

Health Consultation

Cluster of Familial Chronic Lymphocytic Leukemia In A Central Wisconsin Farming Family

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
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HEALTH CONSULTATION

Cluster of Familial Chronic Lymphocytic Leukemia In A Central Wisconsin Farming Family

Prepared By:

Wisconsin Department of Health and Family Services
Division of Public Health
Under a Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Summary

The Wisconsin Department of Health and Family Services (DHFS) was requested to assist a county health department regarding an extended family with three deaths due to chronic lymphocytic leukemia (CLL). DHFS met with the family and conducted an environmental investigation, but did not find notable contamination. Elevated lead and arsenic levels on paint of the house could pose a public health hazard in the future for children and DHFS recommended this paint be mitigated prior to allowing young children to visit or live at the house. DHFS suggested the family consider meeting with a genetic counselor to better understand the emerging scientific knowledge related to familial CLL and their potential risk factors.

Statement of Issues

In July 2007, DHFS was contacted by a local public health department (LPHD) for a central Wisconsin county regarding 3 deaths in an extended family that were attributed to B-Cell chronic lymphocytic leukemia (CLL). A surviving family member inherited the rural farmhouse, outbuildings, and land, where these other 3 family members previously lived and was concerned the cancer cases were caused by environmental contamination at the family farm. This surviving family member has not been diagnosed with CLL. LPHD requested technical assistance from DHFS to address the family's health concerns. In response, DHFS met with the family and subsequently collected environmental samples from the farm. In follow-up DHFS wrote a detailed letter to the family describing the results of the environmental investigation. This health consultation summarizes the process and findings of this investigation.

Background

On September 14, 2007, DHFS and LPHD staff met with seven surviving members of the extended family. The family described two prior generations that lived and worked at this farm, starting in 1903 when their grandfather moved into the farmhouse, which was built around 1870. In 1924, their grandmother married their grandfather and moved to the farm. The grandfather died in 1963 in his 60s due to a reported blood cancer. The grandmother was diagnosed with CLL in 1983, and continued living at the farm until she passed away in 1995. There were five offspring in the second generation, 4 sons and 1 daughter. Two of these siblings developed CLL as adults. A daughter was diagnosed with CLL in 2003, 52 years after moving away from the family farm. She died in 2004, at 73 years old. The son lived his entire life at the family farm, was diagnosed with CLL in 2000, at the age of 52 years, and died in 2007. The mother and her two children were diagnosed with B-cell CLL, which was confirmed by the Wisconsin Cancer Reporting System (WCRS). The grandfather's cancer diagnosis and death predated the WCRS, which was established in 1976, but the cause of death reported on the death certificate was "carcinoma."

The family reported the agricultural activities that occurred at the farm were primarily cash-crop farming for corn, alfalfa, oats, and apples. Some livestock were raised but there was not a full-scale dairy. The family stated they were unaware of any industrial activities at the farm that included the use of chemicals or industrial processes. They said petroleum products and

pesticides were used as part of regular farming activities, but large volumes of related chemicals were not received, handled, stored, or mixed at the farm. Currently, only one elder family member is living at the house and no children were reported to be living or regularly visiting the house. This individual living at the house is working to restore all portions of the house as a typical family dwelling.

Chronic Lymphocytic Leukemia (CLL)

Leukemia is a cancer of the blood and bone marrow, and is distinguished by the uninhibited proliferation of blood cells. For U.S. men and women, leukemia is the 9th and 11th most common type of cancer (NPCR 2007), respectively, with age-adjusted incidences of 15.2 and 9.1 (per 100,000¹). Among men and women in Wisconsin, leukemia is the 7th and 8th most common type of cancer, respectively, with age-adjusted incidences of 18.0 and 10.8 (WCRS 2007).

CLL is the most common type of leukemia, and is noted by a change in lymphocytes formed in bone marrow. These changed lymphocytes then gradually multiply and crowd out normal blood-forming cells in bone marrow. The changed lymphocytes are unable to fight infection like normal lymphocytes. In the U.S., CLL accounts for approximately one-third of leukemia-type blood cancers, with a slightly higher incidence rate of 5.5 among men than the rate of 2.7 for women. The U.S. incidence of CLL is highest among whites, with a decreasing order of incidence observed among blacks, Hispanics, Native Americans, then Asians. This difference among ethnic groups is also observed with international CLL rates, with the highest incidence among whites of North America and Europe, and the lowest in Asia populations.

The Wisconsin Cancer Reporting System describes 2,731 news cases of CLL in Wisconsin, between 1995 and 2004, resulting in an age-adjusted rate of 4.9 per 100,000. For the same ten-year period, this central Wisconsin county had 10 cases of CLL, deriving an age-adjusted rate of 4.0. When ranked against other states, Wisconsin has the 4th highest CLL incidence rate, a statistically significant difference from the U.S. rate (Reis 2007). Several other states in the upper Midwest (Illinois, Iowa, & Minnesota) also rank among the top-ten states for CLL incidence.

There are no clear environmental risk factors for CLL, but some studies have described a possible association between CLL and farming (Brown 2003), certain occupations in rubber and chemical industries (Goldin 2007), and herbicide exposures among Vietnam veterans (IOM 2007). Yet, there is a growing body of knowledge that the occurrence of CLL is affected by genetic factors. Goldin (2007) described “familial CLL” as families with two or more individuals affected by CLL. A number of cases of familial CLL have been reported in the literature, suggesting “a dominantly inherited susceptibility factor” within each family (Lynch 2002). A recent study (Raval et al, 2007) identified a gene mutation among five individuals with CLL from two generations of an Ohio farming family. The authors speculated that this mutation may result in a seven-fold increased risk of developing CLL.

1. Age-adjusted, per 100,000, to the 2000 U.S. standard population.

During the September 14th meeting with the family, staff with LPHD and DHFS stated that agencies regard three CLL cases in a family household to be extremely unusual. Staff also discussed with the family that while environmental and behavioral risk factors have been associated with other leukemia and lymphomas, studies have not identified a plausible cause or likely association between CLL and any environmental, radiation, or other external risk factors. They also shared with the family recently published studies which describe a growing base of information that the occurrence of CLL may be mostly due to genetic risk factors. Staff suggested that the family consider meeting with a genetic counselor to better understand this expanding field of information and how it may relate to the family. Staff also suggested the family discuss with the genetic counselor the details and merits of participating in the National Cancer Institute's Chronic Lymphocytic Leukemia Registry (NIH 2007).

Despite this lack of known or suspected environmental risk factors for CLL, the unusual nature of this case prompted DHFS to visit the house and property, and to evaluate for notable environmental conditions or contamination.

Site Visit

In follow-up to meeting in September 2007, on October 19, 2007, staff from LPHD and DHFS visited the family's farm. There are several metal outbuildings and a large 2-story brick home with a third story attic. Family members reported that when they resided in the dwelling, they primarily lived in rear portions of the first and second floors, which were intended to be servant quarters. The front portion of the house, on the first floor, had clearly not been occupied for many years and was used for storage. The second and third story of the house was used in the past for raising chickens, and was in poor condition. On both stories, several inches of bird fecal droppings remained on the floors, with a noticeable ammonia odor that could be a nuisance to most people, but unlikely to pose a health concern. People who disturb the bird fecal droppings and inhale dust could be at increased risk of developing histoplasmosis. There were leaks in the ceiling in many locations and apparent water damage visible in the lower floors. Staff also saw possible asbestos-containing wrap on heating ducts in the basement.

Staff used an x-ray fluorescence (XRF) meter to screen for heavy metals in dust on the floor and paint on interior and exterior walls. The XRF meter indicated paint on several internal walls, windows, and many external walls had lead and arsenic levels as high as 7,000 parts per million (ppm). Staff used a Lumex 915+ mercury vapor analyzer to screen indoor air for mercury vapors, but no elevated levels were detected. Staff used the XRF to screen exposed surface soils in the yard, inside and around outbuildings, and in the adjacent orchard, but found no elevated levels of heavy metals.

DHFS staff collected water samples from the drinking water well and submitted samples to the Wisconsin State Laboratory of Hygiene (WSLH) for testing of bacteria, metals and minerals, pesticides, and volatile organic compounds (VOCs). Staff also collected indoor air samples from the basement and living room of the home, as well as an outdoor, upwind air sample for determining background ambient air concentrations. Air samples were analyzed for VOCs using EPA Method TO-15a. The costs for laboratory analysis were covered by the basic agreement contract between DHFS and WSLH.

Discussion

The water samples collected by DHFS staff from the drinking water well on the property were analyzed by WSLH for selected pesticides, VOCs, metals and minerals, and bacteria. Water samples analyzed for pesticides and VOCs did not have any detectable levels of the targeted chemicals. The water sample analyzed for metals and minerals had very low levels of the targeted chemicals, all of which were at levels typical of private well water in Wisconsin and not a health concern.

The water sample tested for bacteria found unsafe levels of total coliform bacteria, but fecal coliform and *E.coli* bacteria were absent. The results of this water sample may have been affected by the inability of DHFS staff to properly sterilize the sample tap with a flame prior to collecting the water sample, which was due to very windy conditions at the well. DHFS recommended repeating the bacteria test for the well water, and using the proper flame disinfection method. Should well water continue to be bacteriologically unsafe, the property owner should take actions to properly disinfect the well.

The drinking water well was also tested for fluoride because at certain levels fluoride in drinking water can reduce cavities in children and at high levels can lead to dental or skeletal fluorosis. The detected level of 0.14 parts per million is low and DHFS typically recommends a fluoride supplement for a child who would use this well as their main source of drinking water.

DHFS staff also collected two air samples inside of the home that were tested for VOCs. Extremely low levels of VOCs were detected in indoor air, including: dichlorodifluoromethane, chloromethane, ethanol, acetone, halocarbon 11, isopropyl alcohol, methyl ethyl ketone, benzene, toluene, and 1,4-dichlorobenzene. The presence and very low levels of these VOCs detected in the samples were typical in indoor air of a home, and do not pose a health concern. As a comparison, staff collected an upwind, outdoor air sample when the indoor samples were being collected. This upwind, air sample had similar levels of dichlorodifluoromethane, chloromethane, acetone, halocarbon 11, isopropyl alcohol, methyl ethyl ketone, benzene, and toluene. The chemical 1,4-dichlorobenzene was only detected in the indoor air samples, but this is also the principal ingredient in mothballs and urinal cakes, and is not uncommon in the indoor air for a typical Wisconsin home.

The XRF meter indicated elevated lead and arsenic as high as 7,000 ppm in paint on internal and exterior walls of the house. Such lead and arsenic levels could pose a public health hazard to young children who live in or regularly visit the house. Fortunately, no children live in or regularly visit the house. This would pose a *public health hazard* to children who, in the future, may come to live in or regularly visit the home. DHFS recommended that all lead and arsenic containing paint be removed from the house prior to young children taking up residence.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are

adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

DHFS took these child health considerations into account when making recommendation to the family regarding future visitation or habitation of young children in the home. DHFS recommended the family consider genetic counseling in order to better understand what may be the risks for CLL by future generations of the family.

Conclusions

An environmental investigation of indoor air and drinking water at a single family farm house in a central Wisconsin county did not find any notable chemical contamination issues. The indoor air and drinking water at this home pose *no apparent health hazard*.

Elevated levels of heavy metals in external and internal paint of the house could pose a long-term developmental health risk in the future for children who might live at or regularly visit the house. This poses a *public health hazard* in the future.

The presence of large amounts of bird droppings in portions of the house could pose a health risk to residents and visitors for developing histoplasmosis, about which DHFS advised the property owner.

Recommendations

DHFS recommends that all lead and arsenic containing paint be mitigated at the house prior to allow young children to either regularly visit or live on the premises.

DHFS suggests that the family consider meeting with a genetic counselor to better understand the emerging scientific knowledge related to familial CLL and their potential risk factors.

Public Health Action Plan

DHFS responded to a request for technical assistance from the central Wisconsin county Department of Health and Human Services regarding a family with three cases of CLL and their environmental health concerns.

DHFS met with the family to learn of and better understand the three cases of CLL and the family's medical and occupational history.

DHFS visited the family's farm house and collected drinking well water and air samples to examine for any notable environmental contamination issues.

DHFS sent a letter to the family detailing the laboratory results of all media samples, as well as describing the public health implications of the laboratory data and observations made during the visit to the family's house. This letter included the human health implications of bird droppings inside of the house and DHFS suggestions for addressing this issue.

DHFS will continue to work with the LPHD to address the environmental health questions and concerns of this family related to the family's farm house and their medical history.

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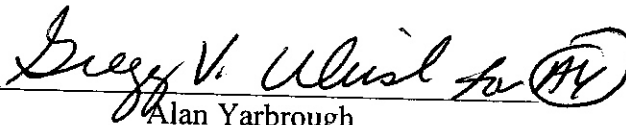
Certification

This Health Consultation was prepared by the Wisconsin Department of Health and Family Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved methodology and procedures existing at the time the Health Consultation was begun. Editorial review was provided by the cooperative agreement partner.



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The Division of Health Assessment and Consultation, ATSDR, has reviewed this Health Consultation and concurs with the findings.



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