# STATISTICAL INDICATORS ANALYSIS OF PRIMARY LIVER CANCER IN THE REPUBLIC OF KAZAKHSTAN

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**Issamatov B.K.[1,2], Baimakhanov B.B.[1], Zholdybay Zh.Zh.[2], Medeubekov U.Sh.[1], Chormanov A.T.[1], Tajibaev T.K.[1], Kaniev Sh.A.[1], Sagatov I.Y.[1], Moskalenko N.I.[1], Shmonin V.M.[1], Lagunov I.I.[1]**

[1]JSC "National scientific center of surgery named after A.N. Syzganov", Almaty, Kazakhstan
[2]JSC "National medical university", Almaty, Kazakhstan

**ABOUT THE AUTHORS**
***Issamatov Bekzhan Kalibayevich*** *- researcher of the JSC «NSCS named after A.N. Syzganov»; doctorant of the Department «Visual diagnostics» JSC "National Medical University".*
***Baimakhanov Bolatbek Bimendeevich*** *– Doct. of Med. Sci., Professor, Chairman of the Board JSC «NSCS named after A.N. Syzganov».*
***Zholdybay Zhamilya Zholdybayevna*** *- Doct. of Med. Sci., Professor, Chairman of the Department «Visual diagnostics», JSC "National Medical University".*
***Medeubekov Ulugbek Shalkarovich*** *– Doct. of Med. Sci., Professor, Deputy Chairman of the Board of JSC «NSCS named after A.N. Syzganov».*
***Chormanov Almat Tursynzhanovich*** *– PhD., Deputy Chairman of the Board of JSC «NSCS named after A.N. Syzganov».*
***Tajibaev Talgat Kydyraliyevich*** *– MD, Department of Hepatopancreatobiliary surgery and liver transplantation, JSC «NSCS named after A.N. Syzganov».*
***Kaniyev Shokan Ahmedbekovich*** *– Surgeon, Department of Hepatopancreatobiliary surgery and liver transplantation, JSC «NSCS named after A.N. Syzganov».*
***Sagatov Inkar Yergalievich*** *– Doct. of Med. Sci., Head Department of Scientific, Innovation activity and international cooperation, JSC «NSCS named after A.N. Syzganov».*

**For correspondence:**
***Issamatov Bekzhan Kalibayevich*** *- 62, Zheltoksan str., Almaty, 050004, Republic of Kazakhstan. Phone: +7-707-828-83-51. E-mail: b.isamatov@mail.ru*

***Abstract***

*Hepatocellular carcinoma is one of the most important problems of the oncological service of the world and Kazakhstan. The article describes the analysis of the main statistical indications of primary liver cancer (hepatocellular carcinoma, HCC) in the Republic of Kazakhstan in the period of 2007-2017. Describes the features of the spread of HCC in the world and in some regions of Kazakhstan. The places for the main indicators of HCC in the structure of oncopathology are identified. Dynamic changes in morbidity and mortality rates of HCC depending on gender, and we have the prognosis for the next 5 years. The incidence and mortality rates of hepatocellular carcinoma of men are higher than women.*

**Keywords**
*statistics, liver cancer, hepatocellular carcinoma, morbidity, mortality.*

## Қазақстан Республикасындағы баурдың біріншілік обырының статистикалық көрсеткіштерін талдау

**Исаматов Б.К.[1,2], Баймаханов Б.Б.[1], Жолдыбай Ж.Ж.[2], Медеубеков У.Ш.[1], Чорманов А.Т.[1], Тажибаев Т.К.[1], Қаниев Ш.А.[1], Сағатов І.Е.[1], Москаленко Н.И.[1], Шмонин В.М.[1], Лагунов И.И.[1]**

[1]«А.Н.Сызғанов атындағы Ұлттық ғылыми хирургия орталығы» АҚ, Алматы, Қазақстан
[2]«Ұлттық медицина университеті» АҚ, Алматы, Қазақстан

**АВТОРЛАР ТУРАЛЫ**
***Исаматов Бекжан Калибайұлы*** *– «А.Н. Сызғанов атындағы ҰҒХО» АҚ ғылыми қызметкері, «Ұлттық медицина университеті» АҚ «Визуалды диагностика» кафедрасының докторанты*
***Баймаханов Болатбек Бимендеұлы*** *– м.ғ.д. профессор, А.Н. Сызғанов атындағы ҰҒХО» АҚ басқармасының төрағасы.*
***Жолдыбай Жамиля Жолдыбайқызы*** *- м.ғ.д. профессор, «Ұлттық медицина университеті» АҚ «Визуалды диагностика» кафедрасының меңгерушісі*
***Медеубеков Ұлықбек Шалхарұлы*** *– м.ғ.д. профессор, «А.Н. Сызғанов атындағы ҰҒХО» АҚ басқарма төрағасының орынбасары.*
***Чорманов Алмат Турсыжанұлы*** *- м.ғ.к., «А.Н. Сызғанов атындағы ҰҒХО» АҚ бас дәрігері*
***Таджибаев Талғат Қыдыралиұлы*** *– «А.Н. Сызғанов атындағы ҰҒХО» АҚ Гепатобилиарлы хирургия және бауыр трансплантациясы бөлімінің дәрігері.*
***Қаниев Шоқан Ахмедбекұлы*** *– «А.Н. Сызғанов атындағы ҰҒХО» АҚ Гепатобилиарлы хирургия және бауыр трансплантациясы бөлімінің хирург-дәрігері.*
***Сағатов Іңкар Ерғалиұлы*** *– м.ғ.д., «А.Н. Сызғанов атындағы ҰҒХО» АҚ ғылым, инновация қызметі менеджменті және халықаралық ынтымақтастық бөлімінің жетекшісі.*

**Хат-хабар алмасу үшін:**
***Исаматов Бекжан Калибайұлы*** *- 050004, Алматы қ., Желтоқсан көш, 62 үй, Қазақстан Республикасы. Тел.: +7-707-828-83-51. E-mail: b.isamatov@mail.ru*

***Аңдатпа***

*Гепатоцеллюлярлық карцинома - әлемдегі және Қазақстандағы онкологиялық қызметтің маңызды мәселелерінің бірі болып табылады. Мақалада 2007-2017 жылдар аралығындағы Қазақстан Республикасындағы бауырдың біріншілік ісігінің (гепатоцеллюлярлық карцинома) негізгі статистикалық көрсеткітеріне талдау жасалды. Әлем және Қазақстанның аймақтарында ГЦК таралуының ерекшеліктері сипатталды. Онкопатология құрылымында ГЦК-ның негізгі көрсеткіштері бойынша орындары анықталды. ГЦК-ның аурушаңдық және өлім-жітім көрсеткіштерінің динамикалық өзгерістері талқыланды, алдағы 5 жылға негізгі көрсеткіштерге болжау жасалды. Ерлердегі гепатоцеллюлярлы карциноманың ауру және өлім-жітім көрсеткіштері әйелдерден жоғары болды.*

**Түйін сөздер**
*статистика, бауыр обыры, гепатоцеллюлярлық карцинома, аурушаңдық, өлім-жітім.*

# Анализ статистических показателей первичного рака печени в Республике Казахстан

**ОБ АВТОРАХ**

***Исаматов Бекжан Калибаевич*** *- научный сотрудник АО «ННЦХ им. А.Н. Сызганова»; докторант кафедры «Визуальная диагностика» АО «Национальный медицинский университет».*

***Баймаханов Болатбек Бимендеевич*** *– д.м.н., профессор, председатель правления АО «ННЦХ им. А.Н. Сызганова».*

***Жолдыбай Жамиля Жолдыбаевна -*** *д.м.н., профессор, заведующая кафедрой «Визуальная диагностика» АО «Национальный медицинский университет».*

***Медеубеков Улугбек Шалхарович*** *– д.м.н., профессор, заместитель председателя правления АО «ННЦХ им. А.Н. Сызганова».*

***Чорманов Алмат Турсыжанович*** *- к.м.н., главный врач АО «ННЦХ им. А.Н. Сызганова»*

***Таджибаев Талгат Кыдыралиевич*** *– младший научный сотрудник отделения Гепатобилиарной хирургии и трансплантации печени АО «ННЦХ им. А.Н. Сызганова»*

***Каниев Шокан Ахмедбекович*** *– врач хирург отделения Гепатобилиарной хирургии и трансплантации печени АО «ННЦХ им. А.Н. Сызганова».*

***Сагатов Инкар Ергалиевич – д.м.н.,*** *руководитель отдела менеджмента научной, инновационной деятельности и международного сотрудничества АО «ННЦХ им. А.Н. Сызганова».*

**Для корреспонденции:**
***Исаматов Бекжан Калибаевич -*** *050004, г. Алматы, ул. Желтоксан, 62, Республика Казахстан. Тел.: +7-707-828-83-51, E-mail: b.isamatov@mail.ru*

**Ключевые слова**
*статистические показатели, рак печени, гепатоцеллюлярная карцинома, заболеваемость, смертность.*

**Исаматов Б.К.[1,2], Баймаханов Б.Б.[1], Жолдыбай Ж.Ж.[2], Медеубеков У.Ш.[1], Чорманов А.Т.[1], Таджибаев Т.К.[1], Каниев Ш.А.[1], Сагатов И.Е.[1], Москаленко Н.И.[1], Шмонин В.М.[1], Лагунов И.И.[1]**

[1]АО «Национальный научный центр хирургии им. А.Н. Сызганова», Алматы, Казахстан
[2]АО «Национальный медицинский университет» Алматы, Казахстан

***Аннотация***

*Гепатоцеллюлярная карцинома является одной из важнейших проблем онкологической службы мира и Казахстана. В статье описывается анализ основных статистических показателей первичного рака печени (гепатоцеллюлярная карцинома, ГЦК) в Республике Казахстан за период 2007 – 2017гг. Описывается особенности распространения ГЦК в мире, а также в отдельных регионах Казахстана. Определены места по основным показателям ГЦК в структуре онкопатологии. Приведены динамические изменения показателей заболеваемости и смертности ГЦК в зависимости от пола, проведен прогноз показателей на ближайший 5 лет. Показатели заболеваемости и смертности при гепатоцеллюлярной карциноме у мужчин выше, чем у женщин.*

## Background

Hepatocellular carcinoma (HCC) - the most common malignant neoplasm of the liver (up to 95%), it is characterized by progressive growth and development [1].

In recent years, the frequency of HCC throughout the world has been increased, for example, more than 600,000 newly detected cases are reported annually [2]. HCC is one of the most actual medical and social problems in the world and in the Republic of Kazakhstan. In the period of 2013-2017, in Kazakhstan has increased the incidence rate of HCC to 5.5 cases per 100 000 (% 000) of population, while the mortality rate remains high (about 1,000 people annually). In 2017, 69% of patients with HCC died before the end of the year. The five-year survival rate is very low (23.7%, 2017) [3 - 13].

HCC is characterized by an aggressive course and an unfavorable prognosis in the most of cases. The five-year survival does not exceed 18%, and after operational recurrence is about 50% [14].

In Kazakhstan, HCC is one of the most actual problems in oncology. The analysis of liver cancer statistics is important in studying of epidemiological situation in the country, consequently the search and development of measures for improving the prevention and diagnosis of HCC.

Hepatocellular carcinoma in the world. According to The GLOBOCAN, in 2018, 18.1 million new cases of cancer and 9.6 million deaths from them were registered worldwide, 841,080 (4.7%) from which were the new cases of HCC and 781,631 (8.2 %) deaths. In the structure of oncopathology, the incidence rate of HCC ranks 6th, after lung, breast, colorectal, prostate and stomach cancers. In terms of mortality it ranks 4th place after lung, colorectal and gastric cancers (figure 1). However, the frequency of men HCC morbidity and mortality was 2-3 times higher than women, therefore, the morbidity and mortality for men ranks 5th and 2nd, respectively [15, 16].

The highest rates of HCC are observed in countries with transitional economies with the low human development index, for example, some African countries (Egypt, Gambia, Guinea) and East and Southeast Asia (Mongolia, Cambodia and Vietnam). In Mongolia, HCC incidence is much higher than in any other country, for example, according to 2018, the incidence of men in Mongolia is four

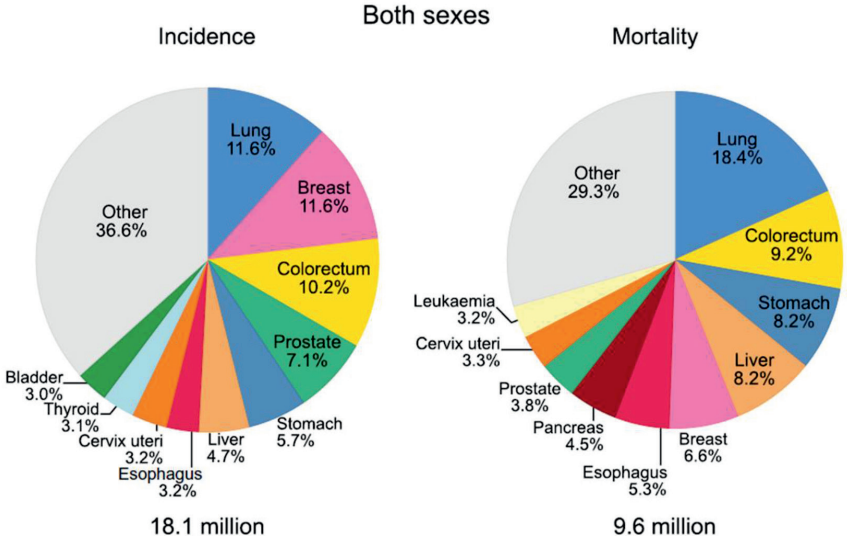



**Figure 1.**
Diagrams of incidence and mortality of 10 the most common malignant neoplasms in the world (GLOBOCAN 2018)

times higher than in China and the Republic of Korea (figure 2, 3) [15, 16].

The main risk factors depend from the region. In the regions with the highest risk of HCC (China, East Africa), the main determinants are chronic HBV infection and influence of aflatoxin, while in other countries (Japan, Egypt), the prevailing cause is HCV infection. In Mongolia, HBV and HCV infection, HBV co-infection with HCV or HBV with δ (delta) agent, as well as alcohol abuse, are the main risk factors for HCC [15, 16].

The purpose of the research. Analysis of incidence and mortality rates of primary liver cancer (HCC) in Kazakhstan for 2007 - 2017 years.

## Material and methods

The analysis is based on the official data of the Committee on Statistics and data of the electronic

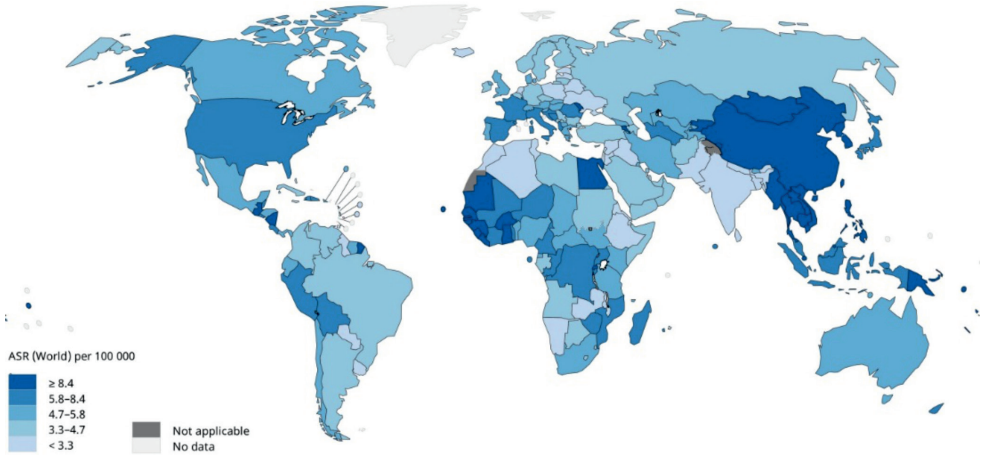



**Figure 2.**
Worldwide incidence rate of liver cancer (GLOBOCAN 2018).

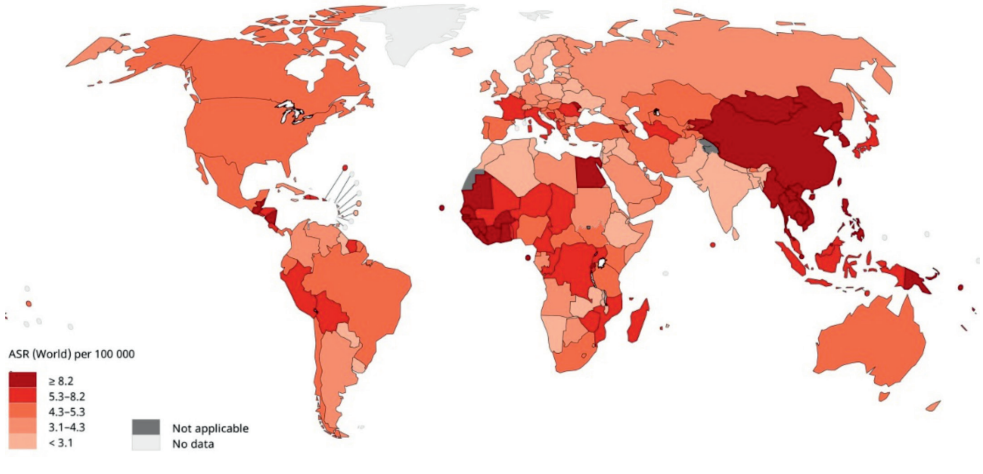
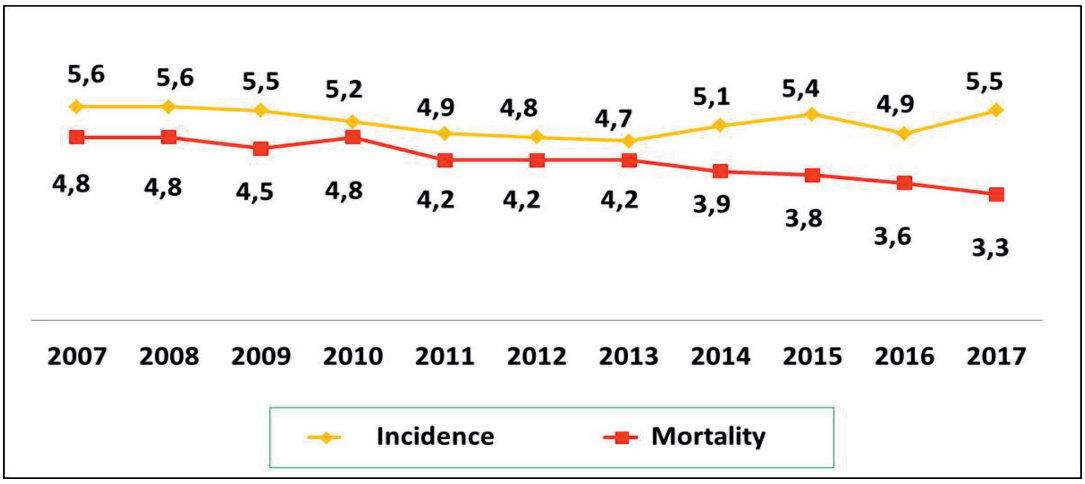



**Figure 3.**
Worldwide liver cancer mortality rate (GLOBOCAN 2018).

**Figure 4.**
Dynamics of incidence and mortality indicators of HCC in Kazakhstan for the period 2007-2017 per 100 000 population




register of oncological diseases of the Republic of Kazakhstan for 2007-2017. Data of the 1st detected cases of HCC disease also were used.

In the analysis standardized incidence and mortality rates (European standard of age) were used, including methods of demographic and mathematical statistics.

For statistical tests carrying out and dynamic graphs of the main indicators of HCC plotting, we've used the SPSS and Microsoft Excel packages.

## Results and discussion

During the period of 2007 - 2017, 8615 patients with primary liver cancer were registered in the Republic of Kazakhstan, 59% of which are men, 41% are women.

According to the data of 2016, the incidence rate of HCC of both sexes ranked 12th in the structure of oncological diseases, namely, after malignant neoplasms of the breast, lung, stomach, cervix, colon, lymphatic and hematopoietic tissues, prostate, rectum, esophagus, pancreas, and among men it takes the 10th place.

The incidence of primary liver cancer in the period from 2007 to 2017, increased on 1.3%. If the incidence rate of HCC in 2007 was 5.6% 000, then in 2013 it decreased to 4.7% 000. However, in recent years, the HCC incidence rate has gradually increased and in 2017 reached 5.5% 000, which is 10.9% more compared to 2016. Analysis of the dynamics of changes in the HCC incidence during the period of the research study showed that there is a risk further increase in incidence in subsequent years (figure 4) [3-13].

The mortality rate of HCC consistently occupied the 10th place in the structure of oncological diseases in Kazakhstan during the analysis of study. For example, in 2017, the mortality rate of HCC was after malignant neoplasms of the lung, stomach, breast, esophagus, colon, under the gastric gland, hemoblastosis, rectum, cervix, accounting for 4.2% of all oncological mortality. Analysis of the dynamics of changes in the mortality rate showed that over the study period, mortality decreases annually, and has a tendency to further decrease, not counting the years where the indicator was the same as the previous year. So, for example in 2007 mortality was 4.8% 000, and in 2017 - 3.3% 000. The average level of HCC mortality over the past decade decreased by 0.84% annually, and in 2017 the absolute number of deaths decreased on 8.0% comparing to 2007 (figure 4) [3-13].

For making the prognosis for the next 5 years (2018 - 2022), incidence and mortality rates of HCC in the Republic of Kazakhstan, we've used the SPSS and Microsoft Excel packages. When performing a regression analysis in terms of incidence and mortality, the approximation coefficient R2 was 0.64 and 0.92 respectively, and the standard error of R2 was 0.23% and 0.15% ($p = 0.017$; $p < 0.001$) respectively. Whereas the standard error R2 is less than 15%, then the data which we obtained, have reliable significance and can be used as regression. The test of the significance of the regression model was carried out with the F - Fisher criterion using (table 1).

**Table 1.**
Determination of the significance of the regression model in terms of incidence and mortality rates HCC 2007 – 2017, with F - Fisher criterion using.

| Year / indicator (per 100 000 population) | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Approximation coefficient $R^2$ | Standard error $R^2$ | p-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Incidence | 5,6 | 5,6 | 5,5 | 5,2 | 4,9 | 4,8 | 4,7 | 5,1 | 5,4 | 4,9 | 5,5 | 0,64 | 0,23 | 0,017 |
| Mortality | 4,8 | 4,8 | 4,5 | 4,8 | 4,2 | 4,2 | 4,2 | 3,9 | 3,8 | 3,6 | 3,3 | 0,92 | 0,15 | <0,001 |

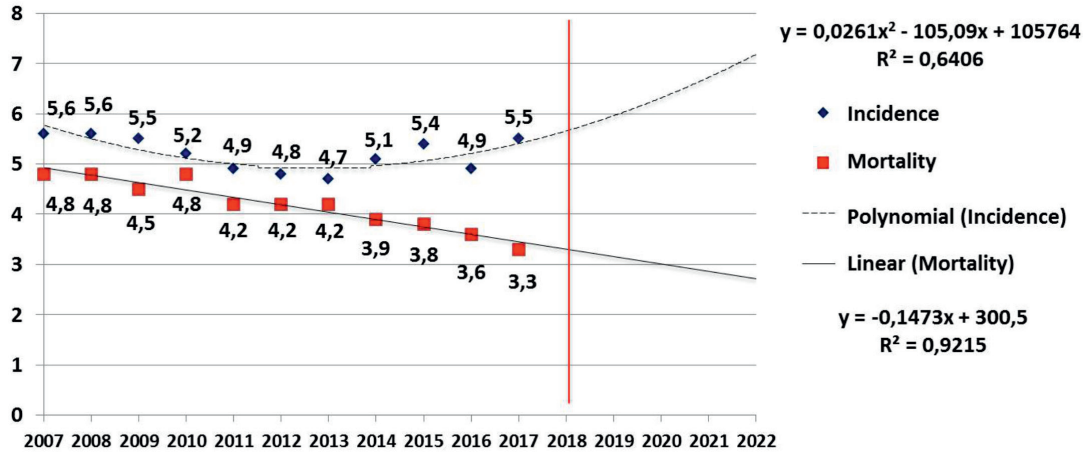



**Figure 5.**
Building a trend line to predict incidence and mortality rates for HCC of both sexes for the next 5 years on the basis of data for the period 2007 - 2017

An increasing trend was obtained, during the usage of a polynomial curve of the second degree to build a trend line in terms of incidence rates of HCC 2007 - 2017. It predicts an increase in the incidence of HCC over the next 5 years. Also for the mortality rate, a linear trend was built, which had a downward line, which predicts a decrease of mortality over the next 5 years (figure 5).

An analysis of the dynamic changes in incidence and mortality in 2008–2017 was carried out all over the regions of Kazakhstan. A graph has been made in the context of 2008, 2010, 2013, 2015, 2017 and the following data obtained. In 2008, the highest incidence of the morbidity marked in West Kazakhstan (11.8% 000), Kyzylorda (10.4% 000), Akmola (7,0% 000) regions and the lowest index marked in North Kazakhstan (3.7% 000), the South Kazakhstan (3.2 % 000), Pavlodar (4.4 % 000) regions. In 2017, the worst situation was registered in Karaganda (8.0 % 000), West Kazakhstan (7.6 % 000) and In East Kazakhstan (6.8% 000) regions. The lowest incidence rates were recorded in Astana (4.2% 000), Aktobe (4.1% 000) and North Kazakhstan regions (3.6% 000) (figure 6) [3-13].

The highest mortality rate in 2008 was registered in West Kazakhstan (10.4% 000) Kyzylorda (8,5% 000), East Kazakhstan (6.1% 000)) regions and the lowest number of deaths observed in South Kazakhstan (2,5% 000), Almaty (2.7% 000), and Pavlodar (3.2% 000) regions. In dynamics, in 2017 the mortality rate prevailed in East Kazakhstan (5.2% 000), Akmola (5.0% 000), West Kazakhstan (4.7% 000) regions. The lowest mortality rate was observed in Kostanay (1.4% 000), Astana (2.1% 000), Aktyubinsk (2.4% 000) belts (figure 7) [3-13].

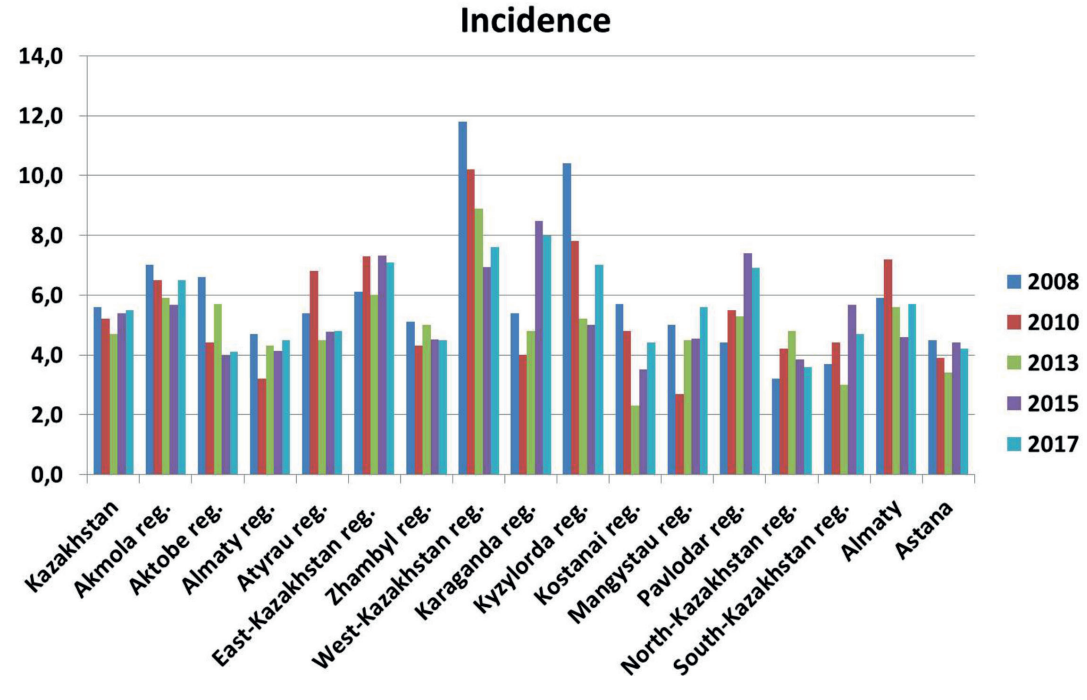
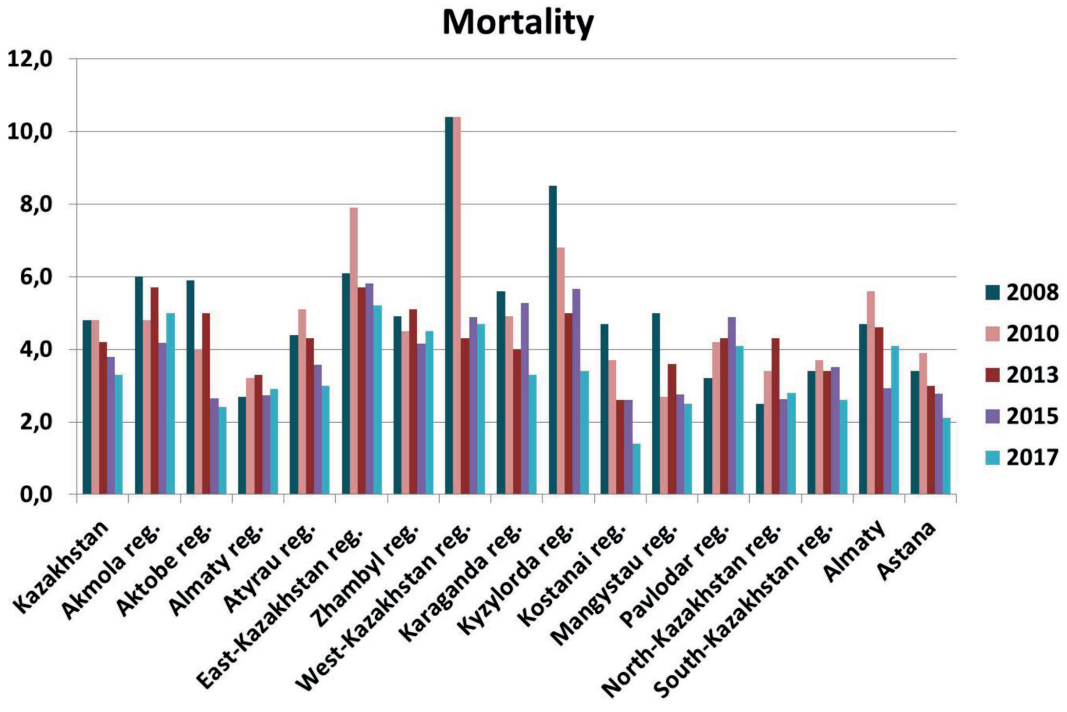



**Figure 6.**
The graph of dynamic changes in the incidence rate of HCC for all regions of Kazakhstan in 2008, 2010, 2013, 2015 and 2017 for 100 000 population.

**Figure 7.**
A graph of the dynamic changes in the mortality rate of HCC for all regions of Kazakhstan in 2008, 2010, 2013, 2015 and 2017 per 100 000 population.




For a comparative analysis of the incidence rate depending on the age group of both sexes, the ratio of the absolute number of new cases of HCC to the population of this age group was calculated and the indicator was obtained in a ratio per 100 000 population. For example, there is a significant increase in the incidence rate among men in the age group of 50 - 54 years, reaching a peak in the group of 70 - 74 years. It is assumed that there is a natural increase in the incidence of HCC after 50 years, with the highest number of new cases up to 70 years of men. Women, the incidence significantly increases from 55 years, but reaches the highest values in the group 75-79 years. Consequently, the data obtained tell us about the dependence of the incidence of HCC on sex and age (table 2, figure 8).

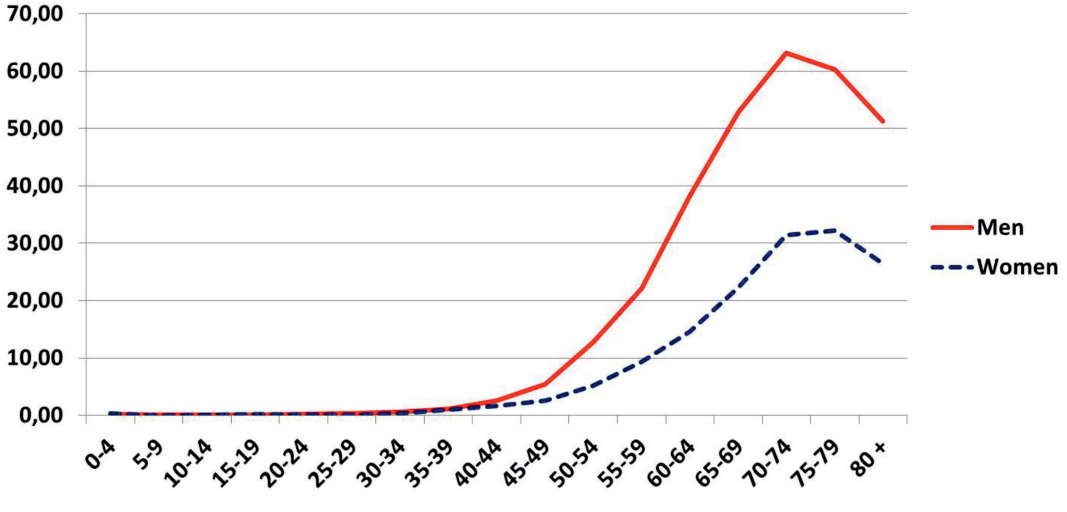
## Conclusion

Thus, primary liver cancer, namely, hepatocellular carcinoma, is one of the most important prob-

**Table 2.**
Indicators of HCC incidence for 2007 – 2017 of men and women, depending on age group per 100 000 population

| Age group | 0-4 | 5-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 | 80 + |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Men | 0,23 | 0,07 | 0,07 | 0,12 | 0,16 | 0,35 | 0,55 | 1,07 | 2,56 | 5,43 | 12,75 | 22,22 | 38,21 | 52,85 | 63,18 | 60,27 | 51,25 |
| Women | 0,31 | 0,01 | 0,06 | 0,17 | 0,12 | 0,14 | 0,40 | 1,05 | 1,63 | 2,62 | 5,16 | 9,36 | 14,55 | 22,29 | 31,39 | 32,26 | 26,49 |

**Figure 8.**
Graph of HCC incidence rate in 2007-2017 depending on the age group of both sexes (per 100,000 population)



lems of the oncological service of the world and Kazakhstan. According to statistics, there is an annual increase in the number of new cases of HCC. HCC occupies the leading places in terms of incidence and mortality in the world. In the structure of oncological diseases of Kazakhstan, HCC, in terms of incidence and mortality, takes, although not the leading places, nevertheless has a significant problem in connection with the progressive course, late detection, low survival rate and unfavorable prognosis. In recent years, there has been an increase in the incidence of HCC and a decrease in the death rate. According to the prognostic test, a further increase in morbidity and a decrease in mortality rate of HCC in both sexes in the next 5 years in Kazakhstan is expected. The highest incidence and mortality rates for the study period were observed in the West Kazakhstan, Kyzylorda and East Kazakhstan regions. The lowest incidence rates are registered in Almaty, North Kazakhstan and Kostanay regions. The lowest mortality rates were observed in the South Kazakhstan, Kostanay and Almaty regions. For men, morbidity and mortality values were 2 times higher than for women. A significant increase in the incidence was observed for men after 50 years and up to 74 years, and for women after 55 years and up to 79 years. Summarizing all of the above, in order to solve this medical and social problem, namely reducing the incidence and mortality rate, in our opinion, we need the mechanisms to identify the causes of morbidity in each region of the country, to pay special attention to people over 50 years old, namely in the "red" regions of the country to apply effective measures for early and clarifying diagnostics, as well as timely tactics for treating patients with hepatocellular carcinoma.

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