



Guam Childhood Leukemia Investigation

Navy Environmental Health Center

March 2004

The Navy has been investigating a sailor's concern that there might be a higher than normal number of leukemia cases among Navy children who have lived on Guam because of environmental exposures on the island. The well being of sailors and their families is paramount, so the Navy takes reports such as these very seriously. The first step in addressing this serious concern is to determine if there actually is a higher than normal rate of leukemia among Navy children who have lived on Guam. The Navy Environmental Health Center (NEHC) recently completed a study to answer this question.

Leukemia and the NEHC Study

Leukemia is a cancer of the blood or blood forming organs. Although cancer is rare among children, leukemia is the most common form of childhood cancer. The exact cause of childhood leukemia is unknown. Sporadic elevations in rates for cancers such as childhood leukemia are not unusual. Numerous childhood leukemia investigations have been conducted around the world when elevated rates are suspected to be occurring in one area or among one group of people. Despite many investigations, a cause or explanation for the elevated leukemia rates has yet to be discovered. Typically the sporadic rate increase recedes to normal over time.

The NEHC study was designed to determine if there is a higher than normal rate of leukemia cases diagnosed per year among Navy children who have lived on Guam. It also included a review of medical literature to see if there are any documented connections between reported environmental exposures on Guam and increased rates of childhood leukemia.

Steps in the NEHC investigation:

- (1) selecting a study group,*
- (2) calculating the rate of leukemia cases per year among the study group,*
- (3) comparing the study group's leukemia rate to the normal, or "expected," leukemia rate, and*
- (4) reviewing medical research to see if there are any associations between reported environmental exposures on Guam and childhood leukemia.*

(1) Selecting the study group: NEHC wanted to select a large study group to avoid missing any cases and make the study as statistically sound as possible. In selecting the study group, researchers also had to ensure they had access to medical records that could be searched quickly and accurately using computer programs.

The study group selected included Navy children who were diagnosed with leukemia from 1993-2002 and had lived on Guam prior to their diagnosis. The year 1993 was selected as a starting point because it was the first year computerized records could be used to link where family members lived with their medical treatment records. Without the use of computerized records, the study would have been very time consuming, labor intensive, and less accurate because cases could easily be missed, resulting in incorrect results.

(2) Calculating the rate of leukemia cases: The medical records of the study group children were reviewed using several different computer data bases to identify as many diagnosed cases as possible. Once the cases were identified and verified, NEHC calculated the leukemia rate for the group using the total number of diagnosed leukemia cases, the number of children involved in the study, and the number of years included in the study. The rates for two distinct types of childhood leukemia, Acute Lymphoblastic Leukemia (ALL) and Acute Myelogenous Leukemia (AML) were calculated for the NEHC study.

(3) Comparing the study group's leukemia rate to the normal, or "expected," leukemia rate: Most cancer investigations start by comparing the calculated rate for their study group to the rate for the general U.S. population. These rates are published by the National Cancer Institute and are known as SEER rates.

The SEER rates are actually an *estimate* of the cancer rates for the U.S. population because they are based on information from 11 different cancer registries that cover approximately 14% of the U.S. population. They are very useful as a screening tool to determine if more study is needed.

If a study group's cancer rate is lower than the SEER rate, then there likely is not a problem among the study group. If a study group's rate is higher than the

SEER rate, then generally more study is needed to determine if a problem actually exists.

The comparison to the SEER values for this study produced mixed results. The number of AML cases was not significantly higher than expected for the Navy children who lived on Guam. However, the number of ALL cases for these children was higher than SEER value. From these results, NEHC determined that more study was needed.

SEER rates are good to use for an initial comparison, but to determine if an actual problem exists the expected or normal rate needs to be calculated using information on all of the children in the comparison group, and not just an estimate based on a percentage of the population as is done with the SEER rates. Similarity between the groups is also important, because the more characteristics or risk factors that children in the study group and comparison group have in common, the more meaningful the results.

NEHC concluded that other Navy children are the best comparison group for this study because the study group is a subset of this much larger, but similar group. Also, NEHC has access to the medical records needed to calculate the actual ALL and AML leukemia rates among Navy children world-wide for the study time frame.

The results indicate that Navy children who have lived on Guam have a similar incidence rate of both ALL and AML as other Navy children world-wide.

(4) Reviewing medical research: The concerned sailor which started this investigation also questioned if exposure to certain chemicals on Guam could be causing a higher than normal number of leukemia cases in children. NEHC reviewed available medical literature and the recently published Centers for Disease Control (CDC) report for Fallon and Churchill County, NV, to determine if environmental exposures to certain chemicals of concern might be a cause for any increase in leukemia rates among Navy children on Guam.

The review did not find any significant associations between these chemicals of concern and ALL or AML in children in Guam or elsewhere in the world. To explore if other environmental exposures may be impacting the children of Guam citizens, the leukemia rates from the Guam Department of Public Health were reviewed and compared with the SEER rate for children in the U.S. general population. The leukemia rate was lower among children in Guam than in the U.S. general population, indicating that environmental exposures on Guam are not increasing leukemia risks in children who live on the island.

Conclusions and Recommendations

The difference between the rate comparison results in this study was not large enough to indicate that a problem or unusually elevated leukemia rate exists. NEHC considered the results of the leukemia rate comparisons and the medical literature review and concluded:

Living in Guam does not appear to have increased the risk of leukemia among the Navy children studied. Because the causes of childhood leukemia are unknown, NEHC will continue to monitor medical treatment records Navy-wide to determine if more investigation is needed.

The investigation results do need to be considered preliminary because of the small number of cases identified and the relatively small study population. NEHC recommended further investigation and continued monitoring of the children in the study population before any final conclusions or recommendations can be made. Accordingly, Navy Medicine is routinely monitoring the medical records of Navy dependents that have lived on Guam to determine whether additional cases surface and, if so, whether further investigation is needed.

In addition, the Navy Surgeon General recommended that the study be expanded to include Air Force personnel because there was also a large Air Force military and dependent population on Guam during the study period. In response, the Air Force Institute for Operational Health (AFIOH) conducted a similar study and determined that there was not a statistically significant increase in the number of cases of Air Force children diagnosed with leukemia while living in Guam.

AFIOH further evaluated the data by combining the Air Force and Navy study groups. The combined rate from adding the Air Force and Navy cases diagnosed in Guam together was found not to be significantly increased over the expected or normal rate of childhood leukemia for the general U.S. population. After reviewing the data and available medical literature, AFIOH researchers felt no further study is needed.

For More Information about This Study

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