CDC

# LEUKEMIA SURVEILLANCE PROGRAM

REPORT NO. 2

DECEMBER 1, 1967

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL
NATIONAL
COMMUNICABLE DISEASE CENTER
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# PREFACE

The leukemia surveillance program was begun in 1966 by the National Communicable Disease Center (NCDC) in association with the National Cancer Institute (NCI). The program consists of a series of leukemia case reporting projects in different parts of the United States with a central case registry maintained at the NCDC. The program's goals are 1) to develop a source of accurate and current leukemia incidence data in the United States and 2) to assist research efforts, especially in the area of viral leukemogenesis, by identifying promptly after diagnosis individual cases or groups of cases worth special epidemiologic, genetic and virologic investigation.

This report contains data obtained through State and Local Health Departments participating in the leukemia surveillance program. Much of this information is preliminary and it is distributed primarily for the use of persons concerned with leukemia and cancer case-reporting or with related epidemiologic activities. Anyone wishing to quote this report is urged to consult the original investigators for confirmation and interpretation.


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## SUMMARY

This report presents data received by the leukemia surveillance program concerning cases of leukemia diagnosed from July 1966 through June 1967. During this time, a total of 583 cases were diagnosed in 8 reporting areas participating in the program. These cases are analyzed in comparison with expected incidence and according to their distribution by age, race and sex, type of leukemia, and reporting area.

Also described in this report are several recent field investigations in which the NCDC has participated. These include studies of 6 leukemia case clusters and one instance of familial leukemia.

## REPORTING AREAS

The leukemia surveillance program presently includes 10 reporting areas. In 7 of these areas (Table 1), case reporting began at the time the surveillance program started (July 1, 1966). In one area (Utah), case surveillance began on January 1, 1967. Case reporting projects have recently been established in two additional areas:

1. Harris County, Texas: Case reporting, retrospective to January 1, 1967, began in September 1967 for all cases of leukemia among residents of Houston and Harris County. Surveillance activities are being conducted in cooperation with the Harris County Health Department, the Houston Health Department, the Texas State Health Department, Baylor University (Texas Children's Hospital), the M.D. Anderson Hospital and Tumor Institute, and the University of Texas School of Public Health.

2. Nassau County, New York: Case reporting retrospective to January 1, 1967, was begun in October 1967. Surveillance is being limited to cases of childhood leukemia (under age 15) among Nassau County residents. This case reporting project is being sponsored by the Nassau County Health Department, Joseph H. Kinnaman, M.D., Commissioner of Health.

In most reporting areas, surveillance encompasses leukemia of all types at all ages. In two areas, however, reporting is being limited to leukemia of specific types or in specific age groups. In Utah, surveillance is directed primarily at cases of acute leukemia. In Nassau County, as mentioned above, case reports are being sought for childhood leukemia only. A single case report form (designed to handle cases of lymphoma as well as leukemia) (Figure 1) is used by all 10 areas in forwarding data to the central NCDC registry.

## INCIDENCE DATA

This analysis concerns 583 cases diagnosed between July 1, 1966, and June 30, 1967, in residents of the 8 reporting areas listed in Table 1. This number of cases represents somewhat fewer cases than might be expected from 1960 incidence estimates. In part, this reflects a lag in reporting, especially for chronic cases. The bulk of the case deficit, however, is accounted for by the state of Washington where effective methods of case surveillance have proved more difficult to develop than in other more compact and centralized reporting areas. In other reporting areas, numbers of cases reported compare closely with expected numbers. (This is true of Utah, as well, if one bears in

mind that case reporting there is focused on acute leukemia and includes no cases diagnosed before January 1, 1967.)

Age, race and sex: Distribution of cases by race, sex and age are shown in Tables 2, 3, and 4. The ratio of male to female cases is reversed from expected in 5 of the reporting areas (Alameda County, Connecticut, Rhode Island, Utah and Washington). While the reason for this sex ratio reversal is not clear, it may merely represent an artefact of incomplete reporting. In the areas of Kansas City and Atlanta where case reporting seems most complete, the expected excess of male over female cases was found.

Case distribution by age follows expected patterns both within individual reporting areas and for the entire group of 583 cases. Among children, cases most commonly appear in the 1-4 year age group, while for adults numbers of cases steadily increase with age.

Type of leukemia: Each reporting area shows larger numbers of cases of acute leukemia than chronic leukemia (Table 5). The deficit in chronic leukemia cases probably reflects slower and less complete reporting. A small number of cases designated as "subacute" are included. All but one of these cases occurred in elderly patients (Table 6).

Predominant cell types are lymphocytic and granulocytic, but with substantial numbers designated as monocytic and undifferentiated. Four cases are described as having other cell types: 2 cases of acute histiocytic leukemia and 2 of leukemic reticuloendotheliosis (one designated as chronic leukemia).

As expected, acute lymphocytic leukemia (ALL) accounts for the bulk of cases under age 20, showing a marked peak in the 1-4 year age group (Table 6). No such peak is present for cases of acute granulocytic leukemia (AGL) under age 20. AGL accounts for the majority of acute cases in adults. Chronic leukemia is limited almost entirely to adults, with chronic granulocytic leukemia (CGL) more common among young adults than chronic lymphocytic leukemia (CLL).

## UNUSUAL CASE FEATURES

Among the 583 cases, a number were reported as having unusual features. These cases, of course, do not represent the true incidence of such features in this case series but include only those cases for which some unusual feature was mentioned on the surveillance report form. These cases are summarized below and in Table 7.

Special clinical features: One case was reported as having histologic features of Burkitt's tumor. There was one case of congenital leukemia, AGL in a 1-month-old child. Five cases of AGL were designated as DiGuglielmo's disease or erythroleukemia.

Associated disease in patients: Eleven patients had a history of coexistent or preceding lymphoma. These included 3 children with ALL developing from lymphosarcoma, 5 adults with diagnoses of CLL and lymphosarcoma, 2 adults with ALL and lymphosarcoma, and one adult with leukemic reticuloendotheliosis following a diagnosis of reticulum cell sarcoma. Eight patients (all adults) had a personal history of cancer: 2 had CLL, 1 with bladder cancer and 1 with adenocarcinoma of the sigmoid colon. The other 6 had acute leukemia, 2 with malignant melanoma and one each with laryngeal cancer, adenocarcinoma of the uterus, adenocarcinoma of the ascending colon and cancer of the breast. One patient (an 80-year-old man) developed CGL one year after diagnosis of polycythemia vera. Two patients had leukemia associated with congenital malformations, one a 50-year-old man with ALL and mongolism, and one an 8-year-old boy with acute monocytic leukemia and syndactyly.

Associated disease in family: Thirteen patients had a history of leukemia, cancer or congenital malformation in immediate family relatives. These cases are listed below:

| Patients | | Family Members | |
|---|---|---|---|
| age, race, sex | diagnosis | relation | diagnosis |
| 58 WM | acute lymphocytic | daughter | acute leukemia |
| 85 WF | subacute granulocytic | sister | acute leukemia |
| 72 WF | chronic lymphocytic | father | leukemia |
| 71 WM | chronic lymphocytic | brother | leukemia |
| 39 WM | acute granulocytic | daughter | cancer of hip |
| 57 WM | chronic lymphocytic | brother | cancer of stomach |
| 92 WM | acute granulocytic | father | cancer |
| | | brother | cancer |
| 85 WF | subacute granulocytic | mother | cancer |
| | | brother | cancer |
| 63 WF | acute granulocytic | mother | cancer of breast |
| 68 WF | acute granulocytic | mother | cancer of breast |
| | | sister | cancer of breast |
| 13 WF | acute lymphocytic | father | cancer |
| 3 WF | acute granulocytic | brother | mongolism |
| 2 WM | acute lymphocytic | sib | club foot |

Epidemiologic features: Seven patients had histories of unusual exposures to x-rays. Four had histories of exposures to a variety of potentially toxic chemicals. One patient (a 7-year-old girl) had contact with a herd of deer in which several animals were sick at the time of her illness onset.

## EPIDEMIOLOGIC STUDIES

During the past year, the NCDC has continued its participation in field investigations of leukemia cases occurring under unusual circumstances. This has largely involved studies of leukemia case clusters or instances of familial leukemia. The main findings in 7 such studies are summarized below. Six of these involved leukemia clusters and 1 a family with multiple leukemia cases.

1. Monticello, Utah: During the 10 year period, 1956-1965, 4 cases of leukemia were diagnosed in residents of this isolated southeastern Utah town (1960 population: 1,845). An investigation of these cases was conducted in the spring of 1967 in cooperation with the Utah State Department of Health.

All 4 cases occurred in children and all were diagnosed as ALL.

| Age, race, sex | Date of onset | Diagnosis |
|---|---|---|
| 3 WF | September 1956 | ALL |
| 12 WF | August 1959 | ALL |
| 15 WM | September 1964 | ALL |
| 9 WF | May 1965 | ALL |

These cases represented more than 10 times the number expected (0.34) among Monticello children for the 10 year period.

Two features of these cases seemed unusual, beyond their being limited to ALL in children. a) The 2 most recent cases had their onset within 8 months of each other in 1964-1965. b) Although none of the patients or their families were related or closely acquainted, all 4 were closely

associated with the town's one elementary school. Two were students at the school at the time of their illness onset, 1 was a pre-school child with 3 older sibs attending the school at onset, and 1 was a high school student whose father was principal of the elementary school.

The town of Monticello was the site of a uranium refining mill between 1949 and 1960. As far as could be learned, there was no relationship between this mill and the 4 leukemia cases.

2. Parowan and Paragonah, Utah: Four cases of leukemia occurred between 1956 and 1967 in these two adjacent southwestern Utah towns (combined 1960 population: 1,786). Epidemiologic investigation of these cases was carried out in cooperation with the Utah State Department of Health in early 1967. The 4 cases represent a 2-fold increase in overall leukemia incidence for these two towns (expected incidence, 1.4 cases in 11 years).

Several features of these cases seemed remarkable. a) All 4 cases were diagnosed as acute leukemia, (2 lymphocytic and 2 granulocytic). No cases of chronic leukemia were known to have occurred in either town.

| Age, race, sex | Date of onset | Diagnosis |
|---|---|---|
| 13 WF | October 1959 | ALL |
| 15 WM | August 1960 | ALL |
| 55 WM | September 1966 | AGL |
| 13 WM | January 1967 | AGL |

b) The 4 cases occurred in two groups (Figure 2). The first 2 occurred within 10 months of each other in 1959-1960, the latter 2 within 4 months of each other in 1966-1967. c) Although there were no known associations among all 4 cases, 3 occurred in teen-age children all of whom attended the Parowan High School at the time of their illness onset.

3. Beulah, North Dakota: Two cases of acute leukemia occurred in this midwestern town (1960 population: 1,318) in the fall of 1966. Investigation of these cases was conducted in cooperation with the North Dakota State Health Department.

Expected incidence of leukemia in Beulah was estimated at roughly one case every 10 years. No previous cases of acute leukemia had been diagnosed in the town since 1953. Both cases occurred in middle-aged men:

| Age, race, sex | Date of onset | Diagnosis |
|---|---|---|
| 55 WM | October (November) 1966 | acute leukemic reticuloendotheliosis |
| 50 WM | October 1966 | acute leukemic reticuloendotheliosis |

Several features of these cases seem unusual: a) Both had their onset at the same time, in October or November of 1966; b) Both were diagnosed as having the same relatively rare leukemic cell type (reticuloendotheliosis); and c) The two men at the time of their illness onset were next door neighbors.

4. Warwick, New York: Two cases of AGL in adult men from Warwick, New York, (1960 population: 12,551) were diagnosed in August 1967. These cases were studied in cooperation with the New York State Department of Health and Dr. Janet Cuttner, Mount Sinai Hospital, New York City. Both cases

had their onset in July 1967.

| Age, race, sex | Date of onset | Date of diagnosis | Diagnosis |
|---|---|---|---|
| 52 WM | July 1967 | August 1967 | AGL |
| 31 WM | July 1967 | August 1967 | AGL |

Although the two men did not live close together in Warwick, both worked at the same automobile factory in Mahwah, New Jersey.

5. Douglas, Georgia: In May 1967, in conjunction with the Georgia State Department of Public Health, an investigation was made of 3 cases of leukemia reported to have occurred in residents of a single house in the southeastern Georgia town of Douglas (1960 population: 8,736). The 3 patients were from three different families living consecutively in a six-room, one-family house.

| Age, race, sex | Date of onset | Period of residence in house | Diagnosis |
|---|---|---|---|
| 7 WM | July 1958 | 1952-1957 | ALL |
| 36 WF | March 1963 | 1957-1963 | ALL |
| 5 WM | December 1966 | 1964-present | CGL |

The first case was a child with ALL, the second a woman with ALL, and the third a child with CGL (Philadelphia chromosome negative). The third patient was the grandnephew of the second. Illness in the first patient developed several months after his family moved away from the house in question. Materials used in constructing the house were typical for the area. Radiation levels in the house and on its lot were not elevated. Inquiries concerning the fate of earlier occupants of the house are in progress.

6. Metuchen, New Jersey: In September 1967, a study in cooperation with the New Jersey State Department of Health was made of 3 leukemia cases among residents of a single residential block in Metuchen, New Jersey (1960 population: 13,581). Two of these 3 patients were adults with CLL diagnosed in 1963; one was a child with acute leukemia diagnosed in 1965.

| Age, race, sex | Date of diagnosis | Diagnosis |
|---|---|---|
| 65 WF | February 1963 | CLL |
| 70 WM | August 1963 | CLL |
| 1 WF | February 1965 | acute stem cell leukemia |

Expected incidence in this one-block area was estimated at about 0.1 case for the 7 year period, 1960-1966. No special associations were found among these 3 cases. Incidence data collected for leukemia in all of Metuchen, however, has suggested a concentration of cases since 1960 in the southern half of the town (Figure 3).

Although each of the above clusters may merely reflect chance aggregation, all 6 showed features which made other etiologic factors distinct possibilities. Because of this, several special studies have been undertaken in each cluster area:

1) Serum and peripheral blood leukocytes have been collected from all available immediate family relatives and surviving patients. Cells from these persons are being grown in vitro at the John L. Smith Memorial for Cancer Research, Maywood, New Jersey, in conjunction with the Special Virus Leukemia Program of the NCI. Efforts will be made to study these cell cultures for the presence of virus-like particles or evidence of viral activity. Serum specimens are being stored at the NCDC in anticipation of future possible research use.

2) Selected environmental materials (soil, water, etc.) have been collected to be screened for radioactivity content at the Southeastern Radiological Health Laboratory (USPHS) in Montgomery, Alabama. In certain cluster situations, measurements have also been made of levels of background radiation.

3) In Monticello and Parowan - Paragonah, Utah, and in Beulah, North Dakota, community-wide questionnaire surveys have been conducted to collect epidemiologic and demographic data on the populations of these towns as a whole. These surveys have been coupled with collection of serum and peripheral blood smear specimens from persons surveyed in each community.

Familial leukemia in Mississippi: Studies of 2 families in southern Mississippi in which multiple cases of leukemia have occurred are being carried out in conjunction with the Mississippi State Board of Health and the St. Jude Children's Research Hospital, Memphis, Tennessee. These families were encountered during an investigation of an apparent leukemia case cluster in Picayune, Mississippi. The 2 families are related by marriage; among their members, 10 cases of leukemia were found to have occurred (Figure 4). These cases are listed below by year of diagnosis. They include 6 cases of CLL, 2 of AGL, and 2 of acute leukemia, cell type unspecified.

| Initials | Age, race, sex | Year of diagnosis | Diagnosis |
|---|---|---|---|
| A.M. | 47 WM | 1951 | CLL |
| S.P. | 17 WF | 1952 | Acute leukemia |
| M.L. | 57 WF | 1954 | CLL |
| M.N. | 44 WF | 1955 | CLL |
| L.L. | 63 WM | 1957 | Acute leukemia |
| N.S. | 58 WM | 1957 | CLL |
| R.P. | 47 WF | 1957 | AGL |
| C.G. | 50 WF | 1959 | CLL |
| S.P. | 15 WM | 1966 | AGL |
| L.M. | 59 WM | 1967 | CLL |

The 6 cases of CLL were remarkable in that they all occurred in two first cousin sibships. Two cases of acute leukemia (R.P., 1957 and S.P., 1952) occurred in a mother and her daughter.

Several special laboratory studies have been undertaken in this family. Cytogenetic studies of peripheral blood lymphocytes are being carried out on 21 first degree relatives of the several leukemia cases. Serum from each of these persons has been stored at the NCDC and white blood cell differentials have been done on peripheral blood smears; one of these smears served to diagnosis CLL in L.M.. Peripheral blood leukocytes from this patient have been put into tissue culture at the John L. Smith Memorial for Cancer Research in a search for evidence of viral activity.

Table 1

Population, Expected Numbers of Leukemia Cases (1960) and Observed Numbers of Cases (July 1966-June 1967) by Reporting Area.

| Reporting Area | 1960 Population | | | Expected number of cases, 1960* | Number of cases diagnosed July 1966-June 1967 |
|---|---|---|---|---|---|
| | Total | White | Nonwhite | | |
| Alameda County, California | 908,209 | 768,996 | 139,213 | 64.52 | 51 |
| Connecticut | 2,535,234 | 2,423,816 | 111,418 | 187.68 | 180 |
| Metropolitan Atlanta (Clayton, Cobb, DeKalb, Fulton and Gwinnett Counties, Georgia) | 1,017,188 | 785,019 | 232,169 | 58.74 | 63 |
| Metropolitan Kansas City (Johnson and Wyandotte Counties, Kansas, and Clay, Jackson and Platte Counties, Missouri) | 1,062,843 | 944,160 | 118,683 | 74.90 | 96 |
| Metropolitan Minneapolis - St. Paul (Hennepin and Ramsey Counties, Minnesota) | 1,265,379 | 1,238,758 | 26,621 | 93.69 | 64 |
| Rhode Island | 859,488 | 838,712 | 20,776 | 66.19 | 53 |
| Utah | 890,627 | 873,828 | 16,799 | 56.60 | 19** |
| Washington | 2,853,214 | 2,751,675 | 101,539 | 214.99 | 57 |
| Total | 11,392,182 | 10,624,964 | 767,218 | 817.31 | 583 |

* Corrected for age, race and sex and based on mortality rates for leukemia in the United States, 1960.

**Case reporting primarily limited to acute leukemia; includes only cases diagnosed since January 1, 1967.

Table 2

Cases by Race, Sex and Reporting Area
July 1966 - June 1967

| Reporting Area | White | | | Nonwhite | | | Unknown Race | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| Alameda County, California | 18 | 24 | 42 | 5 | 3 | 8 | - | 1 | 1 | 23 | 28 | 51 |
| Connecticut | 82 | 94 | 176 | 1 | 3 | 4 | - | - | - | 83 | 97 | 180 |
| Atlanta | 34 | 23 | 57 | 4 | 2 | 6 | - | - | - | 38 | 25 | 63 |
| Kansas City | 58 | 26 | 84 | 10 | 2 | 12 | - | - | - | 68 | 28 | 96 |
| Minneapolis - St. Paul | 32 | 29 | 61 | 2 | 1 | 3 | - | - | - | 34 | 30 | 64 |
| Rhode Island | 21 | 30 | 51 | 1 | - | 1 | 1 | - | 1 | 23 | 30 | 53 |
| Utah | 8 | 11 | 19 | - | - | - | - | - | - | 8 | 11 | 19 |
| Washington | 24 | 31 | 55 | 1 | - | 1 | - | 1 | 1 | 25 | 32 | 57 |
| Total | 277 | 268 | 545 | 24 | 11 | 35 | 1 | 2 | 3 | 302 | 281 | 583 |

Table 3

Cases by Age and Reporting Area
July 1966 - June 1967

| Reporting Area | Age Group | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | <1 | 1-4 | 5-9 | 10-14 | 15-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80+ | Unknown | |
| Alameda County California | - | 2 | 1 | 1 | - | 3 | 3 | 1 | 7 | 9 | 14 | 10 | - | 51 |
| Connecticut | 1 | 9 | 4 | 6 | 5 | 3 | 3 | 14 | 16 | 36 | 51 | 31 | 1 | 180 |
| Atlanta | - | 5 | 2 | 1 | 4 | 5 | 4 | 5 | 6 | 13 | 10 | 8 | - | 63 |
| Kansas City | 1 | 4 | 6 | 4 | 5 | 4 | 5 | 7 | 10 | 14 | 24 | 12 | - | 96 |
| Minneapolis-St. Paul | 1 | 6 | 3 | 2 | 2 | 3 | - | 2 | 6 | 14 | 17 | 8 | - | 64 |
| Rhode Island | 1 | 5 | 4 | 3 | 1 | 3 | 2 | 5 | 4 | 10 | 11 | 4 | - | 53 |
| Utah | - | 2 | 4 | 2 | 2 | 3 | 3 | - | 2 | 1 | - | - | - | 19 |
| Washington | 1 | 5 | - | 2 | 3 | - | 4 | 2 | 9 | 13 | 7 | 10 | 1 | 57 |
| Total | 5 | 38 | 24 | 21 | 22 | 24 | 24 | 36 | 60 | 110 | 134 | 83 | 2 | 583 |

Table 4

Cases by Age, Race and Sex

| Race and Sex | Age Group | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | <1 | 1-4 | 5-9 | 10-14 | 15-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80+ | Unknown | Total |
| White | 5 | 36 | 24 | 16 | 20 | 22 | 21 | 34 | 57 | 102 | 125 | 81 | 2 | 545 |
| male | 3 | 15 | 12 | 6 | 9 | 10 | 14 | 16 | 34 | 57 | 57 | 44 | - | 277 |
| female | 2 | 21 | 12 | 10 | 11 | 12 | 7 | 18 | 23 | 45 | 68 | 37 | 2 | 268 |
| Nonwhite | - | 2 | - | 4 | 2 | 2 | 3 | 2 | 3 | 7 | 8 | 2 | - | 35 |
| male | - | 2 | - | 3 | 1 | 1 | 3 | 2 | 2 | 3 | 6 | 1 | - | 24 |
| female | - | - | - | 1 | 1 | 1 | - | - | 1 | 4 | 2 | 1 | - | 11 |
| Unknown race | - | - | - | 1 | - | - | - | - | - | 1 | 1 | - | - | 3 |
| male | - | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| female | - | - | - | - | - | - | - | - | - | 1 | 1 | - | - | 2 |
| Total | 5 | 38 | 24 | 21 | 22 | 24 | 24 | 36 | 60 | 110 | 134 | 83 | 2 | 583 |
| male | 3 | 17 | 12 | 10 | 10 | 11 | 17 | 18 | 36 | 60 | 63 | 45 | - | 302 |
| female | 2 | 21 | 12 | 11 | 12 | 13 | 7 | 18 | 24 | 50 | 71 | 38 | 2 | 281 |

Table 5

Cases by Type of Leukemia and Reporting Area
1966 - 1967

| | Alameda County | Connecticut | Atlanta | Kansas City | Minneapolis-St. Paul | Rhode Island | Utah | Washington | Total |
|---|---|---|---|---|---|---|---|---|---|
| Acute | 26 | 101 | 44 | 62 | 33 | 28 | 18 | 30 | 342 |
| lymphocytic | 5 | 23 | 10 | 12 | 12 | 14 | 10 | 11 | 97 |
| granulocytic | 14 | 48 | 19 | 35 | 15 | 12 | 7 | 16 | 166 |
| monocytic | 4 | 12 | 6 | 6 | 1 | 1 | 1 | 1 | 32 |
| undifferentiated | 1 | 13 | 8 | 8 | 2 | - | - | 2 | 34 |
| other | - | 1 | - | - | 1 | - | - | - | 2 |
| unknown | 2 | 4 | 1 | 1 | 2 | 1 | - | - | 11 |
| Chronic | 22 | 75 | 18 | 34 | 27 | 23 | 1 | 26 | 226 |
| lymphocytic | 12 | 51 | 12 | 21 | 18 | 16 | - | 22 | 152 |
| granulocytic | 6 | 24 | 5 | 13 | 8 | 7 | 1 | 4 | 68 |
| monocytic | 1 | - | 1 | - | - | - | - | - | 2 |
| other | - | - | - | - | 1 | - | - | - | 1 |
| unknown | 3 | - | - | - | - | - | - | - | 3 |
| Subacute | 1 | 3 | - | - | 4 | 1 | - | 1 | 10 |
| lymphocytic | 1 | - | - | - | 1 | - | - | 1 | 3 |
| granulocytic | - | 3 | - | - | 2 | 1 | - | - | 6 |
| unknown | - | - | - | - | 1 | - | - | - | 1 |
| Unknown | 2 | 1 | 1 | - | - | 1 | - | - | 5 |
| lymphocytic | 1 | 1 | - | - | - | 1 | - | - | 3 |
| other | - | - | 1 | - | - | - | - | - | 1 |
| unknown | - | - | - | - | - | - | - | - | 1 |
| TOTAL | 51 | 180 | 63 | 96 | 64 | 53 | 19 | 57 | 583 |

Table 6

Cases by Age Group and Type of Leukemia
July 1966 - June 1967

| Type of Leukemia | Age Groups | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | <1 | 1-4 | 5-9 | 10-14 | 15-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80+ | Unknown | Total |
| Acute | 5 | 38 | 24 | 21 | 18 | 22 | 22 | 21 | 26 | 52 | 63 | 29 | 1 | 342 |
| lymphocytic | 2 | 33 | 15 | 13 | 4 | 5 | 3 | 2 | 5 | 8 | 2 | 5 | - | 97 |
| granulocytic | 1 | 3 | 5 | 5 | 9 | 12 | 17 | 11 | 17 | 28 | 40 | 17 | 1 | 166 |
| monocytic | - | - | 1 | 2 | 1 | 3 | 1 | 4 | 2 | 4 | 12 | 2 | - | 32 |
| undifferentiated | 2 | 1 | 3 | 1 | 2 | 1 | - | 2 | 2 | 11 | 7 | 2 | - | 34 |
| other | - | - | - | - | - | - | - | 1 | - | - | - | 1 | - | 2 |
| unknown | - | 1 | - | - | 2 | 1 | 1 | 1 | - | 1 | 2 | 2 | - | 11 |
| Chronic | - | - | - | - | 3 | 2 | 2 | 13 | 33 | 54 | 70 | 48 | 1 | 226 |
| lymphocytic | - | - | - | - | - | - | - | 8 | 21 | 42 | 51 | 29 | 1 | 152 |
| granulocytic | - | - | - | - | 3 | 2 | 2 | 5 | 12 | 12 | 17 | 15 | - | 68 |
| monocytic | - | - | - | - | - | - | - | - | - | - | - | 2 | - | 2 |
| other | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| unknown | - | - | - | - | - | - | - | - | - | - | 2 | 1 | - | 3 |
| Subacute | - | - | - | - | 1 | - | - | - | 1 | 3 | 1 | 4 | - | 10 |
| lymphocytic | - | - | - | - | 1 | - | - | - | - | 1 | - | 1 | - | 3 |
| granulocytic | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 3 | - | 6 |
| unknown | - | - | - | - | - | - | - | - | - | 1 | - | - | - | 1 |
| Unknown | - | - | - | - | - | - | - | 2 | - | 1 | - | 2 | - | 5 |
| lymphocytic | - | - | - | - | - | - | - | 1 | - | 1 | - | 1 | - | 3 |
| other | - | - | - | - | - | - | - | 1 | - | - | - | - | - | 1 |
| unknown | - | - | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| TOTAL | 5 | 38 | 24 | 21 | 22 | 24 | 24 | 36 | 60 | 110 | 134 | 83 | 2 | 583 |

Table 7

Unusual Case Features

| | Number of cases |
|---|---|
| a) Special clinical features | |
| resemble Burkitt's tumor | 1 |
| congenital leukemia | 1 |
| erythroleukemia | 5 |
| b) Associated disease in patient | |
| lymphoma | 11 |
| other cancer | 8 |
| polycythemia vera | 1 |
| congenital malformation | 2 |
| c) Associated disease in family | |
| leukemia | 4 |
| other cancer | 7 |
| congenital malformation | 2 |
| d) Special epidemiologic features | |
| x-ray exposure | 7 |
| toxin exposure | 4 |
| animal contact | 1 |

(1-4) LLCS

(5-8) NCDC #

*Figure 1.*

**LEUKEMIA–LYMPHOMA CASE RECORD**

1. NAME _____ (first) (middle) (9-15) LAST

2. RESIDENCE _____ number and street

_____ (16-19) city (20-22) county (23-24) state

3. (25) RACE

☐ 1 White ☐ 2 Negro ☐ 9 Not stated

Other, specify _____

4. (26) SEX

☐ 1 Male ☐ 2 Female ☐ 9 Not stated

5. (27-28) AGE AT DIAGNOSIS _____

6. (29-34) DATE OF BIRTH _____ mo. day yr.

7. ONSET

(35-36) Duration of symptoms before diagnosis _____ mos.

(37-40) Date of onset _____ mo. yr.

8. DATE OF:

(41-46) Diagnosis _____ mo. day yr.

(47-52) Death _____ mo. day yr.

(53-58) Report _____ mo. day yr.

9. NCDC USE

| (59-60) o-d | (61-62) dx-d | (63-64) dx-r |
|---|---|---|
| | | |

10. (65) GENERAL DIAGNOSIS

☐ 1 Leukemia ☐ 2 Lymphoma

☐ 3 Leukemia & lymphoma

☐ 4 Other, specify _____

11. (66) TYPE OF LEUKEMIA

☐ 1 Acute ☐ 4 Subacute

☐ 2 Chronic ☐ 9 Not stated

☐ 3 Other, specify _____

12. (67) LEUKEMIC CELL TYPE

13. (68) TYPE OF LYMPHOMA

☐ 1 Hodgkin's ☐ 2 Lymphosarcoma

☐ 3 Reticulum cell sarcoma

☐ 4 Other, specify _____

☐ 5 Multiple myeloma ☐ 9 Not stated

14. (69) UNUSUAL FEATURES (See instructions)

Name of physician _____ Name of hospital _____

Address _____ Death certificate # _____

WORK SHEET – DEVELOPMENTAL

*Figure 2.*

LEUKEMIA IN PAROWAN AND PARAGONAH, UTAH
BY MONTH AND YEAR OF ONSET
1956 - 1967

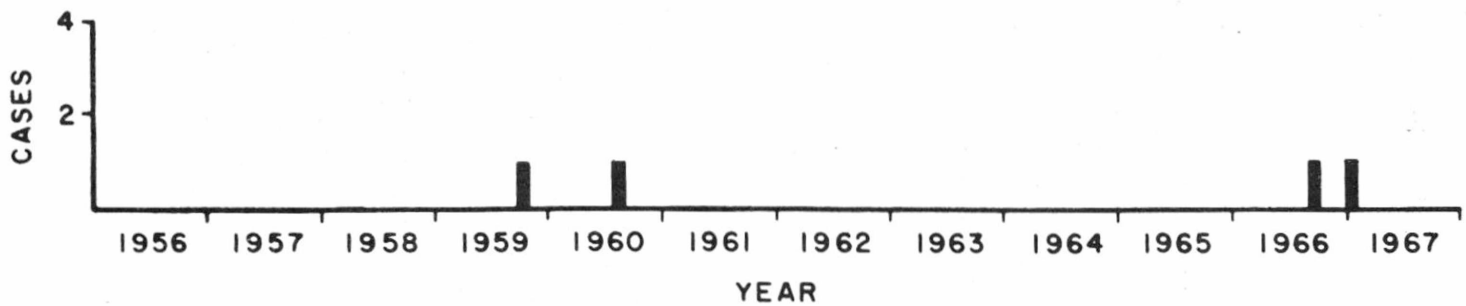

*Figure 3.*

LEUKEMIA IN METUCHEN, NEW JERSEY
1960-1966

*Figure 4*

LEUKEMIA IN TWO MISSISSIPPI FAMILIES