the fertility rate and prevalence of birth defects among the survey population, we would expect three to five major birth defects in this population. The number of cases that we observed (five) is within this expected range.

The estimates for numbers of expected birth defects provided above are based on the number of participants (171) in the survey. However, 330 people were invited to participate and at least 1,000 additional people learned about the survey via email, from media coverage, and word of mouth. As a result, the birth defects reported could have been drawn from of a population of more than 1,300 people. As is the case for people who have been diagnosed with cancer, parents of children born with birth defects may have been more motivated than others to participate in the survey. If we consider this possibility, known as selection bias, the expected number of birth defects could potentially be double the numbers presented here. In other words, it is likely that the overall estimate of three to five expected birth defects is an underestimate.

There are many challenges inherent in an evaluation of birth defects reported in a screening survey. The wide range of types and severity of birth defects, the complex rules regarding what types are reportable and counted in statewide statistics, along with a relatively small number of survey participants and small number of birth defects reported, combine to limit interpretation of the birth defect findings. Based on our evaluation, however, the number and types of birth defects reported do not appear to be unusual and do not warrant additional follow-up.

Chronic Health Conditions Evaluation

Using the information reported by survey participants, and grouping health problems where appropriate, there were approximately 70 different types of health problems other than cancer and birth defects that were reported among 79 people. Only self-reported cancer and birth

defect cases were verified where possible by DOH for this report. Forty of these different types of health problems were reported only by one person; that is, there were no multiple reports for any of these 40 types of health problems; 15 of these different types of health problems were reported by two people only; six of these different types of health conditions were listed by three people; and nine types were reported by four or more people. Some participants provided relatively non-specific information, such as “respiratory” or “thyroid issue” while others provided more specific diagnosis information. Table 5 shows the fifteen types of health conditions reported by three or more participants. The health conditions in Table 5 are listed in rank order based on how many people reported the specific condition.

Table 5 includes the number of participants reporting each type of health condition and the age range of these participants at the time of the survey in 2019. Table 5 also includes information from available from New York State or national data on the occurrence of these outcomes in the general adult population. For purposes of making broad comparisons, the table shows the proportion of the survey respondents who reported the outcome (as a percentage) as well as a state or national rate (percentage) for the adult population. Because the Elmira survey used a brief questionnaire that did not gather full details about the reported health problems, it is important to keep in mind that these health condition percentages among study participants versus the general population are provided for perspective on the health condition reports, rather than as precise comparative data. For an outcome such as headache, for example, the survey did not ask about the timeframe or frequency of headaches, while the comparison rate is based on a survey that asked specifically about such these details.

Comparisons with state and national data do not suggest that any of the types of health problems reported by three or more people are elevated in the survey participant group. Only one type of health condition, rheumatoid arthritis, appears to occur among a higher percentage of the survey participants than among the general population, but given these relatively small numbers, this apparent difference does not signal a clear elevation of rheumatoid arthritis. The three cases of rheumatoid arthritis that were reported comprise 1.7 percent of the 171 survey participants. Estimates of rheumatoid arthritis prevalence among U.S. adults vary between 0.7 and 1.4 percent, slightly lower than the 1.7 percent reported among survey participants. The survey group is showing approximately one more case than would be expected.

Regarding the health conditions that are reported in much smaller percentages among the survey participants than among the general population, it is important to consider that many people who had these conditions may have chosen to not report them. The screening survey did not provide a checklist of health conditions, but rather asked people to list their health problems. It appears likely that participants chose to report health conditions that were more concerning to them, that they thought were more unusual or might be related to environmental contamination, and perhaps participants chose to not report other health conditions, such as osteoarthritis, diabetes, or hypertension.

Table 5: Elmira High School Faculty and Staff Survey Participants -- Reported Health Conditions and General Population Comparisons

Health Condition	Number of Survey Participants Reporting	Participant Age Range at date of Survey	Rate per 171 Survey participants (%)	State or National rate per Adult Population (%)	Notes for State or National Rate:
Allergies	12	39-72	7.0	31.8	U.S. adults
Asthma	10	37-69	5.8	14.7	New York State adults (18+) lifetime asthma
Hypertension	9	44-71	5.3	46.6	U.S. adults (20+)
Diabetes	7	57-71	4.1	9.5	U.S. adults
Thyroid (non-specific)	6	49-77	3.5	7.1	*U.S., age 12+
Osteoarthritis	5	44-85	2.9	21.4	U.S. adults, any type of arthritis
Hypothyroid	4	37-63	2.3	3.7	U.S., age 12+, clinical and subclinical
Infertility	4	39-53	2.3	19.4	US. females, 15-49
Headache	4	41-72	2.3	15.9	**U.S. adults
Sinus Problems	3	38-65	1.7	11.2	U.S. adults
Thyroid nodules	3	58-71	1.7	5.0	U.S. adults
Stroke	3	64-71	1.7	2.8	U.S. adults
Rheumatoid Arthritis	3	44-63	1.7	0.7 – 1.3	U.S. adults
Migraines	3	40-49	1.7	15.9	U.S. adults
Respiratory (non-specific)	3	67	1.7	NA	***

* Hyperthyroid and hypothyroid, clinical and subclinical combined.
** People were asked if they had a migraine or severe headache in the past 3 months.
*** We are not providing a comparison rate for non-specific respiratory symptoms, given the difficulty of knowing the types of respiratory conditions being reported by survey participants.

Source: Elmira School Survey for participant data. Sources and references for each state and national rate are provided in the report's reference section.

As stated above, there were many specific types of health problems reported by only one or two survey participants. We reviewed these conditions to see if there were any extremely rare conditions reported. Two survey respondents reported a very rare type of primary immune deficiency that involves low levels of protective antibodies and an increased risk of infections. The two respondents reporting this condition taught the same general subject, presumably in the same area of the school. Their duration of employment ranged from one year (plus four years as a student) to more than 25 years. From this, it appears their employment dates overlapped for one year. This condition is typically diagnosed after puberty, between ages 20

and 45. One participant was diagnosed at an age within this range and one was somewhat older at diagnosis.

This very rare condition reported by two survey participants tends to be diagnosed in response to recurrent nasal-sinus and lower respiratory system infections, lab tests showing unusually low immunoglobulin levels, and medical evaluations and tests that rule out a variety of other conditions. Research findings show this immune deficiency can be caused by a variety of different genetic abnormalities, but only a few of the abnormalities have been identified, and the cause of most cases is unknown. Current research suggests the condition is likely caused by multiple factors including genes and environmental factors that can affect inflammation and autoimmunity. The term environmental factors as used here means such things as medications and the microbial composition of the gut. The research literature does not point to any other specific types of environmental factors for this condition at this time. (Fischer, A. 2022. Primary Immune Deficiency Diseases. In Loscalzo, J., Fauci, A. S., Kasper, D. L., et al. (Eds.), Harrison's Principles of Internal Medicine. 21st Ed., Ch. 351.)

When evaluating a large number of types of health outcomes for a group of people including 171 participants and potentially representing a larger population, including the 330 people invited to participate, it is not surprising that some rare health conditions were reported. We take note that this rare condition was reported by two people, but the current research on this condition does not point us towards an explanation that might be associated with conditions at the school.

Additional review of the reported health outcomes was conducted by categorizing the types of health outcomes by body system (Loscalzo, J., Fauci, A.S., Kasper, D.L. et al., 2023). As described above, there were 40 types of health conditions reported by one person only and 15 types reported by two people only. Table 5 shows the types of health outcomes reported by three or more participants. Table 6 provides total numbers for categories of health problems grouped by body system for all the survey participants. The second column shows the total number of participants reporting any type of health condition within a body system category. The third column gives examples but does not list all the specific health conditions reported by participants. The fourth column includes the types of health conditions and totals reported by three or more people, as shown in Table 5.

Table 6: Elmira High School Faculty and Staff Survey Participants (N=171) --Numbers of Reported Health Conditions, Grouped by Body System, with Examples and Subgroups

Body System Category	Total	Reported Health Condition Examples*	Reported Health Condition Type and Totals from Table 5
Eyes, Ears, Nose, Throat, Skin	7	Hearing Loss	Sinus Problems = 3
Cardiovascular	14	Atrial Fibrillation	Hypertension = 9
Respiratory	18	Bronchitis, Pulmonary Fibrosis	Asthma = 10 Respiratory (non-specific) = 3

Kidney & Urinary Tract	3	Kidney Disease, Bladder Problems	
Gastrointestinal	12	Colon Polyps, Ulcerative Colitis, Crohn's Disease	
Immune-mediated, Inflammatory & Rheumatologic	30	Autoimmune Conditions, Fibromyalgia, Psoriatic Arthritis	Allergies = 12 Osteoarthritis = 5 Rheumatoid Arthritis = 3
Endocrinology & Metabolism			
Thyroid	17	Hyperthyroid, Hashimoto's Disease	Thyroid non-specific = 6 Hypothyroid = 4 Thyroid Nodules = 3
Sex-based	12	Polycystic Ovarian Syndrome, Uterine Fibroids, Cervical Dysplasia	Infertility = 4
Diabetes & Metabolism	11	High Cholesterol, Osteoporosis	Diabetes = 7
Neurologic	18	Multiple sclerosis, Neuropathy, Anxiety/Depression	Stroke = 3 Headache = 4 Migraine = 3
Genetic	1		
Miscellaneous symptoms	7	Fatigue, Memory Loss, Leg Pain	
Problem not specified**	6		
*Health condition examples show some of the types of health problems listed by one or two participants only. Health problems listed by more than two people are shown in Table 5. These examples are provided for understanding what types of health problems are included in each general category. The list of examples does not include every reported health condition. **Problem not specified: Six participants said they had a health problem but provided no additional information.			
Source: Elmira School Survey; Body System Categories adapted from Loscalzo, J., Fauci, A.S., Hauser, S.L., et al. (eds.) Harrison's Principles of Internal Medicine, 2023.			

From Table 6, it is evident that hypertension accounts for 9 of the 14 cardiovascular conditions reported by participants. Allergies, osteoarthritis, and rheumatoid arthritis account for 20 of the 30 reported conditions in the category "immune-mediated, inflammatory & rheumatologic conditions". The body system categories include a wide range of types of health conditions, and many of the reported health conditions in each category are reported by only one person. This table is useful, however, for providing perspective on the overall picture of what types of health conditions people reported in the survey.

Chronic Health Conditions Conclusion: The types of health conditions other than cancer or birth defects reported by survey participants were grouped based on the descriptions provided, and the percent of the respondents reporting specific categories of conditions was compared with the percentage of the general adult population who have these conditions. In addition, health conditions were grouped by general body system categories for an overall, high-level view of the types of health conditions reported by survey participants. This evaluation of the health conditions reported by survey participants showed no evidence of unusually high numbers of health conditions or unusual patterns of types of health conditions.

Overall Summary and Conclusions

This screening survey was conducted to better understand the health conditions of concern to Elmira High School current and former teachers and staff. The survey was broadly distributed to current and former teachers and staff and to the community. Responses were received from 171 teachers and staff. The survey effort can be considered a success in terms of this number of responses and the quality of information participants provided. In addition, the fact that 41% of participants stated they did not have any health concerns shows that current and former teachers and staff, even those without health concerns, were highly motivated to participate in this screening effort.

This screening evaluation of cancer, birth defects and other health conditions showed no unusual patterns of health outcomes among the Elmira High School current and former teachers and staff. For cancer and birth defects the types and numbers of outcomes reported were evaluated and used New York State general population rates to estimate ranges of expected numbers of these health outcomes. For other types of health conditions, the numbers of conditions reported and percentages of participants reporting various types of conditions were reviewed in the context of state and national health outcome rates. No unusual patterns or elevations were observed among survey responses.

There are limitations associated with this type of health outcome screening evaluation. Despite direct outreach and media coverage, it is likely some former teachers and staff were unaware of the survey, so were unable to participate. A few responses were received from friends or family members of deceased individuals who had cancer, but there was no comprehensive effort to acquire this type of information. Because of uncertainties about the size of the population, from which the participants were drawn, i.e. the number of current and former Elmira High School teachers and staff, it was not possible to precisely estimate expected numbers of outcomes. For this reason, the interpretation of findings did not depend solely on numbers of outcomes, but also on the pattern of specific types of outcomes. This type of screening evaluation is not able to draw conclusions about cause and effect. The evaluation concluded that the overall pattern and numbers of outcomes did not suggest an unusual elevation of adverse health outcomes, but it cannot draw conclusions about the causes of individual health outcomes.

The screening survey was initiated in response to concerns being voiced at various events that were held at the school in 2018 and 2019 to present information about the ongoing remedial and monitoring actions. More detailed information about the status of the investigations and remedial activities is available in the Historical Background section of this report and online at https://www.dec.ny.gov/chemical/102390.html (accessed 8/6/2024).

Based on the findings of this evaluation of health outcomes, additional studies of health outcomes potentially associated with employment at the school are not planned at this time. However, New York State Department of Health staff will continue to be available to respond to questions and concerns.

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Health Condition	**State or National rate per adult population (%)**	**Reference**
Allergies	31.8	Ng AE, Boersma P. Diagnosed allergic conditions in adults: United States, 2021. NCHS Data Brief, no 460. Hyattsville, MD: National Center for Health Statistics. https://stacks.cdc.gov/view/cdc/122809
Asthma	14.7 (age 18+, NY State)	Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Questionnaire. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2019, Table L1. https://www.cdc.gov/asthma/brfss/2019/brfssdata.html
Hypertension	46.6 (age 20+, 2017-2018)	CDC Data Finder (Hypertension, Table 021): https://www.cdc.gov/nchs/hus/data-finder.htm
Diabetes	9.5	Centers for Disease Control and Prevention (CDC). Summary Health Statistics Tables for U.S. Adults: National Health Interview Survey, 2018, Table A-4. https://www.cdc.gov/nchs/nhis/shs/tables.htm
Thyroid (non-specific)	7.1 (age 12+, subclinical + clinical hyperthyroidism + hypothyroidism, 2007-2012)	Jain RB (2015) Thyroid Profile of the Reference United States Population: Data from NHANES 2007-2012. Int Arch EndocrinolClin Res 1:004 https://pdfs.semanticscholar.org/33bb/95cf219aa416e8b71dfc7dcc9bf862937e7b.pdf
Osteoarthritis	21.4 (arthritis, any type)	Centers for Disease Control and Prevention (CDC). Summary Health Statistics Tables for U.S. Adults: National Health Interview Survey, 2018, Table A-4. https://www.cdc.gov/nchs/nhis/shs/tables.htm
Hypothyroid	3.7 (age 12+, subclinical + clinical hypothyroidism, 2007-2012)	Jain RB (2015) Thyroid Profile of the Reference United States Population: Data from NHANES 2007-2012. Int Arch EndocrinolClin Res 1:004 https://pdfs.semanticscholar.org/33bb/95cf219aa416e8b71dfc7dcc9bf862937e7b.pdf
Infertility	19.4 (females aged 15-49, 0 births, 2015-2019)	Centers for Disease Control and Prevention (CDC). Key Statistics from the National Survey of Family Growth 2015-2019. https://www.cdc.gov/nchs/nsfg/key_statistics/i-keystat.htm#infertility
Headache	15.9 (migraine and severe headache)	Centers for Disease Control and Prevention (CDC). Summary Health Statistics Tables for U.S. Adults: National Health Interview Survey, 2018, Table A-5. https://www.cdc.gov/nchs/nhis/shs/tables.htm

Sinus Problems	11.2	Centers for Disease Control and Prevention (CDC). Summary Health Statistics Tables for U.S. Adults: National Health Interview Survey, 2018, Table A-2. https://www.cdc.gov/nchs/nhis/shs/tables.htm
Thyroid nodules	5.0	Jameson, J. L., Mandel, S. J., Weetman, A. P. (2022). Thyroid Nodular Disease and Thyroid Cancer. In Loscalzo, J., Fauci, A. S., Kasper, D. L., Hauser, S. L., Longo, D. L., & Jameson, J. L. (Eds.), Harrison's principles of internal medicine (21st Ed., p.2946). McGraw Hill LLC.
Stroke	2.8	Centers for Disease Control and Prevention (CDC). Summary Health Statistics Tables for U.S. Adults: National Health Interview Survey, 2018, Table A-1. https://www.cdc.gov/nchs/nhis/shs/tables.htm
Rheumatoid Arthritis	**0.7-1.3**	Shah, A., St. Clair, E. W. (2022). Rheumatoid Arthritis. In Loscalzo, J., Fauci, A. S., Kasper, D. L., Hauser, S. L., Longo, D. L., & Jameson, J. L. (Eds.), Harrison's principles of internal medicine (21st Ed., p. 2754). McGraw Hill LLC.
Migraines	15.9 (migraine and severe headache)	Centers for Disease Control and Prevention (CDC). Summary Health Statistics Tables for U.S. Adults: National Health Interview Survey, 2018, Table A-5. https://www.cdc.gov/nchs/nhis/shs/tables.htm
Respiratory (non-specific)	__	No reference – see footnote in report table