North Carolina Department of Health and Human Services
Division of Public Health

Pat McCrory
Governor

Aldona Z. Wos, M.D.
Ambassador (Ret.)
Secretary DHHS

Daniel Staley
Acting Division Director

Report on Standard Incidence Ratio for Uveal Melanoma Cases
Mecklenburg County, North Carolina
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Prepared by Christian Klaus, Gary Leung and Chandrika Rao
North Carolina Central Cancer Registry (N.C. CCR)

Background

The residents of Huntersville-Cornelius area expressed concern about the high incidence of Uveal Melanoma in their neighborhood to the North Carolina Central Cancer Registry. The initial investigation using standard incidence ratios (SIR) did not find any excess cases of Uveal Melanoma in Mecklenburg County. At the request of residents from Huntersville and Cornelius, as well as other state health officials, standard incidence ratios (SIR) were used to further examine whether there was unusually high incidence of Uveal Melanoma in the area of Huntersville-Cornelius.

Standard incidence ratios have been widely used to evaluate whether the incidence of disease, such as cancer, is unusually high for one selected area, such as a county, over a period of time, such as 10 years. It is assessed by calculating the ratio of the *observed number of cases* over the *expected number of cases* in the selected area during the study period. The expected number of cases is estimated by multiplying North Carolina age-specific incidence rates of the disease and the denominator population of the area during the study period. This is based on the assumption that the State rate of the disease is what would be the average rate expected throughout the state. Thus, we can "expect" a certain number of cases in the selected area by using the State rates as a standard. The standard incidence ratio is calculated to compare *the observed and the expected number of cases* in the area. If the standard incidence ratio is greater than one, then the observed incidence of disease may not be "normal" for the area.

Material and Method

Data source

Data used for this investigation were based on cases diagnosed during 2000 – 2013 and reported to the North Carolina Central Cancer Registry (N.C. CCR) as of March 2015 for patients whose address at the time of diagnosis was in North Carolina. Cases were selected based on diagnosis codes as reflected in the pathology and medical reports reported from the hospitals and facilities. Further, cases diagnosed out of the state and country but that may be receiving treatment in facilities in North Carolina were not included as they are not required to be reported to the N.C. CCR. The N.C. CCR receives cancer diagnosis and treatment information from hospitals and other facilities at least six months after the diagnosis. The reason for this is that General Statute 130A-209 requires facilities to report complete first course of treatment data and many cases have an extended period of first course of treatment. The patient may have surgery, followed by multiple courses of chemotherapy, followed by radiation therapy. In order to obtain complete and accurate data from the facilities there is a lag time of at least six months. For some cases, N.C. CCR receives multiple reports from different facilities, which are reviewed and consolidated on an ongoing basis. N.C. CCR continues to receive reports from the hospitals for cases diagnosed in 2013, 2014 and prior years. Therefore, there may be cases diagnosed that have not been reported and included in this report.

Selection criteria for observed Uveal Melanoma cases

Per CDC's guidelines on investigating suspected cancer clusters, county-level data are often used to calculate standard incidence ratios (SIR). However, an investigation focused on three different areas, Huntersville-Cornelius, Huntersville-only and Cornelius-only, was requested. In this investigation, three delineations of the study area were used: 1) Huntersville-Cornelius: the 43 Block Groups from the 2010 Census that encompass the current municipal boundary of Huntersville-Cornelius area; 2) Huntersville-only: the 26 Block Groups from the 2010 Census that encompass the current municipal boundary of Huntersville; and 3) Cornelius-only: the 17 Block Groups from the 2010 Census that encompass the current municipal boundary of Cornelius. Based on the study areas, observed cases were identified and expected cases were estimated. Observed cases of Uveal Melanoma selected for this investigation were diagnosed between 2000 and 2013 in this area of North Carolina. In this investigation, Uveal Melanoma was defined as primary site C69 with histology code 8720-8780.

Estimation of expected cases

In order to estimate expected Uveal Melanoma cases between 2000 and 2013 for the three study areas, Huntersville-Cornelius, Huntersville and Cornelius, North Carolina 2000-2013 age-specific (in 10-year intervals) incidence rates for Uveal Melanoma were used. It should be noted that the incidence rates may be underestimated because the facilities may not have reported all of the cases diagnosed in 2013 to the Cancer Registry (see Data Source section). For Huntersville-Cornelius area, the denominator population was the 2010 Census population of Huntersville-Cornelius, based on the aforementioned Census Block Groups, for each age group multiplied by the time period of study. For Huntersville-only area, the denominator population was the 2010 Census population of Huntersville, based on the aforementioned Census Block Groups, for each age group multiplied by the time period of study. For Cornelius-only area, the denominator population was the 2010 Census population of Cornelius, based on the aforementioned Census Block Groups, for each age group multiplied by the time period of study.[1]

Data Analysis

Data were analyzed using formula-based calculations with Microsoft Excel. The formulas used in this report were based on those listed on the National Cancer Institute website for the standard incidence ratios and exact confidence limits.[2]

Denominator population of an age group:

The area of Huntersville-Cornelius, Huntersville-only or Cornelius-only, based on Census Block Groups, 2010 Census population for each age group x 14

Expected number of cases of an age group:

N.C. age-specific incidence rate (per 100,000) x Denominator population

Standard incidence ratio (SIR):

Observed number of cases / Sum of expected number of cases from all age groups

Exact 95% Confidence Interval:

$$\text{Lower limit} = \frac{\chi^2_{2 \times (\#observed), \alpha/2}}{2 \times (\#\text{Expected})} \qquad \text{Upper Limit} = \frac{\chi^2_{2 \times (\#observed+1), 1-\alpha/2}}{2 \times (\#\text{Expected})}$$

Where $\chi^2_{v,\alpha}$ is the 100α percentile of the chi-square distribution with v degrees of freedom and α is 0.05.

The 95% confidence interval indicates that the "true" value of the standard incidence ratio would be within the interval 95 percent of the time, and is calculated to indicate whether the standard incidence ratio is statistically significant, i.e., the upper and lower bound does not include the value of one.

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Results

Between 2000 and 2013, there were 7 observed cases of Uveal Melanoma who lived in the set of 43 Census Block Groups encompassing the area of Huntersville-Cornelius at the time of diagnosis while the expected number of cases for this area in this period was 9. The standard incidence ratio was less than one, indicating that the incidence of Uveal Melanoma between 2000 and 2013 in Huntersville-Cornelius area was not higher than expected. (See Table 1). The confidence intervals further confirmed that observed number of cases for Uveal Melanoma were not significantly different than the expected number of cases as confidence interval included one.

However, there were fewer than 5 observed cases of Uveal Melanoma diagnosed in Huntersville-only area as well as in Cornelius-only area. Per NC CCR protocol, aggregated data with fewer than 5 cases cannot be released; thus, the standard incidence ratio, as well as the confidence interval, were not estimated (See Table 1). In order for the standard incidence ratios to be significant, the minimum numbers of observed cases needed are 11 in Huntersville-only area and 8 in Cornelius-only area.

Table 1 Uveal Melanoma Observed and Expected Cases, 2000-2013				
	Observed	Expected	SIR	95%CI
Huntersville-Cornelius	7	9	0.8	(0.3-1.6)
Huntersville	*	5	N/A	N/A
Cornelius	*	3	N/A	N/A

*Data suppressed due to low counts, i.e., fewer than 5.
Note: Expected cases are estimates and may not add up due to rounding.

Conclusions

The standard incidence ratios were estimated for Uveal Melanoma to investigate whether the incidence of Uveal Melanoma was unusually high in the area of Huntersville-Cornelius between 2000 and 2013. As of March 2015, the result of the analysis failed to indicate a higher than expected number of Uveal Melanoma cases in Huntersville-Cornelius area during this time period.

However, the standard incidence ratio could not be calculated for Huntersville-only area or Cornelius-only area due to low observed numbers. As of March 2015, the result of the analysis did not indicate a higher than expected number of Uveal Melanoma cases in these two areas during this time period.

There are several limitations to this investigation. First, all cases diagnosed in 2014 may not be included due to the lag time in reporting. Second, the study area is based on Census Block Groups that encompass the municipal boundaries of Huntersville-Cornelius, Huntersville and Cornelius. Therefore, it may include non-incorporated areas of the surrounding county. Third, the NC CCR does not have accurate information on individuals' histories of residential addresses or occupations. Therefore, cases are not present in the investigation if the individuals had previously lived in these areas but not at the time of diagnosis. In addition, individuals who work in these areas but are not residents are not included, as standard analyses are based on residence. Last, the population of the study area is not available on a yearly basis. The population is based on 2010 Census. The estimation of expected cases is based on the assumption that the population is static over the 14-year period. Therefore, the results from this investigation should be used with caution.

References

1. US Census Bureau: 2010 Census of Population and Housing. Summary File 1. Washington, DC, US Department of Commerce Economics and Statistics Administration; 2015. URL: https://www.census.gov/mp/www/cat/decennial_census_2010/summary_file_1_1.html.
2. Standardized Incidence Ratio and Confidence Limits. The National Cancer Institute: Surveillance, Epidemiology and End Results. URL: http://seer.cancer.gov/seerstat/WebHelp/Standardized_Incidence_Ratio_and_Confidence_Limits.htm. Accessed on March 27, 2015.
3. Investigating Suspected Cancer Clusters and Responding to Community Concerns: Guidelines from CDC and the Council of State and Territorial Epidemiologists: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6208a1.htm.