

RESEARCH COMMUNICATION

Trends in Incidence of Childhood Leukemia, Khon Kaen, Thailand, 1985-2002

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Abstract

Background: The Khon Kaen Cancer Registry (KKCR), providing both hospital and population-based registration, was established in 1984 in the Faculty of Medicine, Khon Kaen University. Leukemia is the most common cancer among Thai children in Thailand, including both curable and preventable types, but no assessment of trends has hitherto been performed. **Objective:** To perform a statistical assessment of the incidence trend of childhood leukemia in Khon Kaen, Thailand, between 1985 and 2002. **Methods:** Population-based cases of childhood leukemia registered between 1985 and 2002 were retrieved from the KKCR and cases with an ICD-O diagnosis (coding C42) in children under 15 were selected. Incidence trends were calculated using the Generalized Linear Model method (GLM), which generates incidence-rate-based logarithms. **Results:** Of the 277 cases of leukemia, boys were affected two times more frequently than girls and half of the cases were 0-4 years of age. Most diagnoses were histologically- or cytologically-proven and the most common type (affecting two-thirds, 65.7%) was acute lymphoblastic leukemia (ALL). The overall, age-standardized rate (ASR) for leukemia was 31.9 per million (95%CI: 28.1 to 35.7); 40.3 per million (95%CI: 34.2 to 46.4) in boys and 27.0 (95%CI: 21.8 to 32.2) in girls. Incidence has been increasing by 2.4% per year in boys (95% CI: -0.5 to 5.3) and 4.1% per year in girls (95% CI: 1.1 to 7.2). **Conclusions:** This incidence-rate-based logarithm indicates that childhood leukemia has been increasing, suggesting further epidemiological research on causes and possible prevention is needed.

Key Words: Cancer registry - childhood leukemia - incidence - time trends

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Introduction

Leukemia, a cancer of the bone marrow and blood cells, presents as four major types: 1) acute lymphocytic leukemia (ALL); 2) chronic lymphocytic leukemia (CLL); 3) acute myelogenous leukemia (AML); and chronic myelogenous leukemia (CML) (http://www.leukemia.org/hm_lls). The world's highest age-standardized rate (ASR) of childhood cancer (per million) is among Hispanics living in Los Angeles USA, with 417 cases resulting in an ASR of 59.1 between 1984 and 1992 (Parkin et al., 1998). Between 1985 and 1994, the 5-year survival rate for CLL was 77.0%, as also found in the USA (Malcolm et al., 1999).

In Thailand between 1988 and 1991, there were 630 childhood cancers, the most common being leukemia (39.5%) with an incidence rate of 27.6 per million (Sriamporn et al., 1996). From 1995 to 97, Thailand's five cancer registries recorded 636 cases of childhood cancer (354 boys and 282 girls) and leukemia accounted for 38.7% with an ASR of 36.9 per million (Surapon et al., 2003). In Khon

Kaen, between 1985 and 1997, 586 cases of childhood cancer were recorded and leukemia was the most common (38.7%). The ASR was 28.9 per million (Surapon et al., 2004). The information showed that the most common childhood cancers is leukemia and demonstrate the urgent need for steps to control the disease.

The Khon Kaen Cancer Registry (KKCR) was established in 1984 at the Faculty of Medicine and Srinagarind Hospital, Khon Kaen University. It therefore comprises both hospital and population-based registrations. Despite its longstanding operation, no information on trends has been produced on childhood leukemia in Khon Kaen. Therefore, this study was undertaken by retrieving the population-based cases of childhood leukemia from the KKCR between 1985 and 2002.

Materials and Methods

Case definition

All childhood leukemias (cases under 15 years of age

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living in Khon Kaen province), registered between January 1, 1985 and December 31, 2002, with an ICD-O diagnosis (coding C42), were selected (Fritz et al., 2000).

Registry procedures

Data for Khon Kaen residents diagnosed with cancer at Srinagarind Hospital were extracted from the Hospital-based cancer registry, whereas the medical records of patients registered at other hospitals throughout the province were reviewed by staff from the Khon Kaen Cancer Unit. Death certificates were collected from the Provincial Chief Medical Officer and/or the Civil Registration Section at each district. All of the data were verified, checked for duplication, coded and entered into the CANREG software (<http://www.iacr.com.fr/>). As for rate denominators, the demographic data was available from official sources on a yearly basis. The population in Khon Kaen province was stable vis-à-vis migrational in- and outflows (Table 1).

Outcome measurement

Childhood leukemia: to calculate the incidence of childhood leukemia based on logarithms, and the denominator derived from mid-year population estimates (Table 1).

Data collection

This involved extending the data collection procedures to Khon Kaen Regional Hospital (580 beds) and hospitals in the province. The main sources of cancer registration data are admission records of both out- and inpatients. The relevant information is manually abstracted and recorded on a data form.

Statistical methods

Percentages were used to describe the proportion of males vs. females, age at diagnosis, basis of diagnosis and type of disease. The median, maximum and minimum were used to describe age at diagnosis. The ASR and 95% confidence interval (CI) were used to describe the incidence rates of childhood leukemia (Jensen et al., 1991). The Generalized Linear Model (GLM) was used to analyze the annual incidence rates, the corresponding p-value and 95% CI of the rates (<http://www.statsoft.com/textbook/stglm.html>)

Table1. Childhood Population in Khon Kaen Province in the Middle of the 4-year Period under Consideration, by Age Group and Sex

Year	Age group (yr)	Boys	Girls	Total
1985	0-4	88,041	81,458	169,499
	5-9	95,677	91,276	186,953
	10-14	91,541	88,422	179,963
1990	0-4	87,976	81,926	169,902
	5-9	88,066	84,838	172,904
	10-14	90,732	88,272	179,004
1995	0-4	86,632	81,106	167,738
	5-9	81,817	79,691	161,508
	10-14	86,663	85,400	172,063
2000	0-4	81,577	76,242	157,819
	5-9	80,715	78,910	159,625
	10-14	80,477	80,009	160,486

Table 2 Baseline Demographics and Clinical Data for Childhood Leukemia in Khon Kaen, 1985-2002

Characteristics		Cases	Percentage
1. Sex	Boys	171	61.7
	Girls	106	38.3
	Total	277	100.0
2. Age group	0-4	141	50.9
	5-9	71	25.6
	10-14	65	23.5
3. Diagnosis	Histology/cytology	259	83.0
	Others	18	17.0
4. Type of - ALL	Acute non-lymphocytic, AnLL	71	25.6
	Other	24	8.7

Results

The study comprised 277 cases of leukemia. The average number of cases was 15 per year of diagnosis (Figure 1) and boys were affected two times more frequently than girls. Half of the cases were between 0 and 4 years of age. The basis of diagnosis was primarily histological or cytological evidence. According to type of disease, the most common was acute lymphoblastic leukemia, ALL (Table 2).

Between 1985 and 2002, there were two times more cases among boys than girls, except between 1995 and 1999, when the difference was 1.2 times (Table 3). A total of 277 cases

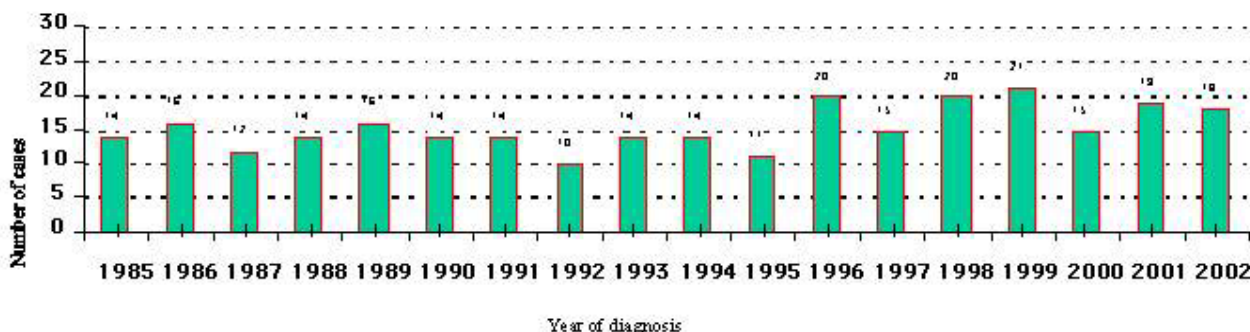


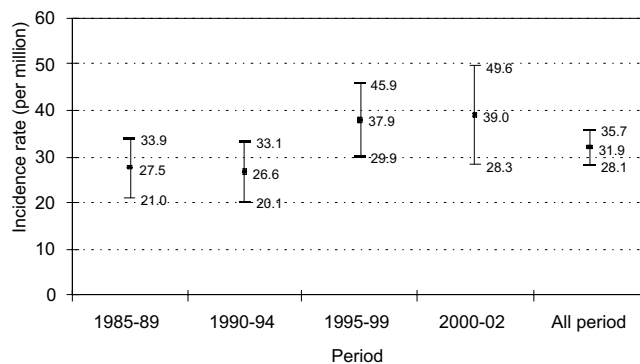
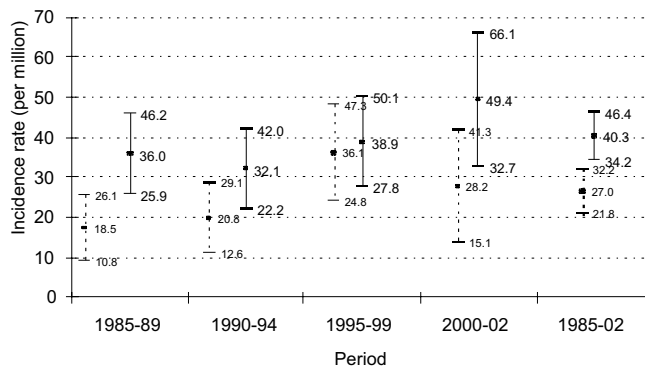
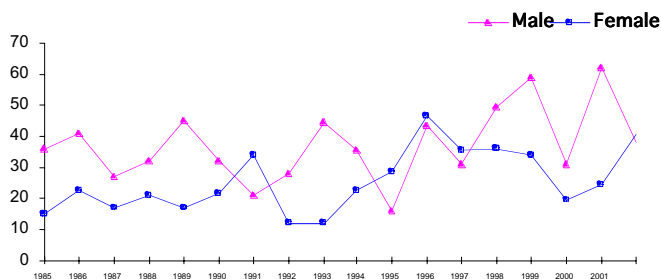
Figure 1. Numbers of Cases of Childhood Leukemia in Khon Kaen, 1985 - 2002

Table 3. Numbers of Cases and Percentages of all Types of Leukemia by Period and Sex

	Age (years)	2000-2002	1985-1989	1990-1994	1995-1999	All (1985-2002)
Boys	0-14	34 (65.4)	49 (68.1)	41 (62.1)	47 (54.0)	171 (61.7)
Girls	0-14	18 (34.6)	23 (31.9)	25 (37.9)	40 (46.0)	106 (38.3)
Total		52 (100)	72 (100)	66 (100)	87 (100)	277 (100)

of leukemia were recorded; corresponding to an ASR of 31.9 per million children (95% CI: 28.1 to 35.7). Between 1985 and 1994, the ASR was unchanged but between 1995 and 2002, it was significantly higher at 27.5 per million to 39.0 per million (Figure 2). By sex, between 1985 and 2002, the ASR for boys was much higher than girls but between 1995 and 1999, the rate was nearly equal.

Between 1985 and 1999, the ASR among girls increased

**Figure 2. Incidence Rates (per million per year) of all Leukemias and Periods (for both males and females)****Figure 3. Incidence Rates (per million per year) of all Leukemias by Period and Sex (Girls ----; Boys —)****Figure 4. Trends of Childhood Leukemia in Khon Kaen, 1985-2002**

from 18.5 to 36.1 per million then declined to 27.0 per million (95% CI: 21.8 to 32.2). Among boys, for the same period, the ASR was 40.3 per million (95% CI: 34.2 to 46.4) albeit fluctuated during this period (Figure 3).

Showing the annual shift in the average incidence rates (age- and sex-standardized, per million per year) for total leukemia. Over the period 1985-02 as whole there was a rise in the rate for both boys and girls; however, the rate for boys was higher than for girls. The rate for girls rose from 15.0 per million in 1985 to exceed the rate for boys, which was ~30.0 per million in 1991. The rate declined the next year, was stable in 1993 but sharply increased to 40.0 per million in 1996, then fell steadily to 20.0 per million in 2000 but sharply increased again in 2002. The pattern rate for boys fluctuated every two years until 2000. In 2000, the rate was ~30.0 per million and rose sharply to ~60.0 per million after declining sharply in 2002 at 35.0 per million (Figure 4). Using GLM (modeling), we found that the annual 2.4% incidence increase in boys was not statistically significant (95% CI: -0.5 to 5.3, p-value = 0.09). However, the 4.1% per year incidence increase in girls is statistically significant (95% CI: 1.1 to 7.2, p-value = 0.009).

Discussion

According to all types of leukemia, our data showed a statistically significant increasing trend in the incidence of childhood leukemia in Khon Kaen between 1985 and 2002, albeit greater in boys than girls. Overall, the ASR for leukemia was 40.3 per million for boys and 27.0 for girls, similar though higher than the 30.0 per million in boys and 25.1 per million in girls between 1988 and 1991 reported by Sriamporn et al. (1996).

In the United States, a sharp rise was reported in childhood leukemia incidence between 1990 and 1995, 47.4 per million in boys and 40.1 per million in girls (Surveillance, Epidemiology, and End Results (SEER) program) (Ries et al., 1999). Around Asia, the incidence rate of childhood leukemia was reportedly higher among boys than girls (Parkin et al., 1998).

The trend in incidence of leukemia among children under 15 years of age has increased over the past 18 years. The estimated annual percent increase for the period from 1985 to 2002 was 3.4% per year. By comparison, the SEER Pediatric Monograph reported an annual increase of 0.9% (Malcolm et al., 1999) and the Swedish Cancer registry an annual increase of 0.85% (Dreifaldt et al., 2004), both of which suggest the annual rate of increase in Khon Kaen is high, even prevalent (Bunin, 2004; Malcolm et al., 1999). Our analyses were limited to the type of leukemia (i.e. ALL,

ANLL and other unspecified cancers) because our data base lacks sufficient cases to do a 'leukemia by age-group' analysis. The cancer registry should be have a quality of data such as completeness and accuracy (Teppo et al., 1994). We suggest that in investigation of temporal trends in incidence of childhood leukemia, evidence from time trends. The epidemiology of childhood leukemia will be study, especially risk factor studies.

Between 1985 and 2002, a significant increase occurred in the incidence rates of childhood leukemia in Khon Kaen. Furthermore, Thailand has improved its utilization of National Cancer Institute Registry data for monitoring cancer management. Notwithstanding, cancer prevention and early detection program needs to be established to fend off childhood leukemias.

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