ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Epidemiology Of Breast Cancer In Kazakhstan: Is It Possible To Change Global Trends?.

Tamara A. Voshchenkova[1]*, Nasrulla A. Shanazarov[1], Nazar K. Seidalin[1], Gulmira A. Ermakhanova[1], Valerii V. Benberin[1], Amir A. Akhetov[1], Sergei V. Zinchenko[2,3], Sergei A. Karamalikov[3], and Airat I. Bilialov[2].

[1]Hospital of Medical Center of Office of the President of the Republic of Kazakhstan, Astana, Kazakhstan.
[2]Kazan (Volga Region) Federal University, Kazan, Russian Federation.
[3]Republican Clinical Cancer Dispensary of the Ministry of Health of the Republic of Tatarstan, Kazan, Russian Federation.

ABSTRACT

Objective of the research was to study the characteristics of the epidemiology of breast cancer (BC) in Kazakhstan over the past 20 years (1997-2016). The data on morbidity and mortality in breast cancer register and official state statistics of Kazakhstan are used. The source of the comparative data was GLOBALCAN2012, European Cancer Information System (ECIS), health information portal of the WHO European Bureau, and UNDP. The analysis was carried out using the methods of descriptive and analytical biostatistics. Four models of epidemiological processes of breast cancer were formed for countries with different levels of the human development index (HDI). Evaluation of changes of indicators in the framework of the formed models allowed us to see country characteristics. The study revealed a link between the epidemiological trends of breast cancer with changes occurring in different countries, including Kazakh health care and society. The results of the study allowed us to more deeply understand the current state and tendencies of breast cancer for Kazakhstan, to determine the control points of the epidemiological situation.

Keywords: breast cancer, morbidity, mortality, Kazakhstan, human development index, epidemiology.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

The problem of breast cancer attracts the attention of Kazakhstani researchers, like the rest of the world, due to its leading position in the structure of cancer morbidity and mortality of women [1].

As life expectancy increases, the burden of breast cancer on national health systems increases. The American Cancer Society (2010) has estimated the global economic costs of early death and disability from breast cancer in the United States at $88 billion per year and the cost of severe debilitating treatment at $17 billion annually [2]. Consequently, in the case of effective management of the epidemiological situation, it is possible to obtain an economic effect of 5 times the costs. The real ability to manage breast cancer and its economic feasibility are a powerful incentive for the implementation of relevant programs at the national level [3,4,5].

Standardized breast cancer rates, which allow comparing the results of different country management strategies, are usually available after 2-3 years, and the national indicators of Kazakhstan currently do not have a convincing level of confidence. The epidemiological pattern of breast cancer, modeled for the country in the medium term, allows predicting its development and building a national management system accordingly.

Thus, the objective of the research was to study and predict trends in the epidemiology of breast cancer in Kazakhstan, as well as to determine the growth points of the effectiveness of managing this disease.

MATERIALS AND METHODS

The source of information for studying patterns of morbidity, mortality and survival in breast cancer was the international databases GLOBALCAN2012, the European Cancer Information System (ECIS), the health information portal of the WHO European Bureau, UNDP, and national statistics of Kazakhstan.

The GLOBALCAN2012 data represent the 2012 age-standardized global indicators and their differences between countries and their groups. The WHO European Bureau's health portal has become a source of dynamic features of the epidemiological indicators of breast cancer in 1997-2016 for assessing the impact of the changing demographic and economic characteristics borrowed from the UNDP database.

The European Cancer Information System (ECIS) has allowed a more detailed study of the situation on the example of countries in the European Region that are closest geographically, economically and politically to Kazakhstan. The combined changes in morbidity and mortality over time are estimated using a relative survival index (1-3/C*100) [6].

Analysis of the patterns of the epidemiological process in breast cancer for groups of countries with different levels of the human development index in 1987-2016 provided the basis for an abstract view of its upcoming aspects for Kazakhstan. A formal extrapolation was chosen as a class for modeling, and its structure includes significant standardized indicators.

The national statistics of cancer diseases in Kazakhstan, since 2008 based on the national coverage of the population (cancer registry), allowed us to see in more detail the possible points of influence on world trends in the epidemiology of breast cancer in Kazakhstan. The analysis was carried out using the methods of descriptive and analytical biostatistics. The peculiarities of the epidemiology of breast cancer in a number of countries were studied and taken into account in the study [6-11].

This research was carried out within the framework of the implementation of the scientific and technical program "New molecular genetic methods for pre-symptomatic diagnostics and treatment methods for a number of significant diseases" on the instructions of the Ministry of Health of the Republic of Kazakhstan. The study protocol was approved by the Research Ethics Committee of S.D. Asfendiiarov Kazakh National Medical University.

ISSN: 0975-8585

RESULTS

Morbidity, mortality, 5-year survival are important parameters in the formation of a disease control strategy, allowing to assess the current situation, see the forecast of events and allocate resources.

From 2008 to 2012, the global incidence of breast cancer increased by more than 20%, mortality increased by 14%, as a result a growing index of the accumulation of the population living with breast cancer was formed, but the epidemiological process in different countries has been developing according to its scenario [12-17].

The Human Development Index (HDI) is an integral indicator that allows assessing the level of accessibility of progress in each country: life expectancy at birth reflects the ability to live a long and happy life, the expected duration of training reflects the ability to acquire knowledge, gross national product - the ability to achieve a decent standard of living. Depending on the results of the HDI assessment, the countries are divided into 4 groups: very high (VHHDI), high (HHDI), medium (MHDI) and low (LHDI) [18]. We defined this distribution, based on the need to study the possibilities of managing the epidemiological situation at the national level in breast cancer, as the main one.

Standardized morbidity, mortality and prevalence rates of those survived for 1, 3, 5 years with breast cancer were grouped for countries with different levels of HDI, special attention was paid to countries developing for a long time together with Kazakhstan, within the framework of the former Union of Soviet Socialist Republics (Table 1). The importance of economic and demographic factors for the epidemiological situation in breast cancer has become obvious.

Table 1: INDICATORS OF MORBIDITY AND MORTALITY FROM BREAST CANCER IN THE COUNTRIES OF THE FORMER SOVIET UNION (2018) (http://globocan.iarc.fr)

countries		cases			mortality			prevalence		
	Position by HDI	rough	ASR (World)	risk	rough	ASR (World)	risk	1 year	3 years	5 years
World: life expectancy - 71.6 years, average years of study - 8.3 years, GDP per capita - 14.4 thousand dollars										
world	178 countries	47.8	43.1	4.6	14.9	12.9	1.37	56.3	154.8	239.9
A group of countries with a very high level of human development: life expectancy - 79.5 years, average years of study - 16.4 years, GDP per capita - 39.6 thousand dollars										
by a group of countries		128	78.2	8.35	29	14.1	1.52	139.0	395.7	626.5
Estonia	30	91.2	51.6	5.64	35.8	15.7	1.75	93.2	254.6	887.4
Lithuania	37	83.8	48.7	5.37	34.4	16.3	1.84	85.4	234.5	358.6
Latvia	44	95.0	52.1	5.76	35.9	17.6	1.98	96.0	262.7	401.4
Russia	49	75.0	45.6	5.06	32.0	17.2	1.98	78.5	215.0	328.3
A group of countries with a high level of human development: life expectancy - 75.5 years, average years of study - 8.1 years, GDP per capita - 13.8 thousand dollars										
by a group of countries, including:		53.2	45.2	7.88	18	14.6	1.65	59.8	162.9	250.5
Belarus	52	74.1	45.9	5.02	24.8	14.2	1.67	76.8	211.5	324.2
Kazakhstan	56	73.5	63.0	6.78	21.9	18	2.04	79.5	210.3	319.0
Georgia	70	67.7	44.0	4.6	23.3	13.2	1.45	63.5	170.0	260.3
Azerbaijan	78	29.7	25.4	2.68	9.9	8.6	0.97	31.3	83.5	127.0
Ukraine	84	67.9	41.3	4.51	33.5	18.4	2.12	69.7	259.0	388.8
Armenia	84	102.5	74.1	7.95	36.7	24.2	2.78	101.8	270.2	411.2
Uzbekistan	105	23.9	27.1	2.91	9.0	10.6	1.2	28	74.5	113.3

ISSN: 0975-8585

A group of countries with a medium level of human development: life expectancy - 68.6 years, average years of study - 6.6 years, GDP per capita - 6.3 thousand dollars										
By a group of countries, including:		28.5	26.5	2.74	10.5	9.8	1.05	31.8	84.3	127.5
Moldova	107	59.7	38.7	4.6	29.7	18.3	2.27	63.7	174.1	265.0
Turkmenistan	111	25.0	26.8	2.7	8.5	9.6	1.03	29.5	78.6	119.9
Kyrgyzstan	120	24.0	27.3	2.96	9.6	11.2	1.26	18.8	50.4	76.9
Tajikistan	129	14.4	20.4	2.24	5.8	8.7	1.01	28.3	75.4	114.6
A group of countries with a low level of human development: life expectancy - 59.3 years, average years of study - 4.6 years, GDP per capita - 2.6 thousand dollars										
By a group of countries		22.7	32.6	3.35	11.5	17	1.82	31.4	82.4	123.8

To assess the distribution of the epidemiological process by age, the standardized morbidity, mortality, mortality to morbidity rates (Table 2) were used.

Table 2: COMPARATIVE DISTRIBUTION BY AGE OF A STANDARDIZED INDICATOR OF MORBIDITY, MORTALITY AND RELATIVE SURVIVAL OF WOMEN, BASED ON WHO'S DATA, GLOBALCAN2012 (2018) (http://globocan.iarc.fr)

Age	VHHDI			HHDI			MHDI			LHDI			Kazakhstan		
	morbidity	mortality	MMR	morbidity	mortality	MMR	morbidity	mortality	MMR	morbidity	mortality	MMR	morbidity	mortality	MMR
15-39	24.7	2.1	8.5	13.8	2.9	21.0	11.1	2.9	26.1	14.6	6.9	47.3	14.5	2.4	16.6
40-44	114.9	12.9	11.2	70.6	16.1	22.8	51.0	14.0	27.5	67.7	27.8	41.1	94.2	18.5	19.6
45-49	164.2	21.1	12.9	100	25.1	25.1	68.8	20.4	29.7	84.4	36.3	43.0	150.3	32.4	21.6
50-54	204.6	31	15.2	125.5	35.9	28.6	80.7	26.2	32.5	94.1	44	46.8	200.1	48.4	24.2
55-59	243.1	42.1	17.3	144.3	47.1	32.6	80.9	28.8	34.9	97.7	50	51.2	225.9	62.2	27.5
60-64	284	52.7	18.6	157.5	56.1	35.6	77.1	31.5	40.9	89.3	55.2	51.8	226.7	68.6	30.3
65-69	310.7	62.5	20.1	164.3	63.2	38.5	73.7	35.1	47.6	80.5	58.9	43.2	223.5	77.3	34.6
70-74	299.8	73.9	24.6	168.6	74.3	44.1	68.7	39.9	58.1	68.1	61.1	89.7	212.2	63	29.7
75+	283.6	127.6	45	159.3	90.4	56.7	62.2	51.7	83.1	22.7	61.4	270.5	194.5	114.3	58.8
total	78.2	14.1	18.0	45.2	14.6	32.3	26.5	9.8	37.0	32.6	17.0	52.1	63	18	28.7

The result of the analysis was 4 epidemiological models for breast cancer, corresponding to 4 levels of the HDI (Table 3).

The ideal epidemiological situation in breast cancer is closest to the group of countries with VHHDI, especially to its top ten countries: decreasing high morbidity and low mortality at a rate of about 1% per year provide, albeit decreasing, growth rates of survival of about 3% per year. Of the 10 cases of breast cancer, as a rule, 8 live 5 years more, thanks to the identification and treatment of more than 30% of primary breast cancer at the subclinical level. This pattern is typical for all ages, which determines the ability to live with breast cancer for much longer, because with the increase in life expectancy there is a longer period for death from breast cancer. The group of countries with VHHDI combines the level of GDP per capita of about $ 39.6 thousand (PPP$), providing an average life expectancy of 79.5 years and an average year of study of 16.4 years. Reproductive behavior is usually the most dangerous for breast cancer, and is characterized by the birth of the first child after 30 years, a short period of breastfeeding, and the widespread use of hormones for contraceptive and replacement purposes. The overall fertility rate in this group is stable – 1.4, and the proportion of children receiving breastfeeding up to 6 months of age is less than 30%.

ISSN: 0975-8585

Table 3: Epidemiological models of breast cancer for groups of countries of different levels of the human development index (HDI)

Indicators	For a group of countries with low HDI	For a group of countries with medium HDI	For a group of countries with high HDI	For a group of countries with very high HDI	Kazakhstan
Morbidity The number of new cases per 100,000 female population standardized to the global age. (ASR(W)) Source: http://globocan.iarc.fr https://gateway.euro.who.int https://ecis.jrc.ec.europa.eu/	Growth by 5-6% per year from 32.6 (2012). A 10-12-times rise from 15-39 years to 50-59 years with a fall of more than 25% by 75+ years Risk 3.35 (2012)	Accelerating growth by 5-6% per year from 26.5 (2012). A 10-12-times rise from 15-39 years to 50-59 years with a fall of 15-25% by 75+ years Risk 2.74 (2012)	Ascending growth by 5-6% per year from 45.2 (2012). A 10-12-times rise from 15-39 years to 65-69 years with a fall of about 10% by 75+ years Risk 4.88 (2012)	Stabilization and decline of about 1% per year from 78.2 (2012) A 12.5 and more times ascending growth from 40 years to 70-74 years, with a fall of less than 5-6% by 75+ years. Risk 8.35 (2012)	Ascending growth by 2% per year from 63.0 (2012). A 15.6-times rise from 15-39 years to 60-64 years with a fall of 16% by 75+ years Risk 6.78 (2012)
Mortality The number of deaths per 100,000 female population standardized to the global age. (ASR(W)) Source: http://globocan.iarc.fr https://gateway.euro.who.int https://ecis.jrc.ec.europa.eu/	Growth by 1% per year from 17 (2012) 2-3-times growth of mortality with increasing age, from 40-44 to 75+ Risk 1.82 (2012)	Growth by 3-4% per year from 9.8 (2012). 3-4-times growth of mortality with increasing age, from 40-44 to 75+ Risk 1.05 (2012)	Decrease by about 0.5% per year due to younger ages from 14.6 (2012) 3-4-times growth of mortality with increasing age, from 40-44 to 75+ Risk 1.65 (2012)	Age-uniform and steady decline in mortality (about 1% per year) from 14.1 (2012) 8-10-times growth of mortality with increasing age, from 40-44 to 75+ Risk 1.52 (2012)	Decrease by about 2.5% per year due to 40-50-years-olds from 18 (2012) 2.4-times growth of mortality with increasing age, from 40-44 to 75+ Risk 2.04 (2012)
Survival	Mortality 1.5-2 times lower than morbidity, from 60-64 years of age	Mortality 2.5-3 times lower than morbidity, lower than the incidence rate for all ages by 1.2 times at the age of 75+	Mortality 3-4 times lower than morbidity for all ages, from 1.2 times at the age of 75+ (maximum) to 3-4 times	Mortality 5 and more times lower than morbidity for all ages, from 2.2 times at the age of 75+ (maximum) to 11	Mortality 3.5 times lower than morbidity for all ages, from 1.7 times at the age of 75+ (maximum) to 6

ISSN: 0975-8585

Mortality-to-morbidity rate (mortality/morbidity*100) The prevalence of cases of 5 years of survival (the number of specific cases of 5 years of survival per 100,000 adult population, standardized to the global age. Source: http://globocan.iarc.fr	Since 2012, the decline in the growth of survival up to 2.2% per year from a level of 52.1 against 12.6% in the previous five-year period 23.8 (2012)	(maximum) to 3-4 times at the age of 15-39 years (minimum). Since 2012, the decline in survival up to 8% per year from a level of 37.00 against 9.6% in the previous five-year period 127.5 (2012)	at the age of 15-39 years (minimum). Since 2012, the decline in the growth of survival up to 6.9% per year from a level of 32.3 against 13% in the previous five-year period 250.5 (2012)	times at the age of 15-39 years (minimum). Since 2012, the decline in the growth of survival up to 2.7% per year from a level of 18.0 against 6.2% in the previous five-year period 626.5 (2012)	times at the age of 15-39 years (minimum). Since 2012 The decline in the growth of survival up to 8.1% per year from a level of 28.7 against 23% in the previous five-year period 319.0 (2012)

The group of countries with HHDI is united by an average level of GDP per capita of $14.4 thousand (PPP$), which ensures an average life expectancy of 71.6 years and average years of study - 8.3 years. The overall fertility rate is 1.5–1.6, while breastfed babies account for 40–50% of their population. Growing in this group of countries at a rate of 2-3% per year, a high incidence of disease is accompanied by a slight, less than 0.5% per year, decrease in mortality. Survival increases at a rate of 6.9% per year, growth rates decline. Five of 10 cases of breast cancer, as a rule, live 5 years more. The distribution of indicators is uneven: from 70 years old, against a background of rising mortality, the registration of morbidity is reduced, which indicates available reserves in the current system of early detection and treatment.

As a rule, the MHDI group includes countries with a life expectancy of 68.6 years, average years of study of 6.6 years, and GDP per capita of about 6.3 thousand dollars (PPP$). The epidemiological situation in breast cancer is characterized by a low mortality growing by 10–15% per year and morbidity - by 3–4% per year. Survival increases at a rate of about 8% per year. Three of the 10 cases of breast cancer have a chance to live 5 years more. The distribution of indicators is even more uneven: the registration of morbidity decreases with the age of 60 years and approaches the mortality rates. In this group of countries, mammography is available to clarify the diagnosis, but the infrastructure for diagnosis and treatment is not developed. Reproductive behavior is characterized by a general fertility rate of 3.0-3.3, and the proportion of children receiving exclusive breastfeeding up to 6 months of age is 60-70%.

The LHDI countries with the lowest morbidity has the highest mortality, the mortality to morbidity ratio is the highest: 2 cases per deceased. The rate of increase in morbidity and mortality is significantly lower than in the previous group of countries. From 60 years old, mortality exceeds morbidity. Those living 5 years more with breast cancer after the diagnosis accounts for 123.8 per 100 thousand women, which is 5 times less than in the group of VHHDI countries. Only 2 of the 10 cases of breast chance have a chance to live 5 years more.
This group of countries is characterized by the lack of infrastructure for the detection and treatment of breast cancer, because the economic situation is the most unfavorable: GDP per capita - $2.6 thousand (PPP$) ensures a life expectancy of 59.3 years and average years of study - 4.6 years. Reproductive behavior in this group of countries is characterized by a total fertility rate of 4.4–4.8 births per woman, over 90% of children under 6 months of age receive breastfeeding only.

Differences in the level and changes of epidemiological indicators in breast cancer for groups of countries with different levels of HDI also reflect variability in national health policies, different prevalence of risk factors, differences in human development, which together have a decisive influence on the epidemiological picture of breast cancer. Adding national data, we formulated an epidemiological model of breast cancer in Kazakhstan.

Kazakhstan has been in the group of the HHDI countries since 2000. Demonstrating the maximum morbidity in its group of countries, its continuing growth is characterized by an earlier decline from 65 years against 70 years in the group. This incidence trend requires closer attention to the health of older people. High mortality rates decline at rates higher than in the VHHDI and HHDI groups. High morbidity and high mortality is a characteristic that is not reflected in any model, however, stabilization of morbidity and a rapid decline in mortality are obvious. The mortality to morbidity rate is growing at a rate exceeding the group of HHDI countries, as an indicator of the prevalence of 5-year survival. Kazakhstan conducts a breast cancer screening on a population basis, and there is an infrastructure for diagnosis and treatment. Reproductive behavior is characterized by a relatively high (2.7) total fertility rate and a high rate of breastfed infants under 6 months (81%).

Thus, the results of the study demonstrated the features of the epidemiological situation of breast cancer in Kazakhstan.

DISCUSSION

In the medium-term prognosis for the epidemiological situation of breast cancer in the world, two trends are obvious: an increase in morbidity and an increase in mortality, both of which are unfavorable and very burdensome. Within the framework of the study, it was important to understand whether the already high morbidity and mortality in breast cancer in Kazakhstan strive for maximum global indicators and whether there is a possibility of creating a more favorable epidemiological situation in the country?

ISSN: 0975-8585

There are more than 10-times change in the incidence rate of breast cancer in the world with a clear geographic pattern: from the highest in the United States and Western Europe to the lowest in Africa and Asia. An evaluation of the available data on parity of the reproductive function indicates the existence of the following regularity. The increase in the incidence of breast cancer is accompanied by an increasingly early onset of menarche, an increase in the timing of first births and a reduction in the duration of breastfeeding, which supports our use of the incidence rate to assess primarily reproductive risk factors [19].

Over the past 5 years in Kazakhstan, the rate of increase in morbidity has been declining, so far it is 2% per year against 1.2% in countries that have joined the EU before 2004. There is also a lower incidence rate of 63 cases with a maximum level of 111, 9 (Belgium) per 100 thousand standardized population, which allows us to predict the beginning of a period of steady decline in incidence after 10 years from not more than 90 cases per 100 thousand standardized population (Table 4).

Table 4: Changes of indicators of the epidemiological process of breast cancer in different groups of Eurasian countries in 1997-2016 (https://gateway.euro.who.int, https://ecis.jrc.ec.europa.eu/) [14].

Groups of countries	standardized morbidity rate (Mb)		standardized mortality rate (Mt)		relative survival (1-3/Mt*100)	
	changes	rate per hour, %	changes	rate per hour, %	changes	rate per hour, %
Kazakhstan	28-50	+2.2%, since 2012 -2%	20.6-16.6	-1.2% since 2012 -2.5%	35.9-201.2	+23%, since 2012 -8.1%
CIS	44-68	+1.8% since 2012 -2.1%	21 – 16.2	-0.94%, since 2012 -2.3%	109.5-319.8	+96% since 2012 -8%
Central Asian countries	16-27	+2.0%; since 2012 -2.2%	13.1-15.2	+0.3% since 1012 + 1.2%	22.1-77.6	+12.6% since 2012 -2.2%
EU after 2004	60-104	+2.2%; since 2012 -1.9%	24.7-22.2	-0.5% since 2012 -0.45%	142.9-368.5	+7.9% since 2012 -2.6%
EU before 2004	122 - 174	-1.5%; since 2012 -1.2%	28.9-21.3	-1.8% per year since 2012 -0.85%	322.1-724.6	+6.2% since 2012 -2.7%

Thus, cultivation in Kazakhstan of the established model of reproductive behavior, which reduces the risk of breast cancer, is the first point of control of the epidemiological situation at the level of morbidity.

Mortality has a significantly lower (up to 4 times) change in the index from the highest in black women in the United States to the lowest in Korean women. In Kazakhstan, over the past 5 years, the rate of decline in mortality has been growing, advancing the EU countries of the VHHDI (1% per year) and HHDI (0.5% per year) group by more than 2 times. Such an epidemiological situation allows for the reduction of mortality in breast cancer to the level of a group of the VHHDI countries, subject to the implementation of their subclinical diagnosis and treatment policies. Thus, the next point of control of the epidemiological situation at the level of mortality is the diagnosis and treatment of breast cancer at the subclinical level of no less than in one third of the patients.

Until 1998, the Kazakhstan epidemiological picture of breast cancer was a rapidly growing morbidity and mortality rate, characteristic of the MHDI countries. Since 1999, a steady trend towards a decline in mortality has begun to take shape, which is typical of a group of the VHHDI countries. Since 2012, the growth rate of the incidence has also significantly decreased. That is, in the epidemiological model of Kazakhstan, the features of the VHHDI countries are quite clearly visible.

Over the past 20 years, the progress of breast cancer in Kazakhstan have changed 2 of 4 epidemiological models. The thing that the transition to a more favorable epidemiological model in Kazakhstan can occur faster

and further is a challenge for national health care. It should be noted that the countries of the former Soviet Union to some extent show the epidemiological features of breast cancer, which are also characteristic of Kazakhstan. For example, the former countries of the Soviet Union, which joined the European Union since 2004, demonstrated rates of increase in morbidity, mortality, and prevalence 2 or more times higher than in countries that joined the EU before 2004. Despite the fact that the USSR command economic system did not have the necessary flexibility and could not adapt to global competition, strict standardization against limited resources for health financing and the transfer policy of proven technology practices in this case play their positive role. Thus, standardization of diagnosis and treatment is the third growth point in managing the epidemiological situation at the national level.

The results of our analysis indicate that Kazakhstan has the possibility of an accelerated transition to a more favorable epidemiological situation in terms of breast cancer. Among the contributing directions are three main control points:

- control of risk factors at the national and personalized levels (cultivation of a lifestyle that reduces the risk of breast cancer);
- ensuring the growth of the proportion of cases of diagnosis and treatment of the disease at the subclinical level of not less than 30%;
- strict standardization and full implementation of proven diagnostic and treatment processes in the group of the VHHDI countries.

Limitations

We used epidemiological data from sources that meet high quality standards at the global level. However, the accuracy of cancer registration varies significantly from country to country, therefore our findings are largely conditional and subsequently require more in-depth studies.

CONCLUSION

Reducing the global burden of disease is possible, subject to the implementation of an effective strategy primarily at the national level, and the ability to compare national models with other countries provides an additional incentive to form control measures in the medium term.

Our approach to modeling epidemiological processes in breast cancer for groups of countries with different levels of HDI and the prognostic assessment of the epidemiological process of breast cancer in Kazakhstan is an attempt to improve the management of breast cancer at the national level.

This study allowed us to determine the epidemiological features of breast cancer in Kazakhstan, which allows reducing the impact of global trends:

- despite the high level of morbidity, Kazakhstan has a real possibility of not reaching the level of a group of the VHHDI countries if maintaining the parity characteristics of reproductive behavior and controlling risk factors at the national and personalized levels;
- despite the high mortality rate, Kazakhstan has a real opportunity to reduce faster than in the group of the VHHDI countries if the disease is diagnosed at the subclinical level and timely comprehensive treatment is provided at the level of highly efficient technologies.

Abbreviations

BC: breast cancer
WHO: World Health Organization
HDI: human development index
VHHDI: very high human development index
HHDI: high human development index
MHDI: medium human development index
LHDI: low human development index
ASR – (age-standardized rate) - weighted average of world age indicators for the distribution of the people of the standard population

CIS – Commonwealth of Independent States
EU – European Union
MH RK – Ministry of Health of the Republic of Kazakhstan

Authors' contributions

All authors' group members:

- have participated in the development of the concept, design and interpretation of data;
- have personally checked the intellectual content of the manuscript;
- have finally accepted the manuscript for publication;
- agree to be responsible for all aspects of the work.

The authors declare no conflict of interest.

REFERENCES

[1] Eldar Beysebayev, Zarina Bilyalova , Lyazzat Kozhakeeva , Ainur Baissalbayeva , Aizhan Abiltayeva «Spatial and Temporal Epidemiological Assessment of Breast Cancer Incidence and Mortality in Kazakhstan, 1999-2013 Asian Pacific Journal of Cancer Prevention, Vol 16, 2015, c.6795-6798. DOI:http://dx.doi.org/10.7314/APJCP.2015.16.15.6795.

[2] Report of the Interagency Breast Cancer and Environmental Research Coordinating Committee (IBCERCC) 2013) https://www.niehs.nih.gov/about/assets/docs/ibcercc_full_508.pdf

[3] Kiven Erique Lukong Understanding breast cancer – The long and winding road. BBA Clinical Volume7, June 2017,Pages 64-77. https://doi.org/10.1016/j.bbacli.2017.01.001.

[4] Arnold M. et al., Recent trends in incidence of five common cancers in 26 European countries since 1988: Analysis of the European Cancer Registry database, Eur J Cancer (2013), http://dx.doi.org/10.1016/j.ejca.2013.09.002.

[5] C. Héry, J. Ferlay, M. Boniol, P. Autier Quantification of changes in breast cancer incidence and mortality since 1990 in 35 countries with Caucasian-majority populations. Ann Oncol, 19 (6) (2008), pp. 1187-1194.

[6] Asadzadeh Vostakolaei F, Karim-Kos HE, Janssen-Heijnen MLG, Visser O, Verbeek ALM, Kiemeney LALM. The validity of the mortality to incidence ratio as a proxy for site-specific cancer survival. Eur J Public Health 2011;21:573–7.

[7] Jacques Ferlay, Hai-Rim Shin, Freddie Bray, David Forman, Colin Mathers, Donald Maxwell Parkin «Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008» International Journal of Cancer. Volume 127, Issue 12 First published: 17 June 2010. https://doi.org/10.1002/ijc.25516.

[8] Li, T., Mello-Thoms, C. & Brennan, PC Breast Cancer Res Treat (2016) 159: 395. https://doi.org/10.1007/s10549-016-3947-0 https://doi.org/10.1007/s10549-016-3

[9] Lindsey A. Torre, Rebecca L. Siegel, Elizabeth M. Ward and Ahmedin Jemal Global Cancer Incidence and Mortality Rates and Trends—An Update Cancer Epidemiol Biomarkers Prev January 1 2016 (25) (1) 16-27; DOI:10.1158/1055-9965.EPI-15-0578.

[10] J. Ferlay, I. Soerjomataram, M. Ervik, R. Dikshit, S. Eser, C. Mathers, *et al.*GLOBOCAN 2012 v1.0, Cancer incidence and mortality worldwide: IARC CancerBase No.11 ARC, Lyon, France (2013)

[11] P. Murawa, D. Muwara, B. Adamczyk, K. Polom Breast cancer: Actual methods of treatment and future trends Rep Pract Oncol Radiother, 19 (3) (2014), pp. 165-172

[12] Sophia HL George, Ana Sandoval Leon, Talia Donenberg, Raleigh Bulter, Darron Halliday, DuVaughn Curling, Theodore Turnquest, John Lunn, Mohammad R. Akbari, Steven Narodand Judith Hurley Changing fertility factors affecting breast cancer in the Bahamas Cancer Epidemiol Biomarkers Prev July 1 2018 (27) (7 Supplement) B81;DOI: 10.1158/1538-7755.DISP17-B81.

[13] Der Muonir Edmund, Simon B. Naaeder, Yao Tettey, Richard K. Gyasi; Breast Cancer in Ghanaian Women: What Has Changed?, *American Journal of Clinical Pathology*, Volume 140, Issue 1, 1 July 2013, Pages 97–102

[14] Salam Hussein Ewaid Luma Hussein AliAl-Azzawi. Breast cancer risk assessment by Gail Model in women of Baghdad Alexandria Journal of MedicineVolume 53, Issue 2Pages 183-186June 2017. https://doi.org/10.1016/j.ajme.2016.09.001.

[15] Bodmer A, Feller A, Bordoni A, Bouchardy C, Dheler S, Ess S . breast cancer incidence in younger swiss women. 2013. http://www.nicer.org/assets/files/publications/presentations/af_poster_sph2013_breast_cancer_final.pdf .

[16] Aleksei Baburin, Tiiu Aareleid, Mati Rahu, Lauri Reedik & Kaire Innos. Recent changes in breast cancer incidence and mortality in Estonia: Transition to the west JournalActa Oncologica Volume 55, 2016 - Issue 6 Pages 728-733.

[17] A.T. Toriola, G.A. ColditzTrends in breast cancer incidence and mortality in the United States: implications of prevention Breast Cancer Res Treat, 138 (3) (2013), pp. 665-673

[18] Human Development Report 2016 Human Development for Everyone.

[19] Hankiston S, Colditz G, Willett W Towards an integrated model for breast cancer etiology. The lifelong interplay of genes, lifestyle, and hormones. Breast Cancer Res. 2004, 6: 213-218. 10.1186/bcr921).