Incidence rate, long-term survival, and loss-of-life expectancy of children with acute lymphoblastic leukemia: a nation-wide analysis of Taiwan during 1997-2015

Chi-Wei Tsai[1], Meng-Yao Lu[2], Alice Lin Tsing Yu[3], and Jung-Der Wang[1]

[1]National Cheng Kung University College of Medicine
[2]National Taiwan University Hospital
[3]Chang Gung Memorial Hospital Linkou Main Branch

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Abstract

Acute lymphoblastic leukemia (ALL) is the number one cancer in children worldwide. Survival with ALL in children has shown a steady improvement over time with contemporary chemotherapy. This study aimed to determine the incidence rates and lifetime health impacts of pediatric ALL in Taiwan. A total of 3,854 patients with the diagnosis of ALL (ICD-9-CM code: 2040) were collected from the Registry for Catastrophic Illness (RCI) between 1997 and 2015 to assure the diagnostic accuracy. We included 2,044 cases for the final analysis. All patients were followed-up until the end of 2017 by linkage with the National Mortality Registry of Taiwan. A survival extrapolation method was applied and validated to estimate the lifetime survival function for life expectancy (LE) and loss-of-life expectancy (loss-of-life LE). The cohort included 1,222 males and 822 females. The average incidence rates (IRs) of pediatric ALL from 1997 to 2015 for age strata of <1, 1-4, 5-9, 10-14, 15-18 were 1.24, 3.39, 2.21, 1.56, and 0.97 per 100,000 person-year, respectively. The cumulative incidence rate up to age 18 (CIR0-18) of pediatric ALL increased after 2001, and was more pronounced in males than females. Most patients received treatments based on the protocol of Taiwan pediatric oncology group (TPOG)-ALL-97 (23.0%) or TPOG-ALL-2002 (62.7%). After extrapolation of survival to age 80, we found LE and loss-of-LE of pediatric ALL were 54.5 and 15.2 years, respectively. Future studies should explore long-term survival for different groups at risk of pediatric ALL and impacts of ALL on the society.

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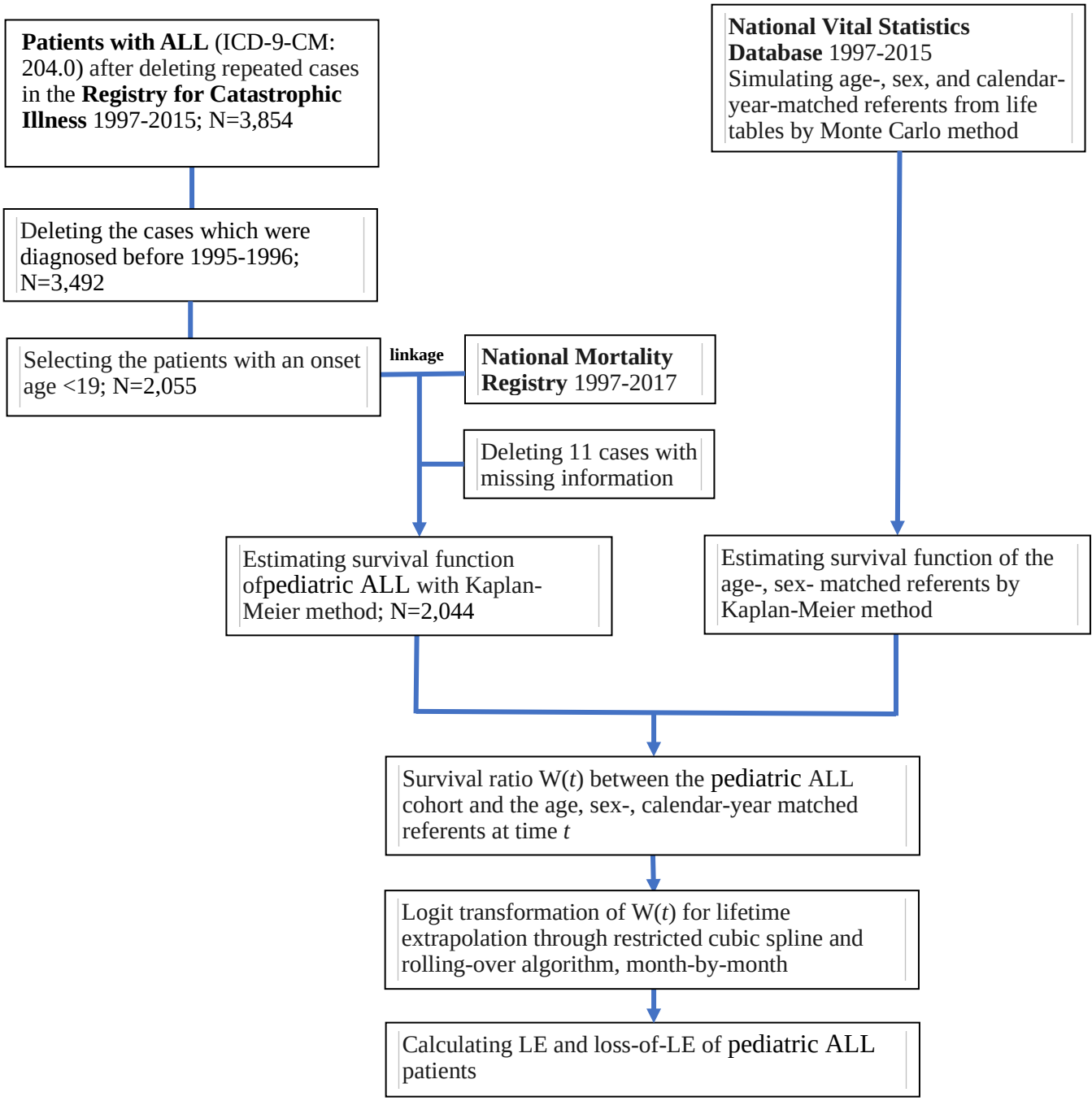

Figure 1. Flow diagram of data-linkage between national registries & vital statistics for estimating health impacts, including life expectancy (LE), loss-of-life expectancy (loss-of-LE) for children with acute lymphoblastic leukemia (ALL).

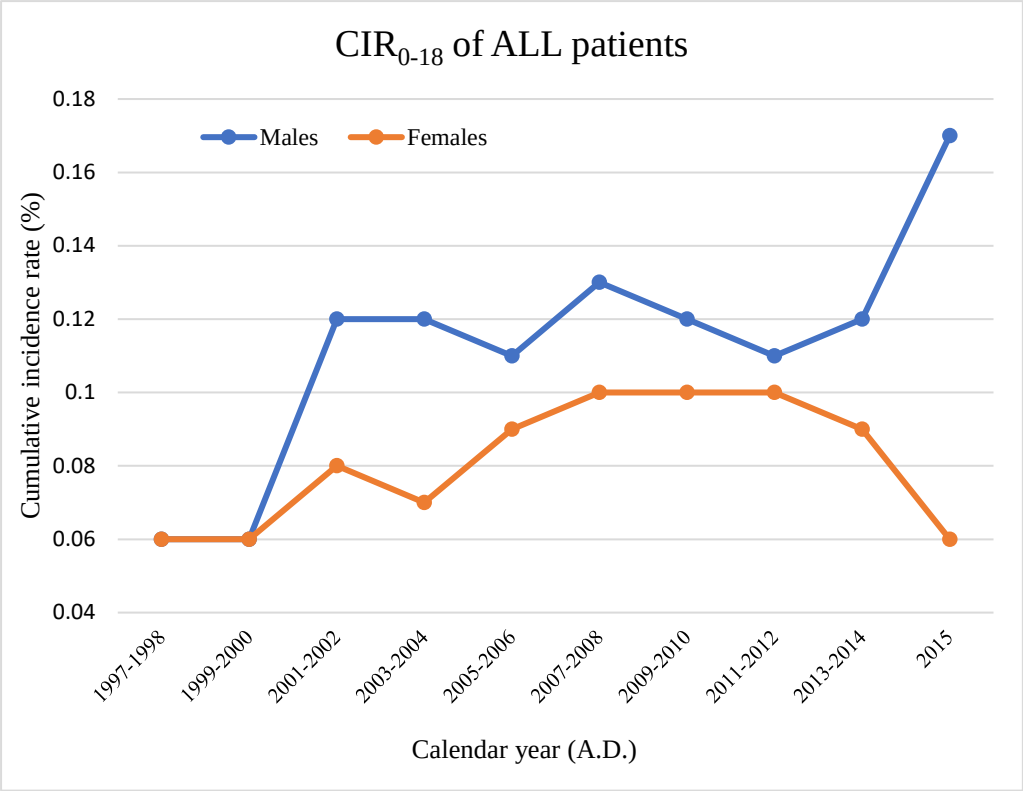

Figure 2. Cumulative incidence rate up to age 18 (CIR_{0-18}) of acute lymphoblastic leukemia (ALL) pediatric patients stratified by age, gender, and calendar years based on the Registry of Catastrophic Illnesses.

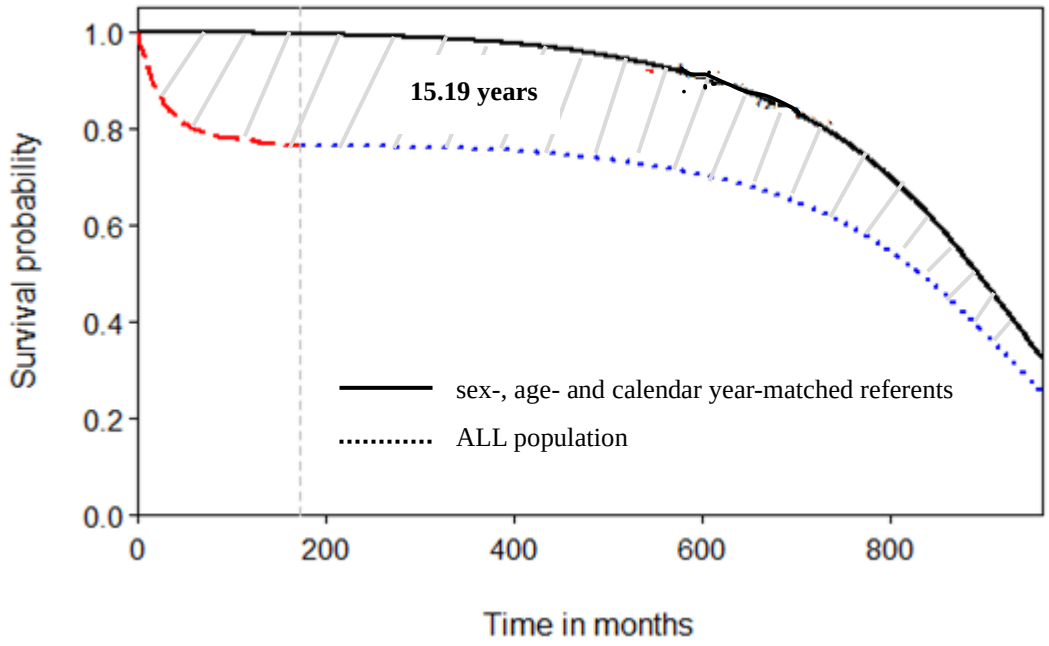

Figure 3. Lifetime survival curves of pediatric patients with acute lymphoblastic leukemia (ALL) and the age-, sex-, and calendar year-matched referents simulated from vital statistics. To assure a sufficient sample size, the extrapolation began at 172 months after diagnosis, as indicated by the dashed vertical line. The Kaplan-Meier survival curve of ALL is depicted by the red dashed line and the extrapolated portion by the blue dotted line. The differences in life expectancy (LE) between ALL patients and corresponding referents, or, loss-of-life expectancy (loss-of-LE), after extrapolation to 80 years old are represented in the shadowed area.