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Division of Public Health

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**Ocular Melanoma Investigation in Mecklenburg County, North Carolina**  
**June 2015**

**Introduction**

The North Carolina Central Cancer Registry (CCR) conducted initial reviews of cancer case reports in November 2013, May 2014, January 2015, and again in May 2015 after several citizens expressed concern of a possible ocular melanoma cluster in the Huntersville area of Mecklenburg County (Appendix 1). CCR did not observe an excess of ocular melanoma cases above what would be expected for the specified time frames and locations. In addition to the review by the CCR, the North Carolina Division of Public Health's Occupational and Environmental Epidemiology Branch (OEEB) initiated an epidemiologic investigation in April 2014 in response to continued concern about the potential cluster.<sup>1</sup> We pursued the investigation due to the atypical demographics (younger females) of case patients brought to our attention by community members and because three of the case patients attended the same high school prior to being diagnosed. The goal of the epidemiological investigation was to look for common environmental exposures and risk factors for ocular melanoma among the cases in the Huntersville area to address environmental concerns expressed by the cases and their families.

For the purpose of this investigation, the potential cluster was defined as eight cases of ocular melanoma diagnosed between 2009 and 2014 who lived in, worked in, or frequently visited Huntersville prior to being diagnosed.

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## **Methods**

To address the potential cluster of ocular melanoma cases and the citizens' concerns about possible environmental exposures in the community, the OEEB:

- identified risk factors for ocular melanoma in the scientific literature,
- utilized the OEEB standard non-infectious disease cluster protocol to evaluate risk factors, and
- assessed environmental concerns expressed by the cases and their families.

During the initial steps of the investigation, OEEB contacted the Centers for Disease Control and Prevention (CDC) to discuss the potential cluster of ocular melanoma cases. Both OEEB and CDC staff performed independent literature reviews searching for known risk factors for ocular melanoma. Next, OEEB staff discussed the potential cluster with oncologists from Thomas Jefferson University Hospital in Pennsylvania who study and treat ocular melanoma and had treated several cases in our investigation. OEEB utilized its standard non-infectious disease cluster protocol to continue the investigation, which included having the CCR calculate a standardized incidence ratio and confidence interval for cases of ocular melanoma in Huntersville, Huntersville/Cornelius, and Mecklenburg County (Appendix 1). In response to a request from the mayor of Huntersville, the federal Agency for Toxic Substances and Disease Registry (ATSDR) searched multiple environmental databases and did not identify any data on the release of hazardous substances in Huntersville (Appendix 2).

A family member of an ocular melanoma case provided the names and contact information to the CCR and OEEB of eight people who were diagnosed with ocular melanoma between 2009 and 2014 and had lived in, worked in, or frequently visited Huntersville prior to being diagnosed. OEEB developed a questionnaire about demographic information, medical history, occupation, and risk factors such as eye color, ultraviolet (UV) light exposure, chemical exposure, and other environmental exposures to further assess common links between environmental exposures among the cases (Appendix 3). The Mecklenburg County Health Department Epidemiology Program staff administered the questionnaire to the eight cases and/or their family members, as well as four additional cases who were referred by the initial cases and one additional case who learned of the investigation from the media.

Since three of the cases attended Hopewell High School in Huntersville prior to being diagnosed, OEEB contacted the Director of Safety for Charlotte-Mecklenburg Schools to gather

information about the history of the school site before the school was built and inquire about radon testing in the school, which were issues of concern for several cases and their families. To investigate possible environmental exposures of concern in the Huntersville area, staff from OEEB and the Mecklenburg County Health Department Epidemiology Program conducted a site visit to the Huntersville area on April 28, 2015.

## **Results**

### *Overview*

According to the American Cancer Society<sup>2</sup>, the National Cancer Institute<sup>3</sup>, and the Ocular Melanoma Foundation<sup>4</sup>, ocular melanomas are a group of cancers that develop from pigment-making cells in the eye. They can develop at any age, but are more common in adults. Ocular melanomas develop in the uvea section of the eyeball and are found in one of three places:

- Choroid body – These cells are responsible for producing the same pigment as melanocytes in the skin.
- Ciliary body
- Iris – Melanomas that develop here often originate in a dark spot in the iris that has been present for many years and then begins to grow. These rarely spread to other parts of the body.

### *Epidemiology*

Ocular melanoma is a rare disease. In the United States, approximately 2,500 adults are diagnosed with ocular melanoma each year. The incidence is approximately 5 to 7.5 new cases per one million people per year. Males have an increased incidence compared to females. The incidence rate increases with age and peaks near age 70.

### *Causal Relationships and Associations*

A possible association does not imply a causal relationship with ocular melanoma or that exposure to the agent causes the disease. A possible association means only that those diagnosed with ocular melanoma may be more likely (or at increased risk) to develop ocular melanoma if a person has been exposed to the selected agent(s) than people who have not been diagnosed with ocular melanoma. If a relationship between an agent and the disease is causal, we would expect to find it consistently in different studies and in different populations.

### *Risk factors*

A risk factor is anything that increases your chances of getting or developing a disease. Different types of cancers can have different risk factors known to be associated with them. The presence of a risk factor does not mean you will get the disease but means you may be more likely to develop the disease than someone who does not have the risk factor. Risk factors such as smoking can be changed, but others such as age, race, and sex cannot be changed. It is possible to develop a disease without the presence of known risk factors as well.

The cause of ocular melanoma is unknown. However, a review of the scientific literature identified the following risk factors for ocular melanoma: white race, light eye color, older age (>50), male gender, sun exposure, artificial tanning, arc welding, occupational cooking, and certain inherited disorders/conditions (dysplastic nevus syndrome, uveal nevus, oculodermal melanocytosis, neurofibromatosis, and congenital eye disease).

Additionally, studies have investigated other potential risk factors for ocular melanoma, including radio frequency radiation, electromagnetism, chemical solvents, asbestos, and smoking. These studies have not found a causal relationship between these exposures and ocular melanoma. A summary of the findings from these studies is listed below.

**Table 1. Selected environmental exposures and findings in the scientific literature**

| <b>Exposure</b>                             | <b>Non- association and possible associations with ocular melanoma in the literature</b>  |
|---|---|
| <b><i>Occupational Exposures</i></b>        |   |
| Arc welding                                 | +   |
| Asbestos                                    | + (One study found a possible association)  |
| Farming                                     | -   |
| Occupational cooking                        | +   |
| Radio frequency radiation/ electromagnetism | +/- (A few studies have found a possible association)   |
| Solvents                                    | +/- (A few studies have found a possible association)   |
| <b><i>Non-Occupational Exposures</i></b>    |   |
| Eye makeup                                  | -   |
| Fluoride                                    | -   |
| Gasoline fumes                              | -   |
| Natural gas storage facilities              | -   |
| Nuclear power plants                        | -   |
| Pesticides                                  | -   |
| Radio frequency radiation/ electromagnetism | -   |
| Radon                                       | -   |
| Smoking/tobacco use                         | - (No specific association has been found with ocular melanoma, but studies have shown an association between smoking and ocular diseases in general) |
| UV light from artificial tanning            | +   |
| UV light from the sun                       | +/- (Several studies have found associations, but more research is needed. Exposure at a young age appears to be of greater concern.)                 |

- + *Possible association has been found in the scientific literature (those diagnosed with ocular melanoma may be more likely (or at increased risk) to develop ocular melanoma if they have been exposed to the selected agents than people who have not been diagnosed with ocular melanoma)*
- +/- *Some studies have found a possible association, while other studies have not*
- *No association has been found to our knowledge*

## **Cancer questionnaire**

The questionnaire findings are shown in Table 2. One of the 13 respondents had been diagnosed with a benign eye tumor but not ocular melanoma; therefore, this person was excluded from the analysis.

*Demographics:* At the time of diagnosis, six cases lived in Mecklenburg County, four lived in other North Carolina counties, and two lived in South Carolina. Three lived in Huntersville or Cornelius at the time of diagnosis, while three others lived in Huntersville at some point prior to being diagnosed and one only worked in Huntersville. Three cases attended Hopewell High School at different times between 2001 and 2011 and were diagnosed with ocular melanoma within six years of graduating. Hopewell High School, located at 11530 Beatties Ford Road in Huntersville, opened in August 2001 and currently has an enrollment of 1,718 students.

*Risk Factors:* Among 12 cases, nine (75%) had light eye color (blue, hazel, or golden), and 11 (92%) were white. Although the risk of ocular melanoma increases with age and the disease is more common in males, seven cases (58%) were younger than age 50 when diagnosed, and 11 (92%) were female. Eleven cases (92%) reported high ultraviolet (UV) light exposure before they were diagnosed: nine cases (75%) had a history of two or more severe sunburns (five of whom also had a history of artificial tanning and one of whom also reported arc welding exposure), and two other cases (17%) had worked outdoors as lifeguards. One case (8%) reported a history of occupational cooking. Four cases (33%) had a history of uveal nevus and two cases (17%) had dysplastic nevus syndrome, but no cases had oculodermal melanocytosis, neurofibromatosis, or congenital eye disease.

| <b>Table 2. Summary of Completed Questionnaire Data</b>             |                          |                         |                      |
|---|--------------------------|-------------------------|----------------------|
|   | <b>Initial cases (%)</b> | <b>Add-on cases (%)</b> | <b>All cases (%)</b> |
| <b>Total</b>  | 8                        | 4*                      | <b>12</b>            |
| <b>Demographics</b>   |                          |                         |                      |
| Race  |                          |                         |                      |
| White   | 8 (100)                  | 3 (75)                  | <b>11 (92)</b>       |
| American Indian   | 0 (0)                    | 1 (25)                  | <b>1 (8)</b>         |
| Sex   |                          |                         |                      |
| Female  | 7 (87)                   | 4 (100)                 | <b>11 (92)</b>       |
| Male  | 1 (13)                   | 0 (0)                   | <b>1 (8)</b>         |
| Eye Color   |                          |                         |                      |
| Blue  | 4 (50)                   | 1 (25)                  | <b>5 (42)</b>        |
| Hazel/Golden  | 2 (25)                   | 2 (50)                  | <b>4 (33)</b>        |
| Brown   | 2 (25)                   | 1 (25)                  | <b>3 (25)</b>        |
| Lived in Huntersville/<br>Cornelius when diagnosed                  | 3 (37)                   | 0 (0)                   | <b>3 (25)</b>        |
| Ever lived in Huntersville/<br>Cornelius                            | 6 (75)                   | 0 (0)                   | <b>6 (50)</b>        |
| Lived in Mecklenburg County when<br>diagnosed                       | 4 (50)                   | 2 (50)                  | <b>6 (50)</b>        |
| <b>School history</b>   |                          |                         |                      |
| Attended Hopewell High School in<br>Huntersville prior to diagnosis | 3 (38)                   | 0 (0)                   | <b>3 (25)</b>        |
| <b>Medical history</b>  |                          |                         |                      |
| Diagnosed with ocular melanoma                                      | 8 (100)                  | 4 (100)                 | <b>12 (100)</b>      |
| Died from ocular melanoma   | 2 (25)                   | 0 (0)                   | <b>2 (17)</b>        |
| Age at diagnosis  |                          |                         |                      |
| <30 years old   | 3 (38)                   | 0 (0)                   | <b>3 (25)</b>        |
| 30–49 years old   | 4 (50)                   | 0 (0)                   | <b>4 (33)</b>        |
| 50+ years old   | 1 (13)                   | 4 (100)                 | <b>5 (42)</b>        |
| Eye injury before diagnosis   | 1 (13)                   | 3 (75)                  | <b>4 (33)</b>        |
| Family history of cutaneous (skin)<br>melanoma                      | 2 (25)                   | 1 (25)                  | <b>3 (25)</b>        |

|   |        |         |                |
|---|--------|---------|----------------|
| Inherited Disorders/Conditions  |        |         |                |
| Uveal nevus   | 3 (38) | 1 (25)  | <b>4 (33)</b>  |
| Dysplastic nevus syndrome   | 2 (25) | 0 (0)   | <b>2 (17)</b>  |
| Oculodermal melanocytosis, neurofibromatosis, or congenital eye disease | 0 (0)  | 0 (0)   | <b>0 (0)</b>   |
| <b><i>Ultraviolet (UV) Light Exposure</i></b>                           |        |         |                |
| <i>High UV light exposure</i>   | 7 (88) | 4 (100) | <b>11 (92)</b> |
| History of two or more severe sunburns                                  | 5 (63) | 4 (100) | <b>9 (75)</b>  |
| Worked outdoors as lifeguard  | 2 (25) | 0 (0)   | <b>2 (17)</b>  |
| History of artificial tanning   | 3 (38) | 2 (50)  | <b>5 (42)</b>  |
| History of arc welding exposure   | 0 (0)  | 1 (25)  | <b>1 (8)</b>   |
| <b><i>Other Environmental Exposures</i></b>                             |        |         |                |
| History of occupational cooking   | 0 (0)  | 1 (25)  | <b>1 (8)</b>   |
| History of smoking/tobacco use  | 3 (38) | 4 (100) | <b>7 (58)</b>  |

*\*One additional person completed a questionnaire but was excluded from analysis due to not having been diagnosed with ocular melanoma.*

### **Environmental Investigation of the Community**

Staff from OEEB and the Mecklenburg County Health Department Epidemiology Program conducted a site visit of the Huntersville area on April 28, 2015. Staff observed high tension electrical lines approximately 0.8 miles from Hopewell High School, a natural gas facility approximately 1.25 miles from the school, and an electrical substation approximately 1.5 miles from the school. McGuire Nuclear Station is located approximately 4.5 miles from the school. Staff did not observe any environmental exposures of concern near Hopewell High School or in the surrounding community.

One family member expressed concern about electromagnetic radiation in and around Hopewell High School. OEEB staff reviewed the scientific literature on the association between electromagnetic fields and cancer. In particular, a comprehensive review paper<sup>5</sup> by the World Health Organization (WHO) identified that "...approximately 25,000 articles have been published over the past 30 years... in the area of biological effects and medical applications of non-ionizing radiation. Despite the feeling of some people that more research needs to be done,



scientific knowledge in this area is now more extensive than for most chemicals... the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields." OEEB staff did not further investigate this exposure based on the lack of scientific evidence supporting such an association.

While radon has not been shown to be associated with ocular melanoma, several cases and families expressed concern about radon exposure. According to the Director of Safety for Charlotte-Mecklenburg Schools, Hopewell High School has not been tested for radon. However, several nearby schools, including Cornelius Elementary, David Cox Elementary, Davidson Elementary, Long Creek Pre-Kindergarten, and North Mecklenburg High School, were tested for radon in 2007 and did not have elevated radon levels. Furthermore, according to the Environmental Protection Agency (EPA) website ([www.epa.gov/radon/aboutus.html](http://www.epa.gov/radon/aboutus.html)), "Lung cancer is the only known effect on human health from exposure to radon in air." This is also supported in the scientific literature.

The Director of Safety for Charlotte-Mecklenburg Schools provided information on the Hopewell High School site. Before the school was constructed, the site was primarily farmland and open fields. No studies have shown an association between farm-related exposures and ocular melanoma.

Eight cases reported using well water at some point in their life, but no cases reported using well water in Huntersville. Drinking water for the Town of Huntersville is provided by the City of Charlotte. No studies have shown an association between water contaminants and ocular melanoma.

## **Discussion**

OEEB performed a cancer cluster investigation of 12 individuals who developed ocular melanoma. The investigation involved multiple steps, and OEEB was provided information by various local, state and federal agencies. Among these agencies, assistance was provided by Mecklenburg County Epidemiology staff, the Charlotte-Mecklenburg School System, the Central Cancer Registry in the North Carolina Department of Health and Human Services, and the Centers for Disease Control and Prevention National Center for Environmental Health.

Studies have found an association between ultraviolet (UV) light exposure from arc welding and tanning lamps and developing ocular melanoma. Five cases (42%) in our analysis reported a history of artificial tanning, and one case (8%) reported a history of exposure to arc welding. Although weaker, some studies have found a possible association between UV light from the sun and developing ocular melanoma. Nine cases (75%) in our analysis reported a history of two or more severe sunburns, and two other cases (17%) had worked outdoors as a lifeguard. Beyond high UV light exposures, OEEB was not able to identify any other shared environmental exposures that are possibly associated with ocular melanoma. Independent literature reviews by OEEB and CDC did not reveal a specific etiologic agent that is known to be causally associated with ocular melanoma.

Supporting the epidemiologic investigation, the Central Cancer Registry did not find an elevated SIR (standardized incidence ratio) for ocular melanoma in Mecklenburg County, Huntersville, or Huntersville/Cornelius from 2000–2013 (Appendix 1). As of May 2015, the CCR had information for seven of the eight initial cases and one of the four add-on cases. The CCR is still receiving information for cases diagnosed in 2014.

Investigations of potential cancer clusters have rarely found a single etiologic agent to explain the apparent clustering of cases. In a review of cancer clusters nationwide during the last 20 years, only 1 of 428 investigations revealed a clear cause.<sup>6</sup> In fact, most clusters appear to be chance events (occurring at random). Cancer cluster investigations are difficult for many reasons, including the following:

- The often small number of cases involved makes statistical analyses problematic.
- The length of time (usually years to decades) from exposure to a carcinogen (or agent) to the development of the cancer (known as the latency period) makes it difficult to correctly identify the relevant exposure.
- We lack clinical or molecular tests that can determine the cause of cancer. From the time the process of developing cancer begins until the person first shows symptoms, many years have usually passed and there is no evidence of the cancer-causing chemical in the person's body.
- In-migration to a community confounds analysis. A person living or working in the community may have a similar cancer but the exposure to an agent associated with that cancer occurred years before the person moved into that community.<sup>7</sup>

These issues may give the appearance that there may be a common environmental exposure in the community, when the cases are not truly related.<sup>8</sup>

### **Conclusion/Recommendations**

OEEB staff members were saddened to learn that several people with connections to the Huntersville area have been diagnosed with ocular melanoma. We investigated potential exposures of concern despite the fact that the number of cases of ocular melanoma was not higher than expected for the populations examined. We also investigated the concerns of the cases and their families with the goal of either identifying and eliminating any harmful exposures to people in the community or providing reassurance that no imminent hazards exist in the community.

The majority of cases in our analysis reported a history of high UV light exposure, which is consistent with findings in the scientific literature. Based on the analysis of the completed questionnaire data, risk factors identified from the literature and investigation of issues raised by the public, we were not able to identify any common environmental exposures specific to the Huntersville area that were likely to be associated with ocular melanoma. Although the specific causes of ocular melanoma remain unknown, the American Cancer Society recommends limiting exposure to intense sunlight, covering up with protective hats and clothing, using sunscreen, and wearing UV-protected sunglasses (UVA and UVB) when outside in strong sunlight.<sup>2</sup>

### **References**

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## Appendix 1.



### 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

November 14, 2013

Dear Mr. Legg:

Thank you for your inquiry to the Central Cancer Registry (CCR) regarding cancer cases in Mecklenburg County. We receive many requests such as yours for information about cancers in local areas throughout the state. The CCR compiles information on cancers across North Carolina and we monitor cancer rates for many types of cancer for each county annually to see if there appear to be areas of the state that need special attention.

Although much has been learned about cancer over the past couple of decades, there is still much that is not known about the causes of cancer. What we do know is that cancer is not one disease, but a group of diseases that behave similarly. We know that different types of cancers are caused by different things. For example, cigarette smoking has been implicated in causing lung cancer, some chemical exposures are associated with leukemia, and prolonged exposure to sunlight causes some types of skin cancer. Genetic research has shown that defects in certain genes result in a much higher likelihood that a person will get cancer. What is not known is how genetic factors and exposures to cancer causing agents interact.

Many people do not realize how common cancers are. It is estimated that one out of every two men and one out of every three women will develop a cancer of some type during his or her lifetime. As a result, it is common to find what appear to be cancer cases clustering in neighborhoods over a period of years. This will occur in any neighborhood. As people age, their chance of getting cancer increases, and so as we look at a community, it is common to see increasing numbers of cancer cases as the people in the community age.

Cancers are diseases that develop over many years. As a result, it is difficult to know when any specific cancer began to develop, and consequently, what the specific factor was which caused the cancer. Because people in our society move several times during their lives, the evaluation of clusters of cancer cases is quite challenging. One can never be certain that a specific cancer was caused by something in the community in which the person currently resides.

When clusters of cancer cases are investigated, we look for several things that are clues to likely associations with exposures in the community. These are:

1. Groups of cases of all the same type of cancer (such as brain cancer or leukemia). Because different things cause different types of cancer, cases of many different types of cancer do not constitute a cluster of cases.
2. Groups of cases among children, or ones with an unusual age distribution.
3. Cases diagnosed during a relatively short time interval. Cases diagnosed over a span of years do not constitute a cluster of cases unless there is consistency in the type of cancer.
4. Clusters of rare cancers. Because lung, breast, colon, and prostate cancers are so common, it is very difficult to find any association between them and exposures in a community.

This report is updated based on cases reported to the North Carolina Central Cancer Registry (CCR) as of October 1, 2013, diagnosed during 1990 - 2012, address at the time of diagnosis in North Carolina and 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 may be receiving treatment in facilities in North Carolina are not included as they are not required to be reported. The CCR does not have real time data because it takes hospitals at least six months after the diagnosis of a malignancy to submit cancer diagnosis reports. The reason for this is that, per General Statute 130A-209, CCR requires facilities to report complete first course of treatment data and many cases have an extended period of first course 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, CCR receives multiple reports from different

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facilities, which are reviewed and consolidated on an ongoing basis. CCR continues to receive reports from the hospitals for cases diagnosed in 2011, 2012 and prior years. Cases diagnosed in 2013 are beginning to be processed.

In order to evaluate the cancer risk in the area requested, all of the cases of cancer in our database diagnosed from 1990 to 2012 were identified. During this time a total of 64,364 cancer cases were diagnosed in Mecklenburg County. Across the county, the four major cancers - female breast, colon and rectum, prostate, and lung and bronchus - comprised 57 percent of the 64,364 cases. Pediatric cancers comprised 1 percent of the total number of cases and 80 percent of the cases were age 50 or older, when cancer diagnoses are quite common. These cases were spread out over the 23 years, not concentrated in a short time period.

Further, we looked at the age-adjusted incidence rates for Mecklenburg County for the 2006-2010 diagnosis years and found that prostate and female breast were relatively higher than the state rates; and colon and rectum and lung and bronchus rates were lower than the state rates. Overall there were 17,741 cases reported in Mecklenburg County for this five year period.

Concern was expressed about cancer incidence in Huntersville. From 1990 to 2012, there were 2,688 cases in this town. The top four cancers comprised 57 percent of these cases. At least 76 percent of the cases were age 50 or older, in which cancer diagnoses are quite common and 1 percent of the cases were pediatric. Further, we looked at cancers that have been shown to be associated with environmental risk factors (liver, pancreas, leukemia, brain, bladder, kidney, multiple myeloma and non-Hodgkin lymphoma) and identified a total of 448 cases in this town for the 23 year period. These cases were spread out over the 23 years and not concentrated in any time period.

There were two particular areas in Huntersville that were of interest. We looked at cases within two miles of the nuclear station and found 205 cases in the area between 1990 and 2011. The four major cancers comprised 52 percent of cases. Eighty percent of cases were age 50 or older and 2 percent of the cases were pediatric. We also looked at cases within a two mile radius of the high school of interest. From 1990 to 2011, there were 289 cases reported in the region. The top four cancers comprised 54 percent of the cases. Almost three-fourths of the cases were diagnosed in people age 50 and older while 1 percent of the cases were diagnosed in pediatrics.

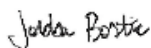
Further, concern was also expressed over the incidence of ocular melanoma (defined as primary site: C69 with histology codes: 8720-8780). Between 1990 and 2012, there were 77 cases (or 0.12% of all cancer cases) of ocular melanoma in Mecklenburg County while there were 1,232 cases (or 0.14% of all cancer cases) statewide. There were less than 5 cases of ocular melanoma in Huntersville in the time period. The number of cases is fairly consistent over the time period for Mecklenburg County, and the cases were spread out over the 23 years, not concentrated in a short time period.

Overall, no consistent pattern of cases was observed other than those previously stated. It is possible that there is an environmental risk for cancer in the area; however, we do not see a higher occurrence of cancers in the populations usually associated with environmental factors at this time or any evidence of a clustering of cancer cases in any of these areas.

On the CCR website ([www.schs.state.nc.us/data/cancer.cfm](http://www.schs.state.nc.us/data/cancer.cfm)), there is additional North Carolina cancer information, including the NC Cancer Profile and the Cancer Profile for Mecklenburg County. There are also fact sheets regarding the leading cancers in the state. If you have questions regarding any of this information or you want additional resources about cancer, please do not hesitate to contact the CCR at (919) 715-7289.

At the request of the North Carolina Senate, House of Representatives and local health departments, copies of neighborhood cancer evaluations are also sent to those who represent and serve the area of the state being evaluated.

Sincerely,



Jordan Bostic, Ph.D.  
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[Kathryn.Bostic@dhhs.nc.gov](mailto:Kathryn.Bostic@dhhs.nc.gov)

CC: Representative Charles Jeter  
Senator Jeff Tarte  
Michelle Lancaster-Sandlin, Mecklenburg County Interim Health Director  
Dr. Rick Langley, MD, MPH, Occupational and Environmental Epidemiology Branch  
Dr. Chandrika Rao, Director, North Carolina Central Cancer Registry



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

Pat McCrory  
Governor

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

Penelope Slade-Sawyer  
Division Director

May 1, 2014

Dear Dr. Keener,

Thank you for your inquiry to the Central Cancer Registry regarding cancer cases in a Mecklenburg County neighborhood. We receive many requests such as yours for information about cancers in local areas throughout the state. The Central Cancer Registry compiles information on cancers across North Carolina and we monitor cancer rates for many types of cancer for each county annually to see if there appear to be areas of the state that need special attention.

Although much has been learned about cancer over the past couple of decades, there is still much that is not known about the causes of cancer. What we do know is that cancer is not one disease, but a group of diseases that behave similarly. We know that different types of cancers are caused by different things. For example, cigarette smoking has been implicated in causing lung cancer, some chemical exposures are associated with leukemia, and prolonged exposure to sunlight causes some types of skin cancer. Genetic research has shown that defects in certain genes result in a much higher likelihood that a person will get cancer. What is not known is how genetic factors and exposures to cancer causing agents interact.

Many people do not realize how common cancers are. It is estimated that one out of every two men and one out of every three women will develop a cancer of some type during his or her lifetime. As a result, it is common to find what appear to be cancer cases clustering in neighborhoods over a period of years. This will occur in any neighborhood. As people age, their chance of getting cancer increases, and so as we look at a community, it is common to see increasing numbers of cancer cases as the people in the community age.

Cancers are diseases that develop over many years. As a result, it is difficult to know when any specific cancer began to develop, and consequently, what the specific factor was which caused the cancer. Because people in our society move several times during their lives, the evaluation of clusters of cancer cases is quite challenging. One can never be certain that a specific cancer was caused by something in the community in which the person currently resides.

When clusters of cancer cases are investigated, we look for several things that are clues to likely associations with exposures in the community. These are:

1. Groups of cases of all the same type of cancer (such as brain cancer or leukemia). Because different things cause different types of cancer, cases of many different types of cancer do not constitute a cluster of cases.
2. Groups of cases among children, or ones with an unusual age distribution.
3. Cases diagnosed during a relatively short time interval. Cases diagnosed over a span of years do not constitute a cluster of cases unless there is consistency in the type of cancer.
4. Clusters of rare cancers. Because lung, breast, colon, and prostate cancers are so common, it is very difficult to find any association between them and exposures in a community.

This report is updated based on cases reported to the North Carolina Central Cancer Registry (CCR) as of March 2014, diagnosed during 1990 - 2013, address at the time of diagnosis in North Carolina and 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 may be receiving treatment in facilities in North Carolina are not included as they are not required to be reported. The CCR does not have real time data because it takes hospitals at least six months after the diagnosis of a malignancy to submit cancer diagnosis reports. The reason for this is that, per General Statute 130A-209, CCR requires facilities to report complete first course of treatment data and many cases have an extended period of first course treatment. The patient may have surgery, followed by multiple courses of chemotherapy, followed by

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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, CCR receives multiple reports from different facilities, which are reviewed and consolidated on an ongoing basis. CCR continues to receive reports from the hospitals for cases diagnosed in 2012, 2013 and prior years. Therefore, all cases diagnosed in 2012 and 2013 may not be included in this report.

In order to evaluate the cancer risk in the neighborhood requested, all of the cases of cancer in our database diagnosed from 1990 to 2013 were identified. During this time a total of 66,780 cancer cases were diagnosed in Mecklenburg County. Across the county, the four major cancers - female breast, colon/rectum, prostate, and lung - comprised 57 percent of the cases. Pediatric cancers comprised about 1 percent of the total number of cases and 81 percent of the cases were age 50 or older, when cancer diagnoses are quite common. These cases were spread out over the 24 years, not concentrated in a short time period.

Further, we examined the age-adjusted cancer incidence rates in Mecklenburg County for the 2007-2011 diagnosis years and found that the rates for female breast and prostate cancers were relatively higher than the state rate, while the rates for colorectal and lung/bronchus cancers were relatively lower than the state rate. Overall there were 18,565 cases reported in Mecklenburg County for this five year period.

Since concern was expressed about cancer incidence in Huntersville, we examined the cancer cases from 1990 to 2013 for this area. There were 2,803 cases in this town during this period in our database; the top four cancers comprised 56 percent of these cases. In addition, 76 percent of the cases were age 50 or older; 1 percent of the cases were pediatric. These cases were spread out over the 24 years, not concentrated in a short time period.

Further, we looked at cancers that have been shown to be associated with environmental risk factors (liver, pancreas, leukemia, brain, bladder, kidney, multiple myeloma and non-Hodgkin lymphoma) and identified a total of 12,551 cases for Mecklenburg County and 486 cases in Huntersville for the 24 year period. These cases were spread out over the 24 years and not concentrated in any time period.

The area surrounding the high school in Huntersville was of particular interest. We examined cases within a two mile radius of the high school of interest. From 1990 to 2013, there were 368 cases reported in the region. The top four cancers comprised 51 percent of the cases. About 74 percent of the cases were diagnosed in people age 50 and older while 1 percent of the cases were pediatric cancers.

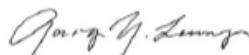
Further, concern was also expressed over the incidence of ocular melanoma (defined as primary site: C69 with histology codes: 8720-8780). Between 1990 and 2013, there were 79 cases (or 0.12 percent of all cancer cases) of ocular melanoma in Mecklenburg County while there were 1,265 cases (or 0.14 percent of all cancer cases) statewide. There were fewer than five cases of ocular melanoma reported in Huntersville in the time period. The number of cases is fairly consistent over the time period for Mecklenburg County, and the cases were spread out over the 24 years, not concentrated in a short time period.

Overall, no consistent pattern of cases was observed other than those previously stated. It is possible that there is an environmental risk for cancer in the area; however, we do not see a higher occurrence of cancers in the populations usually associated with environmental factors at this time or any evidence of a clustering of cancer cases in any of these areas.

On the CCR website ([www.schs.state.nc.us/SCHS/data/cancer.cfm](http://www.schs.state.nc.us/SCHS/data/cancer.cfm)), there is additional North Carolina cancer information, including the NC Cancer Profile and the Cancer Profile for Mecklenburg County. There are also fact sheets regarding the leading cancers in the state. If you have questions regarding any of this information or you want additional resources about cancer, please do not hesitate to contact me at Gary.YH.Leung@dhhs.nc.gov or (919) 715-4559.

At the request of the North Carolina Senate, House of Representatives and local health departments, copies of neighborhood cancer evaluations are also sent to those who represent and serve the area of the state being evaluated as well as the Office of Environmental Epidemiology Branch.

Sincerely,



Gary Leung, Ph.D.  
N.C. Department of Health and Human Services  
Statistician, North Carolina Central Cancer Registry, Division of Public Health  
222 N. Dawson Street, Cotton Classing Building, Raleigh, NC 27603  
(Office) 919-715-4559  
[Gary.YH.Leung@dhhs.nc.gov](mailto:Gary.YH.Leung@dhhs.nc.gov)  
<http://www.schs.state.nc.us/schs/data/cancer.cfm>





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

Pat McCrory  
Governor

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

Penelope Slade-Sawyer  
Division Director

Report on Standard Incidence Ratio for Uveal Melanoma Cases  
Mecklenburg County, North Carolina  
January 2015

Prepared by Gary Leung and Chandrika Rao  
North Carolina Central Cancer Registry (N.C. CCR)

### Background

The residents of Huntersville expressed concern about the high incidence of Uveal Melanoma in their neighborhood to the North Carolina Central Cancer Registry. The initial investigation using N.C. CCR's standard procedure did not find any excess cases of Uveal Melanoma in Mecklenburg County. Per recommendation by the Centers for Disease Control and Prevention (CDC), standard incidence ratios (SIR) were used to further examine whether there was unusually high incidence of Uveal Melanoma in Mecklenburg County.

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 December 2014 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.

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### *Selection criteria for observed Uveal Melanoma cases*

Per CDC's guidelines on investigating suspected cancer clusters, county-level data were used to calculate standard incidence ratios (SIR) for the county; hence, Mecklenburg County was selected as the unit of analysis for this investigation. Observed cases of Uveal Melanoma selected for this investigation were diagnosed between 2000 and 2013 in Mecklenburg County, 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 for Mecklenburg County between 2000 and 2013, North Carolina 2000-2013 age-specific (in 10-year intervals) incidence rates for Uveal Melanoma. It should be noted that the incidence rates may be underestimated because the N.C. CCR does not have complete cases for 2012 and 2013 (see Data Source section). The denominator population of Mecklenburg County was the total population in Mecklenburg County for each age group from 2000 to 2013. The annual age-specific populations for Mecklenburg County came from the National Center for Health Statistics.<sup>1</sup>

### *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.<sup>2</sup>

Denominator population of an age group:

Mecklenburg County population between 2000 and 2013 for each age group

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:

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

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

### **Results**

There were 56 observed cases of Uveal Melanoma diagnosed in Mecklenburg County. The standard incidence ratios for both case definitions were less than one, indicating that the incidence of Uveal Melanoma between 2000 and 2013 in Mecklenburg County was not higher than expected (See Table 1.). The confidence intervals further confirmed that observed number of cases for Uveal Melanoma were significantly lower than expected number of cases as both confidence intervals were lower than one.

| Table 1 Observed and Expected Cases, 2000-2013 |          |          |     |           |
|--|----------|----------|-----|-----------|
|  | Observed | Expected | SIR | 95% C.I.  |
| Uveal Melanoma                                 | 56       | 79       | 0.7 | (0.5-0.9) |

### Conclusions

The standard incidence ratios were estimated for both Uveal Melanoma to investigate whether the incidence of Uveal Melanoma was unusually high in Mecklenburg County between 2000 and 2013. As of December 2014, the result of the analysis failed to indicate a higher than expected number of Uveal Melanoma cases in Mecklenburg County during this time period.

The limitation of this investigation is that all cases diagnosed in 2014 are not included due to the lag time in reporting, and the population estimates required to calculate the rates for 2014 is not available at the this time. Therefore, the investigation and the report did not include cases, observed or expected, for the year 2014.

### References

1. Bridged-Race Population Estimates: Data Files and Documentation. The National Center for Health Statistics. URL: [www.cdc.gov/nchs/nvss/bridged\\_race/data\\_documentation.htm#vintage2009](http://www.cdc.gov/nchs/nvss/bridged_race/data_documentation.htm#vintage2009). Updated on June 24, 2014. Accessed on December 17, 2014.
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](http://seer.cancer.gov/seerstat/WebHelp/Standardized_Incidence_Ratio_and_Confidence_Limits.htm). Accessed on December 17, 2014.
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>



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

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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  
May 2015**

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.

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### *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.<sup>1</sup>

### *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.<sup>2</sup>

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:

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

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

## 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.

|                        | <b>Observed</b> | <b>Expected</b> | <b>SIR</b> | <b>95%CI</b> |
|------------------------|-----------------|-----------------|------------|--------------|
| 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](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](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>.

## Appendix 2



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances  
and Disease Registry  
Atlanta GA 30333

April 28, 2015

Jill Swain  
Mayor  
Town of Huntersville  
P.O. Box 664  
101 Huntersville-Concord Road  
Huntersville, North Carolina 28070

Dear Mayor Swain:

Thank you for your letter of November 20, 2014, to Mr. Carl Blair of our Region IV Office in which you indicate your concern about the occurrence of six ocular melanoma cases in a small area of Huntersville, North Carolina (NC). You asked the Agency for Toxic Substances and Disease Registry (ATSDR) to investigate why these cancer cases are occurring in your community. ATSDR's mission under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is designed to determine whether the public has been, or are currently being, exposed to harmful levels of substances released into the environment from a hazardous waste site or facility. If the public is thought to be exposed to harmful levels of substances, ATSDR would evaluate those exposures based on the available environmental sampling data typically collected by the U.S. Environmental Protection Agency (EPA), state, and local regulatory agencies.

To determine whether there has been a release or releases of hazardous substances into environment near Huntersville, NC, we searched the US Environmental Protection Agency's Toxic Release Inventory and Envirofacts databases (<http://www.epa.gov/enviro/index.html>). Those databases allow the public to search multiple environmental databases for facility information, including toxic chemical releases, water discharge permit compliance, hazardous waste handling processes, Superfund status, and air emission estimates. A search of these databases did not contain any information that would indicate that releases of hazardous substances have occurred in the Huntersville, NC. Therefore, we cannot accept your request to investigate the occurrence of ocular melanoma cases in Huntersville, NC. Even if chemical release data had been available it would be unlikely we could determine the cause of a disease or medical condition.

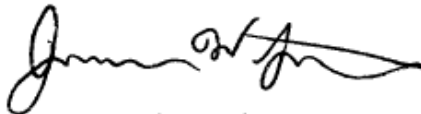
Ocular melanoma is a rare cancer of the eye diagnosed in approximately 2,000-2,500 people annually in the United States. There is no known cause of ocular melanoma, though incidence is highest among people with lighter skin and blue eyes. There are some scientific studies that

indicate people who use tanning beds frequently or participate in welding are at higher risk of being diagnosed with ocular melanoma but those findings are very preliminary.

The Centers for Disease Control and Prevention recommends that the first step to determining whether a particular cancer(s) is occurring more frequently than expected is to consult with the state health department cancer registry (<http://www.cdc.gov/nceh/clusters/default.htm>). Fortunately, the NC DPH has a cancer registry and they have conducted an initial investigation of the occurrence of cancer in Huntersville. On May 1, 2014, NC DPH issued the enclosed preliminary report. That investigation found that there is no consistent pattern of cancer cases and the number of ocular melanoma cases is fairly consistent over the 24 year time period evaluated. It is our understanding that NC DPH and the Mecklenburg County Health Department are currently conducting a follow-up investigation. Should you have any questions regarding NC DPH's activities, please contact Dr. Chandrika Rao, Director, NC Central Cancer Registry, at 919-715-4574 or [Chandrika.Rao@dhhs.nc.gov](mailto:Chandrika.Rao@dhhs.nc.gov).

Thank you for forwarding your concerns to ATSDR. If you have any additional questions regarding ATSDR's petition process or general questions regarding the occurrence of cancer in the United States, please contact Dr. Sven E. Rodenbeck via telephone or e-mail at 770-488-3660 and [Srodenbeck@cdc.gov](mailto:Srodenbeck@cdc.gov) respectively. If you would like, Dr. Rodenbeck can also arrange for one of our physicians to talk with you.

Sincerely,



James Stephens, PhD  
Acting Director  
Division of Community Health Investigations  
Agency for Toxic Substances and Disease Registry



**Appendix 3**

**Adult Cancer Cluster Report Form (Ocular Melanoma)**

*Informant Information (informant is person completing form)*

1. Name of Person Completing Form \_\_\_\_\_

2. Date Form Completed \_\_\_\_\_

3. Address: Street \_\_\_\_\_  
(For address, please list physical street name and number)

4. City \_\_\_\_\_ State \_\_\_\_\_ ZIP \_\_\_\_\_

5. Telephone Number \_\_\_\_\_

6. Relationship to Patient \_\_\_\_\_

*Patient Information (if same as informant, skip to question 11)*

7. Name \_\_\_\_\_

8. Current Mailing Address: Street \_\_\_\_\_  
(For addresses, please list street name and not PO Box Number)

9. City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

10. Telephone Number \_\_\_\_\_

11. Residence address at time of cancer diagnosis (if different from current mailing address above)

Street \_\_\_\_\_  
(For addresses, please list street name and not PO Box Number)

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

How long did the patient live at this address before diagnosis? (Years) \_\_\_\_\_

Please list previous addresses of patient and dates (year moved in/year moved out) of residence prior to diagnosis

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

12. Did the patient ever live on a farm? (Circle) Yes No Don't Know

13. Did the patient live with anyone besides the parents for a significant length of time prior to being diagnosed? (Circle) Yes No Don't Know

If yes, please list address and dates (year)

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14. Before being diagnosed, what schools did the patient attend? Please include dates of attendance and location.

Preschool \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Grade School \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Middle School \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

High School \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

15. Location of primary cancer (anterior eye, posterior eye, orbit, conjunctiva)

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16. Type of cancer (primary, metastatic): \_\_\_\_\_

17. Age at diagnosis (years) \_\_\_\_\_

18. Approximate date when patient first developed symptoms \_\_\_\_\_

19. Date of Diagnosis (month/year) \_\_\_\_\_

20. Physician and facility where the patient was diagnosed and treated

---

21. Sex (circle one) Female Male

22. Race (circle one)    White        Black        American Indian        Asian  
Other (specify) \_\_\_\_\_

23. Color of eyes (circle one)    Blue        Brown        Green        Hazel

24. Color of hair (circle one)    Black    Blonde        Brown        Red

25. Patient's current age (years) \_\_\_\_\_ If deceased, age at death (years) \_\_\_\_\_

26. Patient's Occupation and Industry

Were you working for pay or volunteering outside the home when you were diagnosed with cancer? (Circle)    Yes    No

If yes, describe activities:

Industry \_\_\_\_\_  
Company \_\_\_\_\_  
Job Title \_\_\_\_\_  
Dates Worked \_\_\_\_\_

Were you working for pay or volunteering outside the home before you were diagnosed with cancer? (Circle)    Yes    No

If yes, describe past activities:

Industry \_\_\_\_\_  
Company \_\_\_\_\_  
Job Title \_\_\_\_\_  
Dates Worked \_\_\_\_\_

Industry \_\_\_\_\_  
Company \_\_\_\_\_  
Job Title \_\_\_\_\_  
Dates Worked \_\_\_\_\_

Industry \_\_\_\_\_  
Company \_\_\_\_\_  
Job Title \_\_\_\_\_  
Dates Worked \_\_\_\_\_

Industry \_\_\_\_\_  
Company \_\_\_\_\_  
Job Title \_\_\_\_\_  
Dates Worked \_\_\_\_\_

Did you have to use eye wear (e.g., goggles, safety glasses, sun glasses) for work?  
(Circle) Yes No Don't Know

If yes, describe job

---

Any chemical exposures (e.g., polychlorinated biphenyls, solvents) at work?  
(Circle) Yes No Don't Know

If yes, please list types

---

If yes, describe job

---

Any radiation exposure at work? (Circle) Yes No Don't Know

If yes, describe job

---

Did you do any welding at work? (Circle) Yes No Don't Know

If yes, describe job

---

Did you do any cooking at work? (Circle) Yes No Don't Know

If yes, describe job

---

If yes, describe use of incandescent ovens, microwaves, and other cooking exposures

---

27. Did the patient's mother have any jobs or hobbies while she was pregnant with the patient that involved exposure to chemicals or radiation? (Circle) Yes No

If yes, describe dates of exposure\_\_\_\_\_

---

28. Did the patient's father have any jobs or hobbies that involved exposure to chemicals (e.g., pesticides) or radiation before the patient was born? (Circle) Yes No

If yes, describe dates of exposure\_\_\_\_\_

---

29. Family History of Cancer: list all close blood relatives (grandparents, parents, siblings, uncles, aunts) who have had cancer and give the site and type of cancer (do not give site where cancer has spread)

| Relationship to Patient | Site of Cancer | Type of Cancer |
|-------------------------|----------------|----------------|
| _____                   | _____          | _____          |
| _____                   | _____          | _____          |
| _____                   | _____          | _____          |
| _____                   | _____          | _____          |

30. Did the patient have any medical conditions such as obesity, pertussis, chicken pox, diabetes, asthma, allergies, before being diagnosed with cancer? (Circle) Yes No Don't Know

If yes, describe type and year(s) of occurrence

\_\_\_\_\_

31. Did the patient have a history of dysplastic nevus syndrome? (Circle) Yes No Don't Know

If yes, describe year(s) of occurrence

\_\_\_\_\_

32. Did patient have a history of congenital eye disease? (Circle) Yes No Don't Know

If yes, describe type and year(s) of occurrence

\_\_\_\_\_

33. Did patient have a history of oculodermal melanocytosis? (Circle) Yes No Don't Know

If yes, describe type and year(s) of occurrence \_\_\_\_\_

34. Did patient have a history of uveal nevus? (Circle) Yes No Don't Know

If yes, describe type and year(s) of occurrence

\_\_\_\_\_

35. Did the patient have any previous eye infections before being diagnosed with cancer? (Circle) Yes No Don't Know

If yes, describe type and year(s) of occurrence

\_\_\_\_\_

36. Did patient have a history of eye injury before being diagnosed with cancer? (Circle) Yes No Don't Know

If yes, describe type and year(s) of occurrence

---

37. Did patient or family member have a history of neurofibromatosis?

(Circle) Yes No Don't Know

If yes, describe type and year(s) of occurrence

---

38. Did the patient take any over-the-counter or prescription medications (e.g., birth control) on a regular basis before being diagnosed with cancer? (Circle) Yes No Don't Know

If yes, please list medication(s) and duration

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*Radiation Exposure*

39. Did the patient have any significant radiation exposure (example: dental or other X-rays, sun bathing, and/or artificial tanning) before being diagnosed with cancer? (Circle) Yes

No Don't Know

40. Did the patient have any dental or head and neck X-rays before being diagnosed with cancer?

(Circle) Yes No Don't Know

If yes, describe type and frequency of exposure

---

41.. Did the patient do any frequent sun bathing before being diagnosed with cancer?

(Circle) Yes No Don't Know

If yes, describe frequency of exposure, whether sun glasses and hats were worn, and sun block was applied

---

42. Did the patient have two or more severe sunburns? (Circle) Yes No Don't Know

If yes, describe frequency

---

If yes, describe location on body of sunburns

---

43. Did patient ever have a history of ocular burns from UV radiation exposure?

(Circle) Yes No Don't know

If yes, describe type and year(s) of occurrence

---

44. Did the patient tan artificially (e.g., tanning beds, tanning lamps)?  
(circle) Yes No Don't Know

Describe frequency of sessions (e.g. 2 times a month)

---

Describe duration of sessions (e.g. 20 minute sessions)

---

Describe length of time of artificial tanning and age first begun.(e.g. Used tanning beds for 3 summers starting age 11)

---

If yes to artificial tanning, were eye shields worn? (Circle) Yes No Don't Know

Describe frequency \_\_\_\_\_

45. Did the patient have any hobbies (e.g., welding) that may have emitted ultraviolet radiation before the patient was diagnosed with cancer? (Circle) Yes No Don't Know

If yes, describe dates of exposure

---

46. Did the patient live near overhead high-voltage power lines or electrical substation or microwave tower? (Circle) Yes No Don't Know

If yes, describe proximity and dates of residence

---

*Use of Tobacco*

47. Did the patient ever smoke tobacco on a regular basis before being diagnosed with cancer?  
(Circle) Yes No Don't Know

If yes, how often and how much \_\_\_\_\_

48. Did the patient chew tobacco before being diagnosed with cancer?  
(Circle) Yes No Don't Know

If yes, how often and how much \_\_\_\_\_

49. Did either parent smoke while the mother was pregnant or before the patient developed cancer?  
(Circle) Yes No Don't Know

*Recreation*

50. Did the patient ever engage in water recreation activities (e.g., swimming, water skiing, power boating, sailing) in any body of water (e.g., lake, river)? (Circle) Yes No Don't Know

If yes, describe how often and where \_\_\_\_\_

*Chemical Exposure*

51. Did the patient have any hobbies in which chemicals were used inside or outside of the home before the patient was diagnosed with cancer? (Examples: photography, staining of furniture, gardening)

(Circle) Yes No Don't Know

If yes, list the chemicals used and location \_\_\_\_\_

\_\_\_\_\_

52. Did the patient wear cosmetics around eyes? (Circle) Yes No Don't Know

If yes, describe frequency and type of product \_\_\_\_\_

53. Did the patient's mother use well water or public water for drinking while pregnant?

(Circle) Well Water Public Water Don't Know

If well water, provide home address

\_\_\_\_\_

54. Did the patient use well water or public water for drinking before the patient developed cancer?

(Circle) Well Water Public Water Don't Know

If well water, provide home address

\_\_\_\_\_

55. Did you live close to any hazardous or toxic waste sites, such as leaking underground storage tanks, chemical plants, waste incinerators, or landfills, before you developed cancer?

(Circle) Yes No Don't Know

If yes, describe the site, location, the dates the exposure has been present, and the contaminants that were present.

A. Site \_\_\_\_\_

Location \_\_\_\_\_

Date from \_\_\_\_\_ to \_\_\_\_\_

Contaminants \_\_\_\_\_



B. Site \_\_\_\_\_  
Location \_\_\_\_\_  
Date from \_\_\_\_\_ to \_\_\_\_\_  
Contaminants \_\_\_\_\_

C. Site \_\_\_\_\_  
Location \_\_\_\_\_  
Date from \_\_\_\_\_ to \_\_\_\_\_  
Contaminants \_\_\_\_\_

*Use of Herbal Products*

56. Did the patient use alternative therapies (e.g., supplements) before being diagnosed with cancer? (Circle) Yes    No

If yes, please list

\_\_\_\_\_

57. Are there any other things you can think of that may help us with this investigation?