World Cancer Research Journal WCRJ 2018; 5 (2): e1085

EPIDEMIOLOGY, INCIDENCE AND MORTALITY OF HODGKIN'S CANCER IN THE WORLD AND ITS RELATION WITH DEVELOPMENT

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Abstract – *Objective:* *There is a high incidence and mortality rate of Hodgkin's cancer in all countries around the world. Due to the importance of knowledge about incidence and mortality rate of Hodgkin's cancer, this study has been conducted to investigate the age-standardized incidence and mortality rate of this cancer, its relationship with the human development index (HDI) and its components in the world.*

Materials and Methods: *The study was conducted based on the world data of cancer and the World Bank (including the HDI and its components). Data about the age-specific incidence and mortality rate (ASR) for every country in 2012 were obtained from the global cancer project. To analyze data, correlation tests between incidence, death rates, HDI and its components were employed with a significance level of 0.05 using SPSS software.*

Results: *Globally in 2012, the standardized incidence and mortality rate of Hodgkin lymphoma were 0.9 and 0.3 per hundred thousand people, respectively. A positive statistically significant correlation was seen between Hodgkin's lymphoma cancer's standardized incidence rate and HDI (r: 0.626;* p*<0.001). A negative correlation was observed between the standardized mortality rate of Hodgkin lymphoma cancer and HDI, which was statistically significant (r: -0.181;* p*=0.019).*

Conclusions: *The age-standardized incidence rate of Hodgkin's cancer is higher in countries with higher HDI. The age-standardized mortality rate is higher in countries with higher HDI than countries with lower HDI. Informing people about the risk factors of the disease and prevention is recommended for reducing the incidence of disease.*

KEYWORDS: *Epidemiology, Incidence, Mortality, Hodgkin's cancer.*

INTRODUCTION

Although infectious diseases are much more common than cancer in developing countries, mortality rate of cancer is more than an infectious disease[1]. Non-communicable diseases are the major cause of mortality and morbidity of adults worldwide[2,3]. Among non-communicable diseases, cancer is one of the most dreaded diseases and is one of the important factors for global burden of disease[4-6].

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Cancer is a public health issue worldwide[7,8]. Aging, lifestyle changes, increasing urbanization, changes in reproductive patterns, diet, obesity, smoking, alcohol consumption, and chronic infection have caused a steady increase in the cancer burden[9].

The age-specific incidence and mortality rate of Hodgkin's disease in developed countries in 2012 were 2.3 and 0.4 in men, and 1.9 and 0.3 in women. In developing countries these amounts were 0.8 and 0.4 in men and 0.5 and 0.3 in women[10].

The incidence of Hodgkin's disease has shown a significant heterogeneity due to age, sex, race, geographic location and social class[11]. The risk of Hodgkin's disease is higher in men, among people with higher socioeconomic status, and genetic-related factors[12]. Despite the specified epidemiological characteristics, the cause of Hodgkin's disease remains unknown[13,14]. The first age peak is between the ages of 15 and 34 and the second one is in elderly people[11,15]. 17% of patients with Hodgkin's lymphoma in all ages have advanced disease and the 5 year survival rate is 63%[16]. Survival of patients with Hodgkin's disease has improved significantly in the past 25 years and the risk of late recurrence is relatively reduced[17]. In young adults, epidemiological findings showed that the illness may increase with pathological response of host to a common late-onset infection. Infection with the Epstein-Barr virus has been identified as such infection[13,14]. Second primary cancers are major causes of morbidity and mortality among survivors with long-term survival of Hodgkin's lymphoma[18].

Human Development Index (HDI) has been launched by the United Nations to assess the economic and social achievements in three sectors that include longevity, knowledge and standards of living. Life duration is measured by life expectancy at birth, knowledge by combination of literacy rate of adults, and registration rate and the standard of life were measured by Gross domestic product (GDP) per capita[19,20]. In various areas, there are differences in terms of incidence and mortality. One of the causes of these differences could be due to the different development of countries. In several researches, the relationship between the human development index and various cancers and disease has been surveyed[21-24]. To date, the relationship between HDI and its components has not been addressed, due to the variation of incidence and mortality of this cancer. We aimed at investigating the epidemiology, the age-standardized incidence and death of Hodgkin's cancer, and its relationship with HDI and its components.

MATERIALS AND METHODS

Materials

This study was an ecologic study in the World for assessing the correlation between age-specific incidence and mortality rate (ASR) with HDI and its components, including life expectancy at birth, mean years of schooling, and Gross national income (GNI) per capita. Data about the age-specific incidence and mortality rate (ASR) for every country in 2012 were obtained from the Global Cancer Project (http://globocan.iarc.fr/Default.aspx)[25] and HDI from Human Development Report 2013[26], including information about HDI and its components worldwide in 2012. The method of estimate the age-specific incidence and mortality rates in global cancer project by international agency for research on cancer was previously reported[25,27].

Human Development Index (HDI)

HDI is a composite measure of indicators along three components: life expectancy, educational attainment, and command over the resources needed for a decent living (26).

Statistical Analysis

The correlation bivariate method was used for the assessment of the correlation between age-specific incidence and mortality rate (ASR) with HDI, and its components (life expectancy at birth, mean years of schooling, and GNI per capita). Statistical significance was assumed if $p<0.05$. All reported p-values are two-sided. Statistical analyses were performed using SPSS PASW Statistics for Windows, Version 15.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

The incidence number of Hodgkin lymphoma cancer

In 2012, 65950 cases of Hodgkin's lymphoma cancer occurred. 25165 cases happened in countries with very high HDI, 15788 cases in countries with high HDI, 16748 cases in countries with average HDI, and 8243 cases in low HDI countries. 5 countries that had the largest number of Hodgkin's lymphoma cancers included: United States of America (USA) with the 8601 cases, India with 8371 cases, the Russia with 2911 cases, China with 2101 cases, and Brazil with 2031 cases. 5 countries that had the highest number of Hodgkin's lymphoma cancer in men were: India with 5677 cases, USA with 4804 cases, Russia with 1401 cases, Pakistan with 1333 cases, and China with 1243 cases, respectively. About women, 5 countries that had the highest number of Hodgkin's lymphoma cancer included: USA with 3797 cases, India with 2694 cases, Russia with 1510 cases, Brazil with 957 cases, and Germany with 936 cases.

The age-standardized incidence rate of Hodgkin lymphoma cancer

The standardized incidence rate of Hodgkin's lymphoma cancer was 0.9 per hundred thousand people in the

world. This amount was 1.9 per hundred thousand people in very high HDI, 1.4 per hundred thousand people in high HDI, 0.5 per hundred thousand people in average HDI and 0.7 per hundred thousand people in low HDI countries. 5 countries that had the highest age-standardized incidence rate of Hodgkin lymphoma cancer included: Israel with 3.7 per hundred thousand people, Lebanon with 3.7 per hundred thousand people, State of Palestine with 3.3 per hundred thousand people, Croatia with 3.1 per hundred thousand people and Switzerland with 2.7 per hundred thousand people. 5 countries that had the highest age-standardized incidence of Hodgkin's lymphoma cancer for men included Lebanon with 4.2 per hundred thousand people, Israel with 3.9 per hundred thousand people, State of Palestine with 3.3 per hundred thousand people, Croatia with 3.3 per hundred thousand people, and French Guiana with 3.1 per hundred thousand people. Also, 5 countries that had the highest age-standardized incidence of Hodgkin's lymphoma cancer for women included Israel with 3.6 per hundred thousand people, State of Palestine with 3.3 per hundred thousand people and Lebanon with 3.2 per hundred thousand people, Croatia with 2.9 per hundred thousand people, and Portugal with 2.8 per hundred thousand people.

Death numbers of Hodgkin lymphoma cancer

In 2012, 25469 cases of death from Hodgkin's lymphoma occurred worldwide; there were 4578 deaths in countries with very high HDI, 6301 deaths in countries with high HDI, 8886 deaths in countries with average HDI, and 5703 deaths in countries with low HDI. The five countries that had the highest number of deaths from Hodgkin's lymphoma cancer included: India, Pakistan, USA, Russia, and China with 4342, 1403, 1295, 1167 and 1067 deaths, respectively. Five countries that had the most cases of Hodgkin's lymphoma cancer deaths in men included: India with 2938 deaths, Pakistan with 934 deaths, USA with 730 deaths, Russia with 656 deaths, and China with 622 deaths. In women, five countries that had the most cases of Hodgkin's lymphoma cancer deaths included; India with 1404 deaths, USA with 565 deaths, Russia with 511 deaths, Pakistan with 469 deaths, and China with 445 deaths.

The age standardized mortality rate of Hodgkin lymphoma cancer

In 2012, the standardized death rate of Hodgkin's lymphoma cancer was 0.3 per hundred thousand people in the world, but this rate was 0.2 per hundred thousand people for countries with very high HDI, 0.5 per hundred thousand people in countries with high HDI, 0.2 per hundred thousand people in countries with average HDI, and 0.6 per hundred thousand people in countries with low HDI. 5 countries that had the highest standardized mortality rate were: State of Palestine, Yemen, Lebanon, Iraq and Syrian Arab Republic with 2.4, 2, 1.6, 1.5 and 1.4 per hundred thousand people, respectively. 5 countries that had the most standardized Hodgkin's lymphoma cancer mortality rate for men were: Yemen with 2.6 per hundred thousand people, State of Palestine with 2.3 per hundred thousand people, Iraq with 1.9 per hundred thousand people, Lebanon with 1.9 per hundred thousand people, and Uganda with 1.7 per hundred thousand people, respectively. Moreover, 5 countries that had the highest standardized mortality rate of Hodgkin's lymphoma cancer in women included: State of Palestine with 2.5 per hundred thousand people, Yemen with 1.4 per hundred thousand people, Jordan with 1.3 per hundred thousand people, Lebanon with 1.2 per hundred thousand people, and the Syrian Arab Republic with 1.2 per hundred thousand people. Most of the countries of underdeveloped areas have higher incidence than the countries of underdeveloped areas. The standardized mortality rate of developed countries is lower than that of underdeveloped ones.

The relationship between the standardized incidence of Hodgkin lymphoma cancer and Human Development Index

A significant positive correlation was observed between the standardized incidence rates of Hodgkin's lymphoma cancer with the HDI (r: 0.626; $p<0.001$). Also, a significant positive correlation was seen between components of HDI with standardized incidence rate of Hodgkin lymphoma cancer. Standardized incidence rate was significantly positive correlated to life expectancy at birth (r: 0.56; $p<0.001$); significant positive correlation with mean education years (r: 0.590; $p<0.001$) and significant positive correlation with income level per person of population (r: 0.440; $p<0.001$), (Figure 1).

The relationship between the standardized mortality rate of Hodgkin lymphoma cancer and Human Development Index

There is significant negative correlation between the standardized mortality rate of Hodgkin's lymphoma cancer and the HDI (r: -0.181; p: 0.019). An inverse correlation was observed between the components of HDI and standardized mortality of Hodgkin's lymphoma cancer. There is negative significant correlation between standardized mortality rate and life expectancy at birth (r: -0.117; p: 0.013), average years of education (r: -0.167; p: 0.03) and income level to each person of population (r: -0.256; p: 0.001) (Figure 2).

DISCUSSION

Cancer is one of the most important health problems in the world[28]. The standardized incidence and mortality rate of Hodgkin's cancer in the world

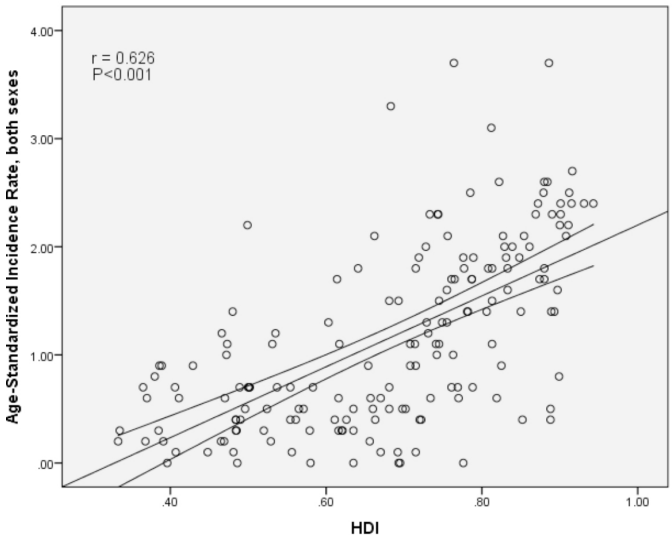

Fig. 1. The relation between the standardized incidence rate and the human development index (HDI).

in 2012 were 0.3 and 0.9 per hundred thousand people, respectively. Hodgkin's disease risk is in high incidence among individuals with higher socioeconomic status. Although most of the countries of underdeveloped areas have higher incidence than countries in underdeveloped areas, the standardized mortality rate in developed countries is lower than that of undeveloped ones. The incidence rate is increasing in developing countries with the increase in life expectancy over time, urban sprawl and lifestyle changes. Survival of patients with Hodgkin's disease has significantly improved in the last 25 years and the risk of late recurrence has rather decreased[17].

In the present work, a positive correlation was observed between Hodgkin's cancer and HDI, in agreement with other studies that reported a positive relationship between HDI and cancer. We showed that, with growth and development improvement, the incidence of some cancers increases while others decrease[29]. In another study that examined the relationship between HDI and kidney cancer, a negative correlation was observed between two variables[30].

A positive correlation was found between the incidence of Hodgkin and earnings. In the study conducted among young adults, a significant relationship was seen between the incidence of Hodgkin's lymphoma and high socioeconomic status[31]. Economic and social conditions have been associated directly with stage of disease and survival. The relationship may be due to ethnicity and not related to socioeconomic status. The differences in ethnicity and race may led to bias[31]. In another work conducted by Smith et al[16], a meaningful increase of chance of advanced Hodgkin's cancer was detected in areas with low socioeconomic status. This increase may be due to weaker care system in these regions in comparison to areas with high socio economic

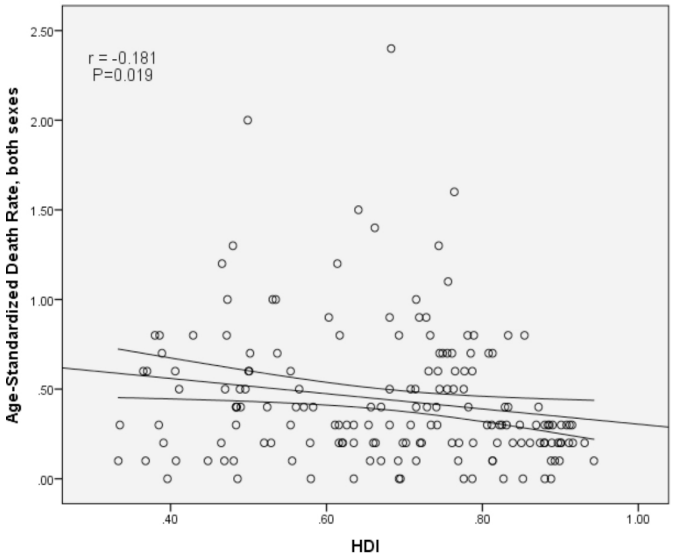

Fig. 2. The relation between the standardized mortality rate and the human development index (HDI).

status. We found an inverse relationship between the standardized mortality rate of Hodgkin's cancer and life expectancy; the more life expectancy, the lower standardized mortality rate observed. In a study of the relationship between life expectancy and 5-year survival of cancer, the lowest survival rate was seen between the regions which had the lowest life expectancy. This relationship did not show high correlation for Hodgkin's cancer. This observed relationship between life expectancy and survival may be due to differences in diagnostic accuracy or people follow up in different areas and may not be due to differences in life expectancy[32]. An inverse relationship was seen between Hodgkin's cancer mortality rate and income. It was shown that survival in patients with higher socioeconomic status is more than people with lower socioeconomic status, which is due to track and early diagnose of diseases by people with former group[33]. Ward et al[34] showed that for any kind of cancer, patients in poorer regions have higher mortality and lower survival rate (both men and women). The 5-year survival rate for people in the poorer areas was lower than richer countries. This difference may be due to various accesses to health care system and the quality of treatments. In order to prevent and balance the disease in various regions, treatment and early diagnosis are required significantly. A study in the USA reported that people who live in poverty have higher incidence and mortality cancer rates than people who are richer. More differences in mortality are due to late diagnosis by poorer people. Although, the life style and behavior are also effective in survival declining. A potential escalation factor among the poor people is the lack of knowledge about cancer and its treatment[35].

CONCLUSIONS

The age-standardized incidence rate of Hodgkin's cancer is more predominant in countries with higher HDI than countries with lower HDI, while the age-standardized mortality rate is higher in countries with higher HDI than countries with lower HDI. Informing people about risk factors and prevention is recommended for reducing the incidence of disease.

Conflict of Interest:
None

Ethical Committee:

Ethical Committee is not required for this study.

Informed Consent:

Informed Consent is not required for this study.

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