

# Incidence, Mortality, and Epidemiology of Leukemia in South Asia: An Ecological Study

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## Abstract

**Background:** Nowadays cancer is a buzzword in every corner of the world. Back a few decades, cancer was not that much known to the people of South Asia let alone known of Leukemia. Many countries in the South Asian region are designated as developing countries. Hence, the deficiency of diagnosis system, treatment, management, and lack of knowledge about leukemia in this region are major problems. Therefore, the incidence rate, mortality rate, and several deaths are increasing day by day. **Methods:** This cross-sectional study is aimed to investigate the incidence and mortality of leukemia in South Asian Countries for the year 2020 by acquiring data from the global cancer project (GLOBOCAN2020) accessible at <https://gco.iarc.fr>. **Results:** In South Asia, 1,733,573 cancer cases were documented in 2020 where 62,163 cases were leukemia related. The highest incidence rate was reported in Pakistan (4.3 in 1,000,000) and Sri Lanka (4.1 in 1,000,000) and the lowest in Bangladesh (1.8 in 1,000,000) and Nepal (2.0 in 1,000,000). On the other hand, 1,124,875 death had been reported in 2020, where 45,707 (4.1%) death was associated with leukemia. Pakistan (3.4 in 1,000,000) and Maldives (3.1 in 1,000,000) had the highest death and lowest in Bangladesh (1.4 in 1,000,000) and Nepal (1.5 in 1,000,000). Adults aged from 60 - 85 years old have the highest rate of incidence and mortality rate in all countries except Nepal. **Conclusions:** Leukemia is one of the major concerning cancer of all ages people in South Asia, the situation and related risk factors information can be helpful to reduce death through proper treatment.

## Keywords

Leukemia, Blood Cancer, South Asia, Incidence, Mortality, Epidemiology

## 1. Introduction

Cancer is considered a massive range of diseases that can initiate or proliferate in any part of the organ or tissue of the human body, it occurs when the growth of cells undergoes unusual such uncontrollably, will go beyond the usual barrier to invade adjoining segments of the human body and expand to other parts of the body's organ. (*World Health Organization*) Cancer is positioned as a dominant cause of death all around the world after cardiovascular disease, which plays a key role as the hurdle in the extension or elevation of average life expectancy in every continent and developed and developing countries and others. Leukemia is described as blood cancer that refers to a group of malignant disorders. In leukemia, the number of white blood cells raises unusually in the blood and bone marrow, where the stem cell initiates the production of different types of blood cells [1]. It is thought to be that leukemia originated from anomalies in bone marrow blood cells or stem cells, which ultimately lead to a high rate of immature and unappropriated blood cells and hinder the formation and proffering of normal and mature blood cells [2]. There are mainly four types of leukemia. Types of leukemia are based on the pathogenesis, origin, incidence, and prognosis. In chronic lymphocytic leukemia, the mature cells are predominantly present in the blood. The precursor of various lineage is greater in acute leukemia. However, in chronic myeloid leukemia, not only the precursor lineage is present at a greater rate but also the mature cells in chronic lymphocytic leukemia. The incidence rate of leukemia may differ among people due to different ages, sexes, races, and the environment they belong to. All these factors play a major role in mortality rate as well as in prevalence rate [3]. These discrepancies are mainly characterized by/involved with the intensity of exposure to environmental risk factors such as radiation, fume, smoking, etc. and genetic risk factor. For instance, about 10% of individuals might develop Chronic Lymphocytic Leukemia, who have a genetic history of their family to have this disease [4]. The fundamental reason for the incidence of leukemia is unrevealed and still mysterious, but the researcher, scientists, and many scholars have done numerous studies to find out the reason, which was conducted in different countries. They reach out to declare that there are some factors to be incorporated with the development of cancer and leukemia as well. The risk factors that are considered as the stimulant or precursors of leukemia are the weight of infant after birth, exposure to X-ray radiation, age of the mother at the time of childbirth, tonsillectomy, habits of smoking among the parents, use of insecticides, rate of birth, longer lactation period prolonged more than 6 months [5] [6]. Between acute lymphoblastic leukemia and acute myeloid leukemia, the most consistently diagnosed leukemia in children and young adults is Acute Lymphoblastic Leukemia, with incidence peaks between 2 and 5 years of age [7]. On the other hand, Acute Myeloid Leukemia is mostly found among adult individuals [8]. Leukemia was found to be the unceasingly happening cancer among all different races and ethnicities with relative coherence differing between 25% and 40% [9]. As per the data of the

global cancer project (GLOBOCAN2020), leukemia exhibited the 15<sup>th</sup> rank for most diagnosed cancer and 11<sup>th</sup> prime reason for cancer death in the year 2020 resulting in 474,519 new cases and 311,594 deaths of cancer. Across the World, the disease burden is higher among males than females by leukemia.

The incidence rates and mortality rates of leukemia in men are 2.7% and 3.2% respectively. And in women, the incidence rates and mortality rates are 2.6% and 3.0% respectively in the world [10].

## 2. Objective

This study was pointed out to estimate of leukemia incidence and mortality rates of infants to old adults (0 - 85+ years) in South Asian countries in an age-specific group.

## 3. Materials and Methods

This study attempts to observe the incidence and mortality rate of leukemia in 8 South Asian countries named Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The data were accumulated from the Global Cancer Project in the year 2020 accessible on <https://gco.iarc.fr> Global Cancer Project is a web platform that shows the statistics of global cancer by “International Agency for Research on Cancer” a part of the WHO. Here we classify in 6 age-specific groups (0 - 14, 15 - 29, 30 - 44, 45 - 59, 60 - 74, 70 - 85 and over).

### Age-Specific Incidence Rate

The procedures estimate the gender, the age-country specific approximation is based on available data for each country. A complete appropriate data is impossible to find for the incidence and mortality valuation due to several varieties and complications in measuring methods as countries. So, an alphabetical counting scheme autonomously defines the obtainability of the data found at the country level. The collective evaluation is shown for each country to offer an extensive hint of the estimation.

These procedures evaluate the gender, age, and country-specific incidence rates of cancer incidence rates fall into several categories, based on priority:

- 1) Observed the rates up to the year 2020 (45 countries).
- 2) Observed the most recent incidence rates in the population of 2020 (54 countries).
- 3) National mortality data estimates were mated from cancer registries via mortality-to-incidence ratios (14 countries).
- 4) National mortality data was estimated from cancer registries via mortality-to-incidence ratios in adjacent countries (37 countries).
- 5) Age and sex-specific rates were obtained by overall rates of adjacent countries.
- 6) The partitioned rate for specific spots by existing relative frequency data of specific cancer (5 countries).
- 7) Estimated an average rate for selected adjacent countries (30 countries).

### Age-Specific Mortality Rate

Adequate data on the national mortality rate fall into several categories, based on priority:

1) Observed the rates up to the year 2020 (80 countries). 2) Observed the most recent mortality rates in the population of 2020 (21 countries). 3) National mortality data was estimated from cancer registries via mortality-to-incidence ratios in adjacent countries (81 countries). 4) Estimated an average rate for selected adjacent countries (3 countries) [11].

## 4. Result

### Incidence Rate

In South Asia total of 1,733,573 cancer Cases had reported in 2020, where 62,163 (3.59%) cases were associated with leukemia. In those leukemia cases, the number of men were 36,315 and females were 25,848. The highest incidence is shown in India (48,419), Pakistan (8305), and Bangladesh (2812). Pakistan (4.3 in 1,000,000) and Sri Lanka (4.1 in 1,000,000) had the highest incidence rates and where the highest number of incidences in men shown in Maldives and women in Pakistan (**Table 1**).

According to the age-specific range, the highest incidence rate was observed in 0 - 14 years in Maldives (4.8 in 100,000); between 15 - 29 years in Sri Lanka (2.6 in 100,000); in the age range 30 - 44 years in Pakistan, Sri Lanka (3.2 in 100,000); then age range of 45 - 59 years in Maldives (12.4 in 100,000); later 60 - 74 years in Maldives (12.7 in 100,000); in the end 70 - 85+ years In Bhutan (20.6 in 100,000) (**Figure 1**).

### Mortality Rate

In South Asia total of 1,124,875 death had been reported in 2020, where 45,707 (4.1%) death was associated with leukemia. In leukemia death, men were 26,105 and females were 18,602. The highest mortality is shown in India (35,392), Pakistan (6261), and Bangladesh (2132). Pakistan (3.4 in 1,000,000) and Maldives (3.1

**Table 1.** Leukemia incidence and mortality rate of ASR and case number in male, female and both sex in 2020.

Country	Incidence Rate						Mortality Rate					
	Male (ASR)	Male (Case No.)	Female (ASR)	Female (Case No.)	Both Sex	Both Sex (Case No.)	Male (ASR)	Male (Case No.)	Female (ASR)	Female (Case No.)	Both Sex (ASR)	Both Sex (Case No.)
Afghanistan	3.5	606	2.9	472	3.2	1078	2.7	434	2.1	327	2.4	761
Bangladesh	2.1	1616	1.6	1196	1.8	2812	1.6	1250	1.1	882	1.4	2132
Bhutan	3	13	1.8	7	2.4	20	2.7	12	1.6	6	2.2	18
India	4.2	28,274	3.1	20,145	3.6	48,419	3	21,054	2.1	14,338	2.6	35,392
Maldives	5.8	15	3	5	-	20	4.1	12	1.7	3	3.1	15
Nepal	2.3	305	1.8	293	2	598	1.8	219	1.3	218	1.5	437
Pakistan	5	4941	3.6	3364	4.3	8305	3.9	2699	2.8	2562	3.4	6261
Sri Lanka	5.2	545	3.2	366	4.1	911	3.7	425	2.1	266	2.8	691
Total:		<b>36,315</b>		<b>25,848</b>		<b>62,163</b>		<b>26,105</b>		<b>18,602</b>		<b>45,707</b>

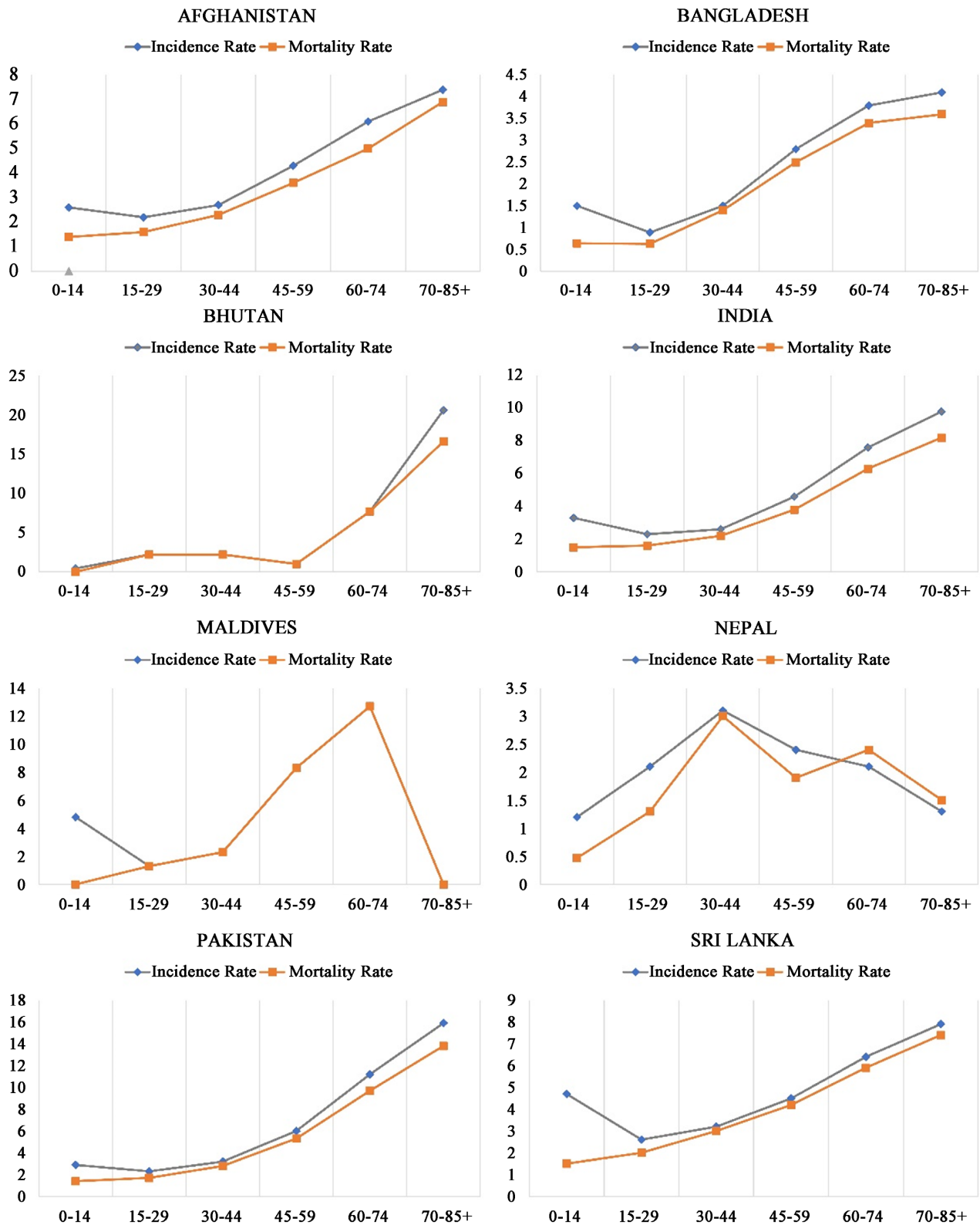


Figure 1. Age-specific incidence and mortality rate of leukemia in 8 countries.

in 1,000,000) had the highest death and where the highest number of deaths in women shown in Maldives and men in Pakistan (Table 1).

The highest mortality rate was observed in India and Sri Lanka in the age range 0 - 14 years (1.5 in 100,000); between 15 - 29 years in Bhutan (2.2 in 100,000); in the age range of 30 - 44 years in Nepal, Sri Lanka (3.0 in 100,000); then age range of 45 - 59 years in Maldives (8.3 in 100,000); later 60 - 74 years in Maldives (12.7 in 100,000); in the end 70 - 85+ years in Bhutan (16.6 in 100,000) (**Figure 1**).

## 5. Discussion

About 44% of leukemia is diagnosed compared to all kinds of cancer in the age range 0 - 15 years population [12]. About 10% of cases have been epidemiologically and clinically distinguished in childhood cancers and the rest of 90% of cases of cancer could not identify with specific diagnostics. In childhood leukemia, it is observed that not only leukemia but also other cancer is associated with the environment and multiple genes [13].

Fatigue, Muscular cramps, musculoskeletal pain, abdominal disturbances, edema, and skin problems are the most common symptoms of leukemia [14]. Bone marrow biopsy is one of the diagnosis methods of leukemia. Chemotherapy, intensification therapy, stem-cell transplantation, and continuation treatment are widely used to treat this cancer [15]. This kind of cancer is a common reason for child death. The routine screening agendas might be useful for early identification and proper medical support for this kind of patient [16].

In the last four decades, the treatment and diagnosis system of leukemia has noticeable progress for all aged people. 30% - 40% of younger people with leukemia can be lifelong cured by different treatment systems [17]. Several diagnoses criteria and the treatment duration of leukemia needed a heavy resource which is an economic burden. Treatment cost of acute myeloid leukemia between 2007-2016, almost \$386,077 is paid for each patient in the USA. At the time of treatment, around 60% of costs are spent in inpatient situations [18].

The highest incidence rate was reported in South Asia in Pakistan and Sri Lanka as 4.3 and 4.1 cases compared with other lower mortality rates in Bangladesh, Nepal, and Bhutan as 1.8, 2.0, and 2.4 cases per 100,000 people (**Figure 2**).

In 2020 around 56,876 (13% of the world) incidence cases of leukemia and 26,941 (8.7% of the world) mortality cases were shown in northern America. Compared with less-developed South Asian countries, the mortality rate is a significantly decent scenario in developed countries like northern America. The developed countries have significantly comparable mortality of leukemia due to proper treatment, medication, healthcare system, implantation of stem cells for a specific class of leukemia [19].

In European countries, the incidence of leukemia rate was 3.8 in 100,000 people of both genders [20]. According to the Surveillance, Epidemiology, and End Results (SEER) report (1973) incidence rate is 3.43, but in 2010 it rose to 4.2 in the United State of America [21]. According to Healey *et al.* [22] stated that this rate in Canada is 4.01 in 100,000 people.

In Nordic countries including Denmark, Finland, Iceland, Norway, and Sweden showed that the age and sex-specific incidence rate of Acute Lymphoblastic Leukemia (ALL) in the four-year interval of 3.84 - 4.03 cases per 100,000 population where the yearly mean of 0.22% [23].

In 2012, 8301 cases occur in Australia-New Zealand. This incidence is 11.3 in males and 7.2 in females per 100,000 people and the male-female ratio is 1.6. In Africa, 5.6 males and 2.6 females are affected by leukemia [11].

Here, the highest mortality rate was reported in Pakistan and Maldives as 3.4 and 3.1 cases compared with lower mortality rates in Bangladesh, Nepal, and Bhutan as 1.4, 1.5, and 2.2 cases per 100,000 people (Figure 3).

In Asia, the mortality rate in males is 3.8 cases and 2.6 in females per 100,000 people. The peak mortality rate reported in Eastern Asia, especially in China, and Japan were an average of 4.2 cases in males and 2.9 in females. In Western Asia, the mortality rate is 6.8 cases in males and 4.8 in females per 100,000

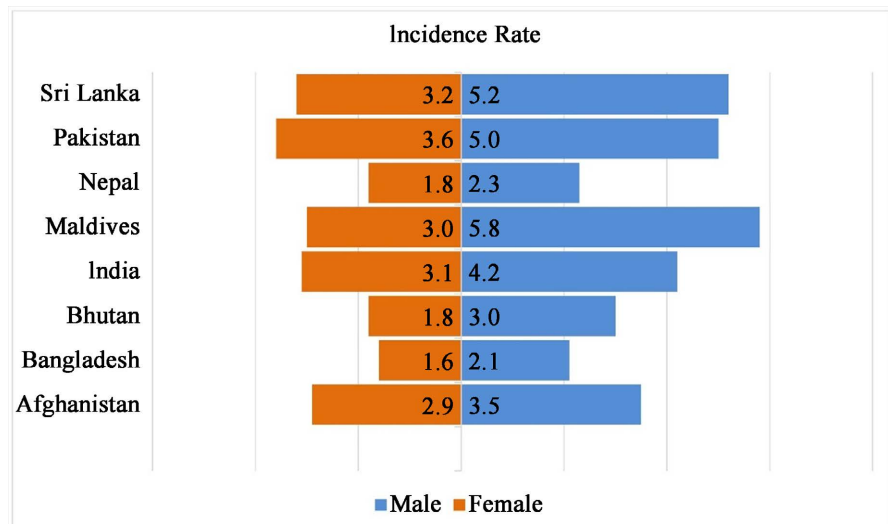


Figure 2. Leukemia incidence rate in 8 South Asian countries (male and female).

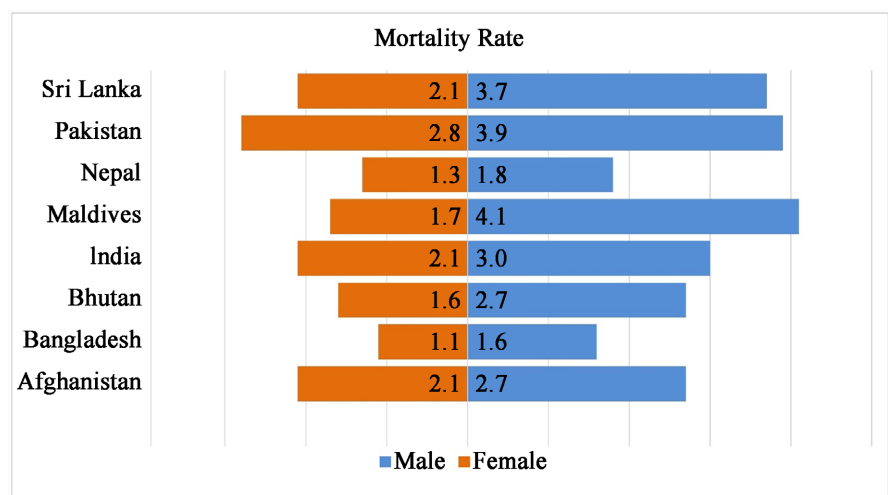


Figure 3. Leukemia mortality rate in 8 south Asian countries (male and female).

people [19]. Observe this continent, the western part of Asia has the highest mortality rate than Asia.

In Age-specific analysis incidence and mortality is quite high in Geriatrics people (especially those above 60 years older) compare with younger. In children (0 - 14 years), the rate is a little bit high. In the comparison between 8 countries, not only the incidence rate but also the mortality rate is enormously high in Bhutan, Maldives, Pakistan.

Poverty is one of the obstacles of detect the early diagnosis of leukemia. Lack of Sufficient nutrition and proper health facility makes complications of this kind of cancer treatment. As a result, the mortality e also is increased. Prevalence studies of leukemia should be keeping an effective role to identify the specific regions to identify the factors that can be reduced not only the incidence but also the mortality of leukemia.

## 6. Conclusion

Screening programs can be one of the effective supervision systems for identifying the incidence of leukemia. The prevalence and evaluation of all kinds of cancer occurrences might provide a vital role in evidence and prediction so that it is effective to decrease the incidence of cancer. Proper diagnosis-counseling and treatment could reduce the mortality of those patients.

## Author Contribution

RHR & MRR designed and supervised the study. SI was responsible for the abstract and introduction. MMA contributed to the writing methodology. ATS contributed to the acquisition of data, and analysis of data and figures. MSP wrote the result, discussion and prepared the manuscript. MRR edited the final manuscript. All authors have read and approved the final manuscript.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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