Review Article

Received: 2025-02-10
Accepted: 2025-03-25

BCCR
2025, No 1, Vol 17 :26-31
www.bccrjournal.com

http://doi.org/10.18502/bccr.v17i1.22715

Epidemiology of Pediatric Cancers in Iran: Incidence, Mortality and Survival Pattern

Azadeh Angouraj Taghavi[1], Kazem Zendehdel[1], Hamideh Rashidian[1*]

1. Cancer Research Center, Cancer Institute, Tehran University of Medical Sciences, Tehran, Iran

*Corresponding author
Hamideh Rashidian
Cancer Research Center, Cancer Institute, Tehran University of Medical Sciences, Tehran, Iran

hmdhrashidian@yahoo.com

ABSTRACT

Pediatric cancers are a leading cause of death from non-communicable diseases among children worldwide, with considerable regional variation in age-standardized incidence and mortality rates. This study reviews the epidemiology of pediatric cancers in Iran in the context of global patterns, highlighting disparities in incidence, mortality, and survival outcomes.

Incidence and mortality data were compared using the Iranian national cancer registry and GLOBOCAN 2020, while survival data were contrasted between the Iranian national study (IRANCANSURV) and the international CONCORD-3 project. Globally, childhood cancer incidence ranges from 157 per million in very high-income countries to 85 per million in low-income regions. Iran reports an age-standardized incidence rate of 136 per million—one of the highest in the Eastern Mediterranean Region.The leading cancer types are leukemia (21 per million mortality) and brain/CNS tumors (15 per million). In Iran, the five-year survival rate is approximately 68–70% for leukemia and 49% for CNS tumors, substantially below the > 90% and > 70% observed in high-income settings. Survival also varies markedly across provinces—from 56.9% to 71.5% for leukemia and 16% to 57% for CNS cancers—reflecting disparities in healthcare access and data quality.

Overall, although Iran exhibits relatively high childhood cancer incidence, outcomes remain limited by disparities in healthcare infrastructure, resource constraints, and incomplete registry coverage. These findings underscore substantial gaps in surveillance and emphasize the urgent need to strengthen pediatric oncology services, expand equitable access to specialized care, and enhance data collection to inform evidence-based policy decisions.

Keywords: Pediatric Cancer; Incidence; Mortality; Survival; Health disparity; Iran

INTRODUCTION:

The Incidence of pediatric cancers is approximately 400000 cases annually in the world among children and adolescents aged 0-19 years (1). Although pediatric cancers are rare, accounting for only about 2% of all cancers, they are the leading cause of death from non-communicable diseases in children under 20 worldwide (2, 3). According to GLOBOCAN 2020, the highest and the lowest age-standardized incidence rate (ASIR) of pediatric cancers were reported in Northern America (180 per one million) and Africa (92 per one million), respectively. In contrast, age-standardized mortality rates (ASMRs) show an inreverse pattern, with Northern America having the lowest ASMR (23 per million) and Africa the highest (48 per million) (2).

Children under age 20 years comprise 31 % of the total population of Iran, where ASIR and ASMR shows a relatively high values of 136 and 64 per million, respectively. Despite significant incidence and mortality rates of pediatric cancers, Iran currently lacks a dedicated pediatric cancer registry (4, 5).

The present study aims to comprehensively review the epidemiology of pediatric cancers in Iran, comparing incidence, mortality, and survival rates with global patterns. Specifically, it seeks to highlight the current burden of childhood cancer in Iran, identify regional variations within the country, discuss challenges related to cancer registration and healthcare infrastructure, and underscore areas requiring targeted research and policy attention. In this review, we used incidence and mortality data based on the Iranian national cancer registry and GLOBOCAN 2020, while survival data were contrasted between the Iranian national study (IRANCANSURV) and the international CONCORD-3 project (2, 6, 7). By providing a detailed analysis, this review intends to inform healthcare professionals, policymakers, and researchers engaged in improving childhood cancer outcomes in Iran and similar middle-income contexts.

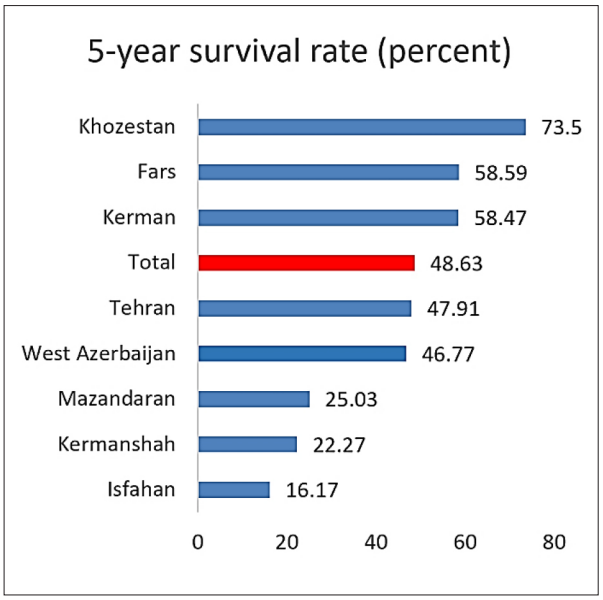
Epidemiology of pediatric cancers in Iran

Table 1 presents the number of new cases, ASIR, and ASMR of childhood cancer in Iran in 2020. In total, 2,818 new pediatric cancer cases were diagnosed that year, with an overall ASIR of 136 per million children at risk. The highest age-standardized incidence rates were observed for leukemia (53 per million), followed by brain and CNS tumors (19 per million), and non-Hodgkin lymphoma (7.6 per million). According to Table 1, the total ASMR was 62 per million, with 1,676 reported childhood cancer deaths in Iran for 2020. The highest age-standardized mortality rates were seen for leukemia (21 per million), brain and CNS tumors (15 per million), and non-Hodgkin lymphoma (4.7 per million).

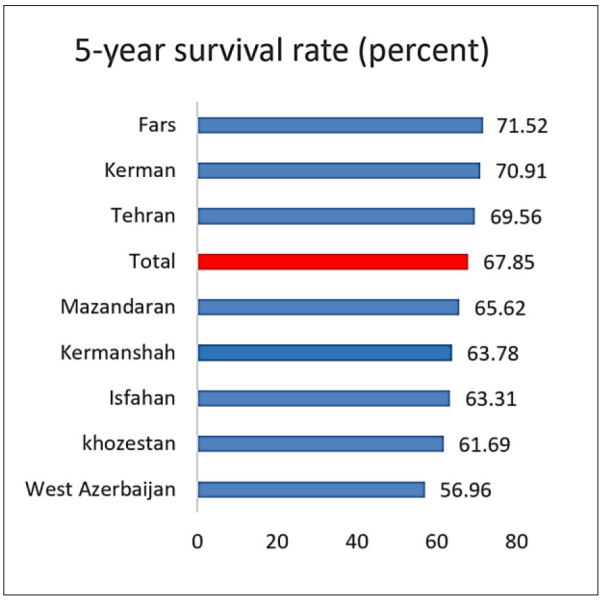
Table 1. Age-standardized incidence and mortality rates of prevalent pediatric cancers per one million in Iran in 2020 (age group 0-14)

Cancer type	Number of incident cases	Incidence Rate per million	Cancer type	Number of Deaths	Mortality Rate per million
All cancers except non-melanoma skin cancer	2818	136.0	All cancers except non-melanoma skin cancer	1287	62.0
Leukemia	1086	53.0	Leukemia	433	21.0
Brain and CNS tumors	393	19.0	Brain and CNS tomurs	306	15.0
Non-Hodgkin lymphoma	159	7.6	Non-Hodgkin lymphoma	97	4.7
Hodgkin lymphoma	129	6.1	Liver	53	2.6
Kidney	85	4.2	Lung	33	1.6
Liver	73	3.6	Kidney	20	1.0
Lung	45	2.2	Hodgkin lymphoma	16	0.8
Others	214	12.0	Others	60	3.0

Furthermore, from a nationwide study covering eight provinces conducted by the Cancer Institute of Iran on childhood cancer survival reported a 5-year net survival rate of 67.8% for leukemia and 48.64% for brain and CNS tumors. This study also revealed a 15% variation in leukemia survival rates across provinces, ranging from a high of 71.52% in Fars Province to a low of 56.96% in West Azerbaijan Province. Survival rates in Kerman (70.91%) and Tehran (69.56%) were above the national average of 69.56%. In contrast, provinces including Mazandaran (65.62%), Kermanshah (63.78%), Isfahan (63.31%), Khuzestan (61.69%), and West Azerbaijan (56.96%) reported survival rates below the national average (6). Observed inequalities in survival rates for brain and central nervous system (CNS) cancers were more pronounced, ranging from 57.33% in Khuzestan Province to 16.17% in Isfahan Province (Figure 1). However, interpreting these findings requires caution due to limitations in childhood cancer registration, especially in more deprived provinces where coverage and quality are suboptimal (8). Moreover, there is a significant variation in the validity of registered cases across regions. For example, considering leukemia as the most common childhood cancer, the proportion of microscopically verified cases (MV%) varies widely—from approximately 39% in Kermanshah, 53% in Tehran and Sistan and Baluchestan, to 100% in Zanjan and North Khorasan provinces (9). Furthermore, there is no dedicated focus on childhood cancer within the cancer registry system in Iran. Among the registered data from various regions, only the Golestan Province registry contributed to the International Childhood Cancer Incidence study (IICC-3), highlighting concerns about the quality of data submitted from other regions (10). The pattern of incidence and mortality for childhood cancers in Iran by cancer type is similar to global trends, with leukemia and brain and central nervous system (CNS) tumors being the most common cancers in terms of both incidence and mortality. However, Iran reports the highest childhood cancer incidence rates in the Eastern Mediterranean region, exceeding the global average. Although mortality rates associated with pediatric cancers in Iran are close to the regional and global averages, the 5-year survival rate for leukemia in Iran resembles that of low-income countries such as Peru and falls significantly behind those reported in high-income countries. Similarly, the 5-year survival rate for brain and CNS cancers in Iran remains far below survival rates observed in high-income countries. Limited access to specialized healthcare facilities, insufficient diagnostic and treatment resources, shortages of skilled healthcare professionals, and underdeveloped healthcare infrastructures have been identified as major contributors to these poor outcomes.



A. Brain and CNS tumors



B. Leukemia

Figure 1: Five-year survival rate (percent) of pediatrics' leukemia and brain and CNS tumors in 8 provinces of Iran in 2014-2018

Pronounced provincial disparities in survival—especially for brain and CNS cancers—indicate that factors beyond socioeconomic status and healthcare access may also play a role.

To address these gaps, future research should focus on identifying regionspecific barriers to timely diagnosis and treatment, investigating the underlying causes of low survival in certain provinces, and assessing interventions aimed at improving care delivery. Policy efforts must prioritize the expansion of pediatric oncology infrastructure, equitable access to specialized services, and investment in workforce training. Strengthening the quality and completeness of childhood cancer registries is also essential to generate reliable data for evidencebased planning and evaluation of national cancer control strategies.

Global Comparison of Pediatric Cancers

Based on global cancer statistics (Globocan) for childhood cancer from 2020 very high-income countries exhibit the highest estimated ASIR of 157 per million children at risk. In contrast, low-income countries have the lowest ASIR, approximately 85 per million. Iran's age-standardized incidence rate is approximately 136 per million, comparable to those seen in high-income countries (Figure 2). The most common childhood cancers in Iran reflect the global pattern, comprising leukemia, brain and central nervous system (CNS) tumors, non-Hodgkin lymphoma, kidney tumors, and Hodgkin lymphoma as the most common cancer subsites (11).

Figure 2 shows that the highest ASMR per million children at risk was observed in low-income countries, (approximately 48 per million), while the lowest mortality was seen in high-income countries, (approximately 26 per million) in 2020. Iran's pediatric cancer mortality rate (about 62 per million) exceeds the global average rate and ranks ninth in the world. The global average pediatric cancer mortality rate is about 40 per million. There is a significant negative correlation between a

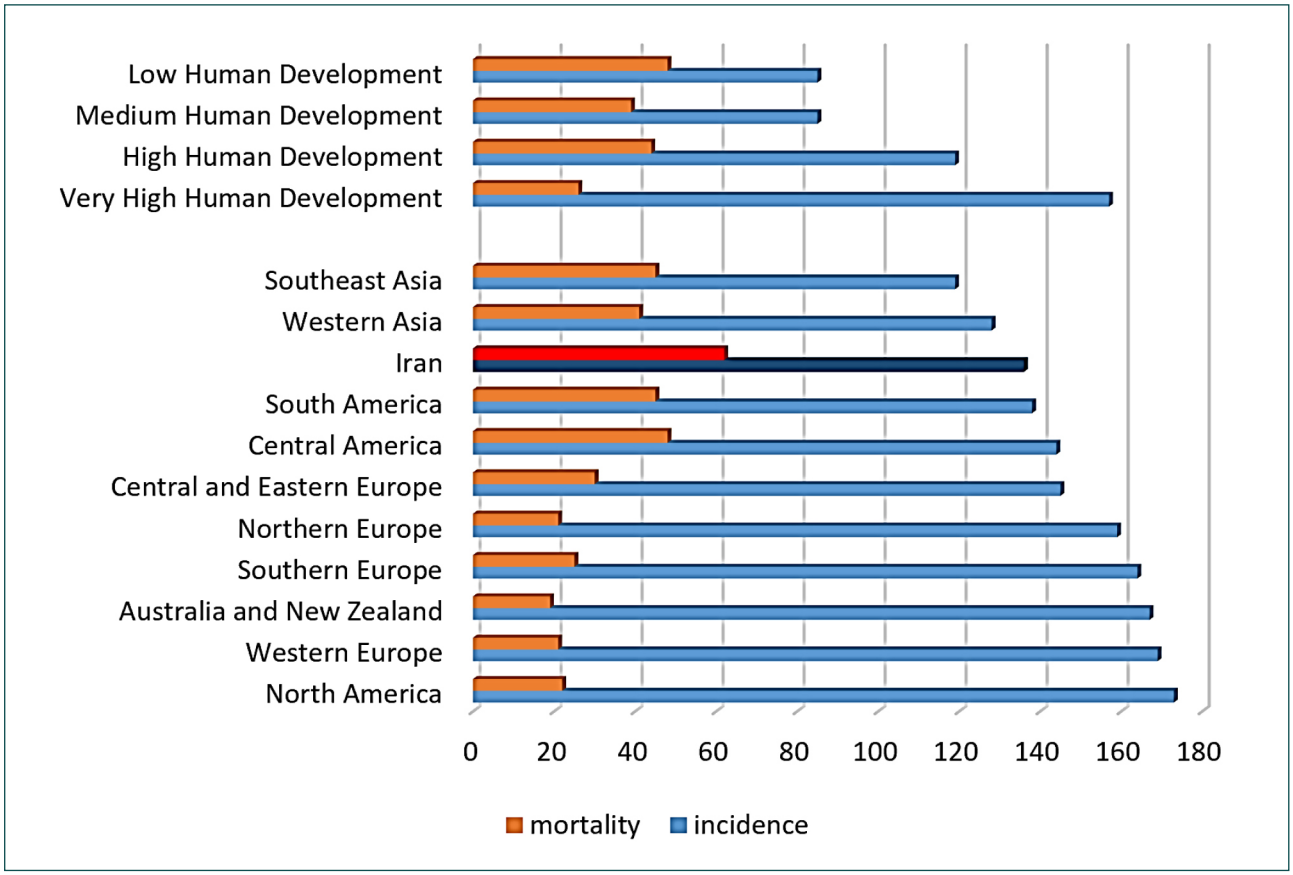


Figure 2: incidence and mortality rate of pediatric cancers (per million) in Iran in comparison to other regions according to GLOBOCAN 2020

country's economic status and pediatric cancer ASMR, whereas low-income countries experience the highest ASMR (11).

Worldwide, the highest ASMRs per million children are reported for leukemia (13 per million) and brain and CNS cancers (6 per million). In Iran, these rates are elevated at 21 and 15 per million for leukemia and CNS cancers, respectively.

Iran's 5-year survival rate for childhood leukemia is below 70%, similar to countries such as Brazil, Chile, Thailand, and Peru, while in high-income countries like Denmark, the USA, Canada, and the UK report rates above 90% (Figure 3). The international 3-CONCORD study notes that some Asian countries (e.g., Kuwait, Turkey, Taiwan, South Korea) have improved childhood leukemia survival over the past decade, achieving approximately 80% (7).

The Iranian national cancer survival study (IRANCANSURV) reports a 5-year survival rate of 48.6% for brain and CNS cancers (6), substantially lower than in high-income countries (Denmark, the USA, and Canada) and some upper-middle incomes countries like Chile (Figure 4).

Conclusion:

The epidemiological profile of pediatric cancers in Iran mirrors global patterns, with leukemia and brain/CNS tumors being the predominant malignancies. However, the incidence rates in Iran exceed both regional and global averages, while survival outcomes remain considerably below those of high income countries. Persistent challenges—including limited diagnostic capacity, uneven access to specialized care, shortages of trained pediatric oncology professionals, and inter provincial disparities—continue to hinder progress. Inadequate data quality and incomplete cancer registry coverage further constrain evidence based planning and evaluation. Strengthening the nation's pediatric oncology infrastructure, ensuring equitable access to timely and high quality treatment, and enhancing the accuracy and completeness of cancer registration should be prioritized. Addressing these deficiencies through targeted research, robust surveillance, and equitable policy interventions is essential to improve survival outcomes and reduce regional inequalities in childhood cancer care across Iran.

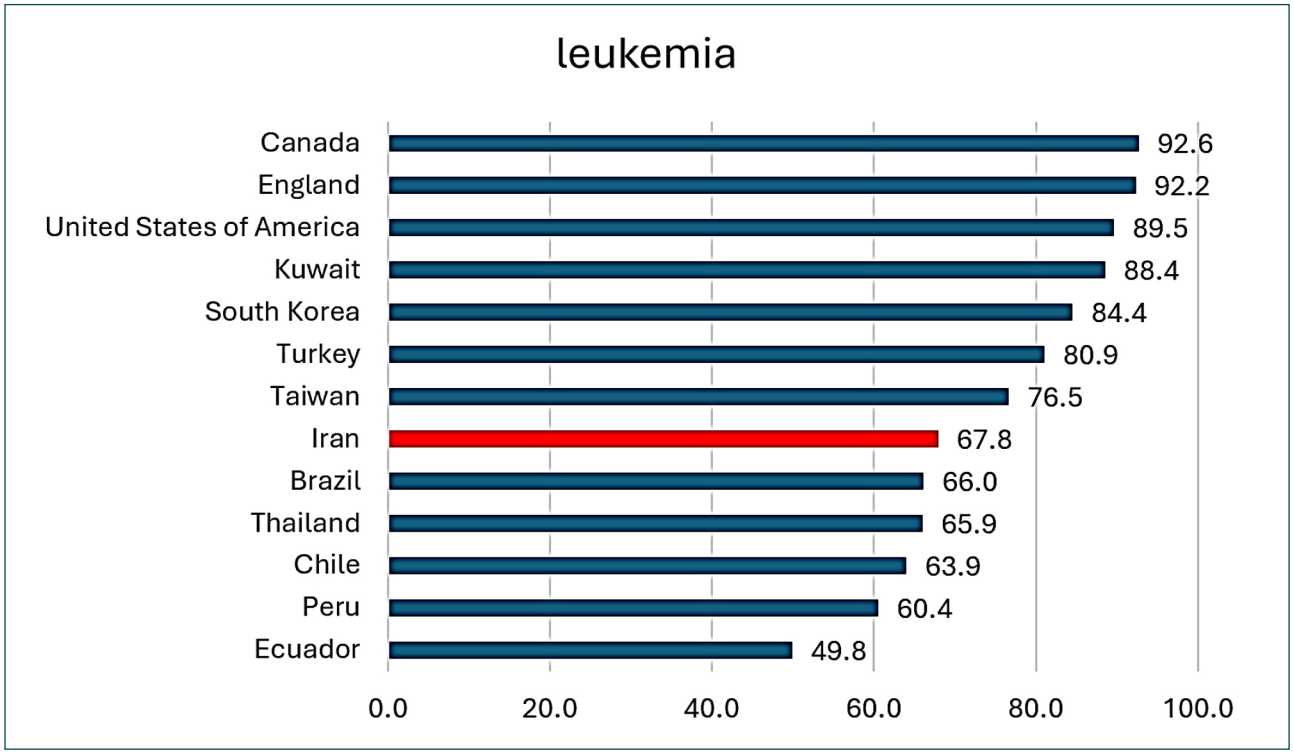


Figure 3: Five-year survival rate (percent) of pediatrics' leukemia in Iran in comparison to other regions in 2014-2018

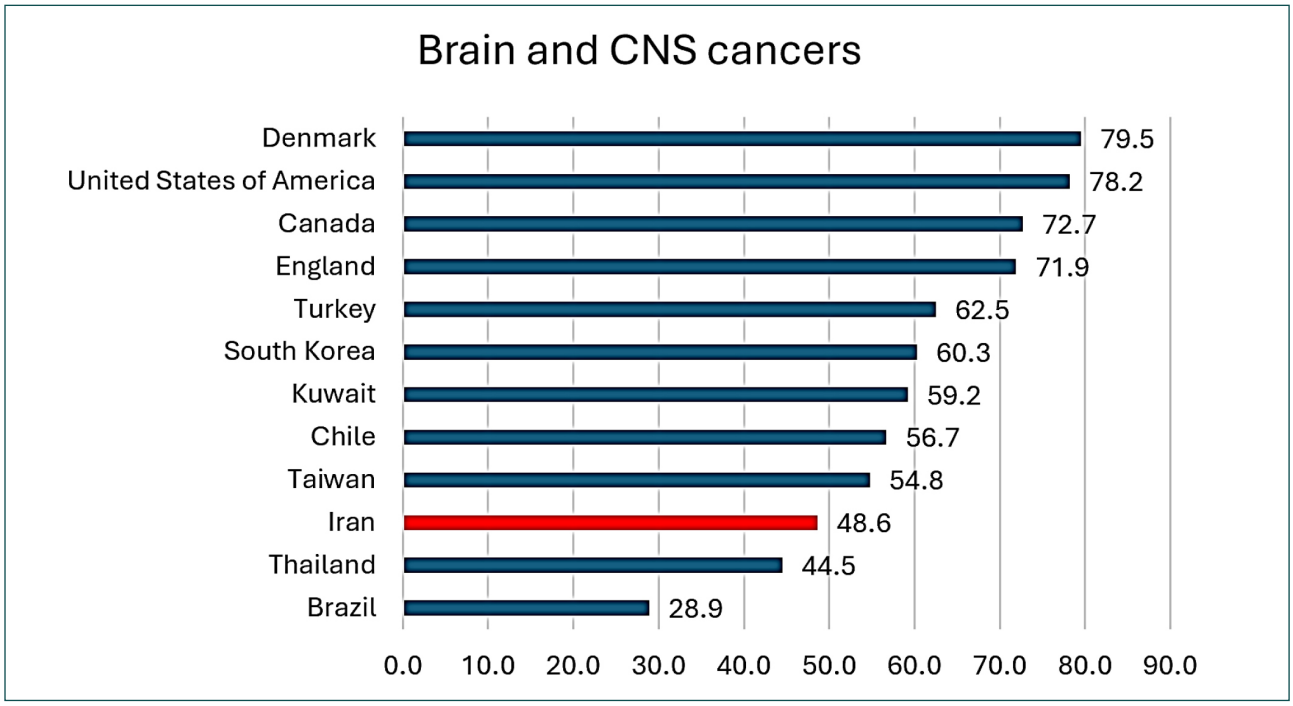


Figure 4: Five-year survival rate (percent) of pediatrics' brain and CNS tumors in Iran in comparison to other regions in 2014-2018

References:

1. WHO fact sheet-childhood cancer 2025 [Available from: https://www.who.int/news-room/fact-sheets/detail/cancer-in-children.
2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021;71(3):209-49.
3. Metrics IfH, Evaluation. Global burden of disease study. IHME Seattle; 2017.
4. Roshandel G, Ghanbari-Motlagh A, Partovipour E, Salavati F, Hasanpour-Heidari S, Mohammadi G, et al. Cancer incidence in Iran in 2014: Results of the Iranian National Population-based Cancer Registry. Cancer Epidemiol. 2019;61:50-8.
5. Statistical Centre of Iran, iranian national census 2016.
6. Saeedi E, Nemati S, Lotfi F, Domingues A, Abdi S, Pirnejad H, et al. IRANCANSURV: A comprehensive analysis of childhood cancer survival in Iran. Int J Cancer. 2025.
7. Allemani C, Matsuda T, Di Carlo V, Harewood R, Matz M, Nikšić M, et al. Global surveillance of trends in cancer survival 2000-14 (CONCORD-3): analysis of individual records for 37 513 025 patients diagnosed with one of 18 cancers from 322 population-based registries in 71 countries. Lancet. 2018;391(10125):1023-75.
8. Mohammadi G, Akbari ME, Mehrabi Y, Ghanbari Motlagh A. Quality assessment of the national cancer registry in Iran: completeness and validity. Iranian Journal of Cancer Prevention. 2016;9(6).
9. Education MoHaM. National cancer report Ministry of Health and Medical Education; 2018.
10. Cancer IAfRo. ChildGICR [Available from: https://gicr.iarc.fr/child-gicr/.
11. Fadhil I, Soliman R, Jaffar S, Al Madhi S, Saab R, Belgaumi A, et al. Estimated incidence, prevalence, mortality, and registration of childhood cancer (ages 0-14 years) in the WHO Eastern Mediterranean region: an analysis of GLOBOCAN 2020 data. Lancet Child Adolesc Health. 2022;6(7):466-73.