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ANALYSIS OF EPIDEMIOLOGICAL INDICATORS OF BREAST CANCER IN THE ALMATY REGION IN 2015-2024

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ABSTRACT

Relevance: *Breast cancer (BC) is the most common form of malignant neoplasm among women worldwide. In 2020, 2.3 million new cases and about 685,000 deaths were registered. More than 80% of the cases are women over 50. Developing countries have higher mortality rates. An increase in incidence to 3 million cases by 2040 is forecasted. This study is the first comprehensive 10-year regional analysis of breast cancer incidence, mortality, and stage at detection.*

The study aimed to *analyze the impact of measures implemented in the Almaty region (Kazakh-stan) for early detection and treatment of breast cancer on the dynamics of morbidity, mortality, and stage of detection in 2015-2024.*

Methods: *Assessment of trends and distribution of BC morbidity and mortality rates among the fe-male population of the Almaty region from 2015 to 2024. Statistical reporting forms No. 7, No. 090/U, and data from the regional cancer registry were used. Demographic data were obtained from the official public materials of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (Committee on Statistics). The indicators were calculated using standard epidemiologi-cal formulas, direct standardization, and statistical software programs, including Microsoft Excel and SPSS Statistics 23.0.*

Results: *The incidence of BC increased from 34.8 to 42.5 per 100,000, and the standardized rate increased from 34.2 to 39.1. Mortality fluctuated, peaking at 11.6 in 2021, then decreased to 8.5 in 2024. The conditional mortality rate ranged from 20.1% to 35.1%. Early detection at stages I-II in-creased from 74.1% to 89.2% and decreased at stage III from 20.6% to 4.6%.*

Conclusion: *There is a positive trend in early diagnosis and survival in BC in the region. However, the continuing mortality rate and the stable proportion of stage IV indicate the need for further im-provement in the routing and availability of therapy.*

Keywords: *breast cancer (BC), epidemiology, morbidity, mortality, survival, Kazakhstan, Almaty region.*

Introduction: Breast cancer (BC) is the most common cancer among women worldwide. In 2020, approximately 2.3 million new cases were registered, accounting for 11.7% of all malignant tumors. More than 80% of cases are diagnosed in women over 50 years of age, highlighting age as a key risk factor. BC has become the leading cause of cancer death among women, claiming the lives of approximately 685,000 patients in 2020. Almost two-thirds of deaths occurred in low- and middle-income countries. While five-year survival rates in developed countries exceed 80%, in India, they are less than 70%, and in South Africa, they are less than 50% [1-3]. BC remains the most common form of malignant neoplasm (MN) among women in Southeast Asia. According to 2022 data, this type of cancer ranks first in incidence among women in all countries of the region. The highest standardized incidence rates (ASIRs) were recorded in Singapore, at 72.61 per 100,000 women, and in the Philippines, at 60.34 per 100,000. In addition, breast cancer is the leading cause of cancer death among women in several Southeast Asian countries. The highest standardized mortality rates (ASMR) from breast cancer were noted in the Philippines – 21.47 per 100,000, in Malaysia – 19.30, in Singapore – 17.82, in Vietnam – 14.67, in Indonesia – 14.35, and in Timor-Leste – 10.24 per 100,000 women [4]. In the United States of America, breast cancer ranks second among the causes of death from cancer in women, second only to lung cancer [5, 6]. In the United States, the highest incidence of breast cancer is observed in white women (130.8 per 100,000), and the highest mortality rate is in African American women (28.4 per 100,000), which is 40% higher than in white women. African American women are more often diagnosed with the aggressive triple-negative subtype of breast cancer, especially in women under 40 years of age. Mortality differences between black and white women are most pronounced in young women and decrease with age [7, 8].

Breast cancer remains the most common malignant disease among women in Kazakhstan. Between 2017 and 2021, 22,736 new cases were registered, representing a 14% increase over previous years. The highest number of cases was identified in 2019 and 2021 (4945 and 4939, respectively) [9]. According to forecasts, by 2040, the number of new cases of breast cancer will increase by more than 40% and reach approximately 3 million per year. The greatest increase in incidence and mortality is

predicted in countries with transition economies and a low development index, where the number of new cases and deaths may double. The share of these countries in the overall incidence structure will increase from 18.4% to 22.2%, and in the mortality structure, from 30.1% to 35.2%. Such changes are primarily due to population aging and growth, but the dynamics may intensify with changes in the incidence rate [10].

Among non-reproductive risk factors for breast cancer, obesity and alcohol consumption are particularly significant. Being overweight nearly doubles the risk of developing the disease in postmenopausal women. Approximately 4% of breast cancer cases in 2020 were associated with alcohol consumption [11].

Molecular diagnostics of breast cancer includes the determination of estrogen and progesterone receptors, HER2, and the proliferation marker Ki-67. These parameters allow us to determine the biological subtype of the tumor and select effective targeted or hormonal therapy. Breast cancer is a clinically and genetically heterogeneous disease. Mutations in the *BRCA1, BRCA2, TP53, PTEN, and other genes significantly increase the risk of its development, emphasizing the importance of genetic testing for early detec*tion and a personalized approach to treatment [12, 13].

A country-specific study covering 2015–2024 demonstrated an increase in breast cancer incidence, coupled with a decline in mortality and an increase in early detection to 88.7%. Five-year survival increased by 81%, demonstrating the effectiveness of preventive and diagnostic measures [14]. This study is the first to conduct a comprehensive regional analysis over 10 years, focusing on the dynamics of breast cancer incidence, mortality, and detection stages.

The study aimed to analyze the impact of measures implemented in the Almaty region (Kazakhstan) for early detection and treatment of breast cancer on the dynamics of morbidity, mortality, and stage of detection in 2015-2024.

Materials and methods: The trends and distribution of breast cancer incidence and mortality rates among the female population of the Almaty region were assessed for the period from 2015 to 2024. The study relied on data retrieved from annual medical reports, specifically Form No. 7, "Information on the Incidence of Malignant Neoplasms," and Form No. 090/U, "Statistical Card of Cancer Patients," as well as information from the regional cancer registry. Demographic data on the female population by age group for the corresponding years were obtained from official materials of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (Statistics Committee).

An assessment of intensive and standardized incidence and mortality rates from breast cancer per 100,000 women was conducted, a conditional case fatality rate (mortality-to-incidence ratio, %) was calculated, the age structure of incidence was analyzed in comparison over two five-year periods (2015-2019 and 2020-2024), as well as the stage distribution at the time of primary diagnosis and the share of breast cancer in the structure of all malignant neoplasms in women.

Standardization was performed using the direct standardization method, based on the age structure of the World Health Organization standard population. Calculations were performed using standard epidemiological formulas and Microsoft Excel, as well as SPSS Statistics version 23.0. The evaluation included a comparison of absolute and relative values, an analysis of trends, and interperiod changes. Ethical approval was not required because the study utilized aggregated, anonymized data that did not contain identifiable patient information.

Results: Between 2015 and 2024, a 40.6% increase in the number of patients registered for malignant neoplasms was observed in the Almaty region, from 8,207 to 11,541. A similar trend is observed in relation to breast cancer: the number of women with this disease increased from 1,520 in 2015 to 2,494 in 2024, which amounted to an increase of 64.1%. The share of breast cancer in the overall structure of oncological morbidity in women also increased, from 18.5% in 2015 to 21.6% in 2024 (Figure 1).

Between 2015 and 2024, significant changes in breast cancer epidemiological indicators among the female population were observed in the Almaty region. During this period, the intensive incidence rates increased from 34.8 to 42.5 per 100,000 women, and the standardized rates grew from 34.2 to 39.1. The minimum values were recorded in 2019 (the intensive rate was 19.6, the standardized rate was 18.5). Since 2020, a steady upward trend in incidence has been observed, reaching a maximum of 43.7 (intensive rate) and 40.8 (standardized rate) per 100,000 women in 2022. Despite a slight decrease in rates in 2023-2024, the incidence rate remains stably high and significantly exceeds the values at the beginning of the period. This trend could be attributed to both an objective increase in the number of new cases and improved detection, including the expansion of access to diagnostics and the resumption of screening programs in the post-pandemic period (Figure 2).

Mortality rates in the Almaty region changed along a more complex trajectory. In 2015, the mortality rates were 7.0 (intensive) and 6.9 (standardized) per 100,000 women. Over the following years (2016-2020), those rates stabilized, ranging from 5.4 to 6.7. However, in 2021, the mortality rates spiked: the intensive rate reached 11.6, and the standardized rate reached 11.3. This trend could be attributed to delayed patient visits during the COVID-19 pandemic, late detection of malignant tumors, and temporary restrictions on scheduled medical care. The mortality began to decline between 2022 and 2024, reaching 8.5 (intensive) and 8.3 (standardized) in 2024, which was

still above the baseline. This trajectory highlights the partial restoration of oncology services and improvement in patient routing, although certain problems in the availability of timely therapy remain (Figure 3).

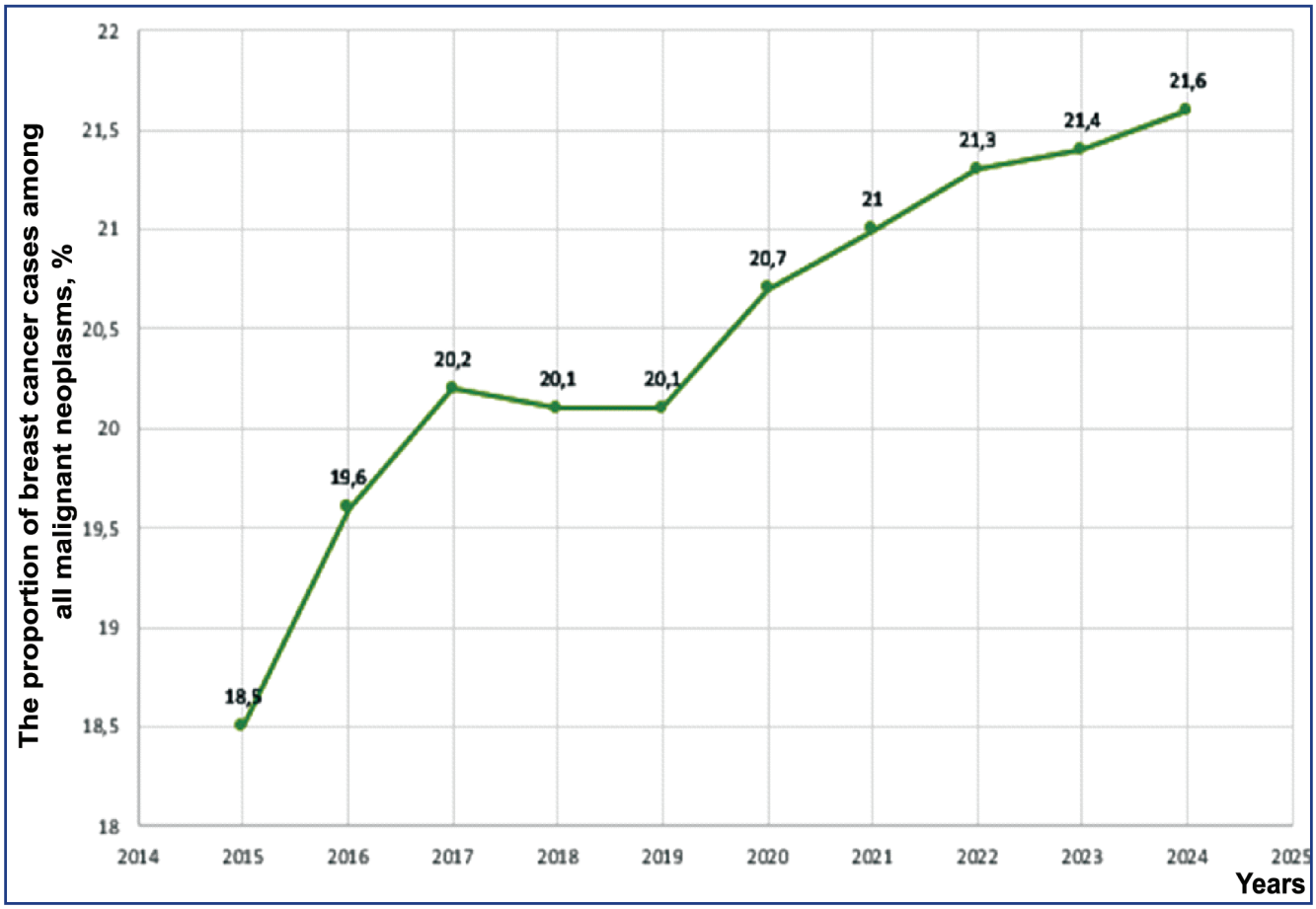

Figure 1 – Dynamics of the proportion of breast cancer in the structure of all newly diagnosed malignant neoplasms in the female population of the Almaty region for 2015-2024 (%)

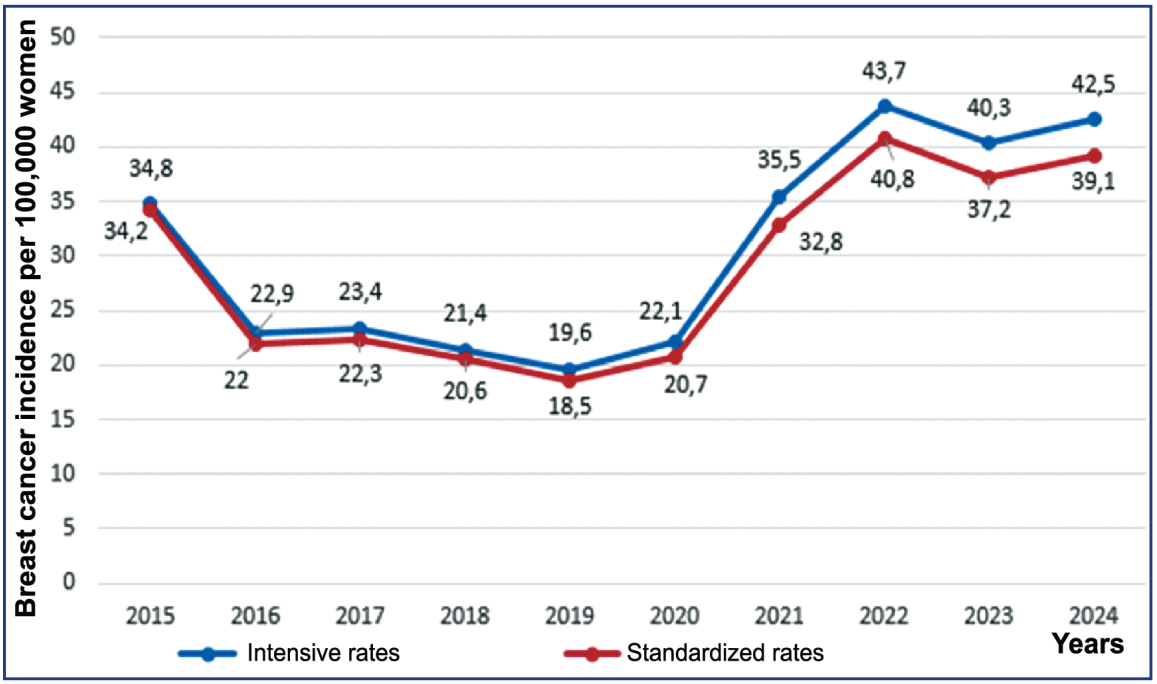

Figure 2 – Dynamics of intensive and standardized rates of breast cancer incidence among women in the Almaty region in 2015-2024 (per 100,000 female population)

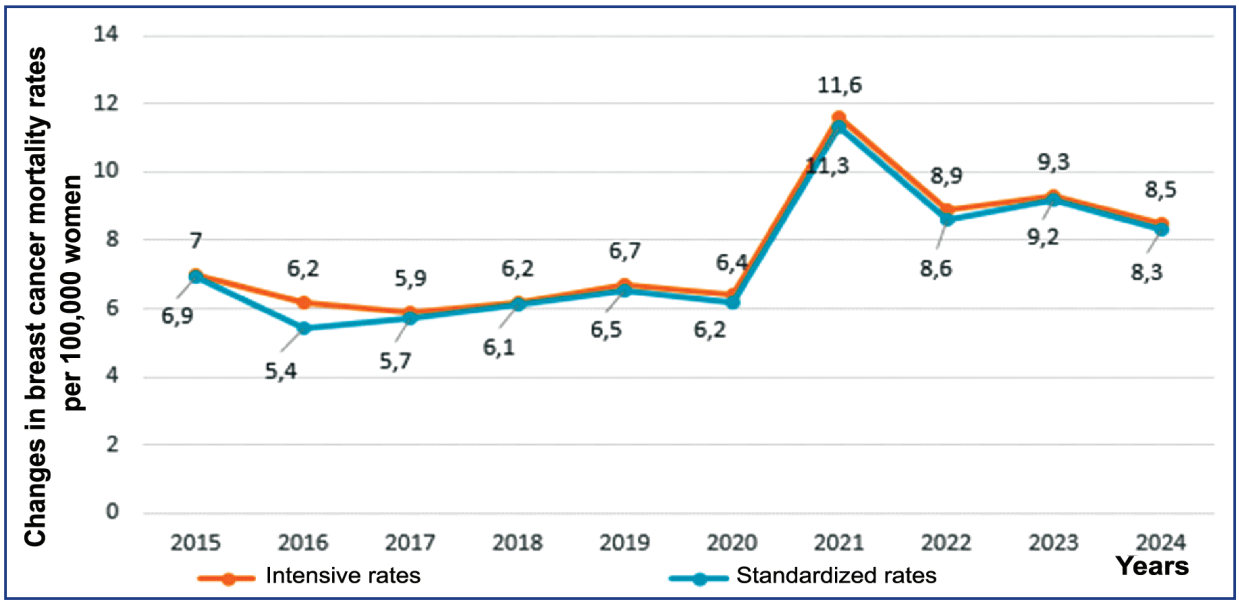

Figure 3 – Dynamics of intensive and standardized mortality rates from breast cancer among women in the Almaty region in 2015-2024 (per 100,000 female population)

Figure 4 shows the dynamics of intensive indicators of morbidity and mortality from breast cancer among women in the Almaty region for the period from 2015 to 2024 (per 100,000 women), as well as the conditional mortality rate, reflecting the mortality-to-incidence ratio as a percentage. Over the analyzed period, the intensive incidence rate increased from 34.8 to 42.5 per 100,000, with a minimum value of 19.6 in 2019. A steady increase was observed since 2020, reaching a maximum of 43.7 in 2022. The intensive mortality rate ranged from 6.2 to 11.6 per 100,000 women. The mortality rate peaked in 2021, after which it decreased to 8.5 in 2024.

The case fatality rate fluctuated from 20.1% in 2015 to a peak of 35.1% in 2019. The minimum value of 20.4% was recorded in 2022, amid the peak incidence rate. Over the last two years, the rate has increased to 28.2% and 27.2%, respectively (Figure 4).

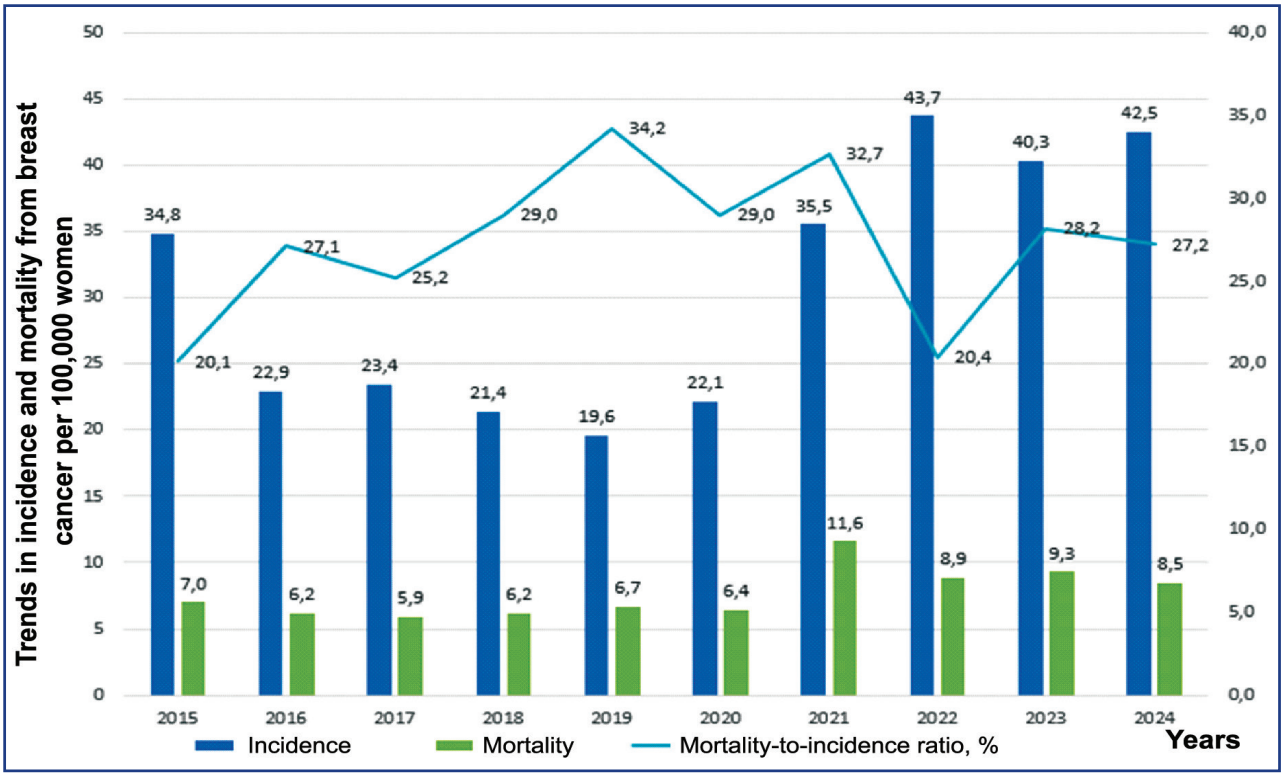

Figure 4 – Intensive indicators of morbidity and mortality from breast cancer and their ratio (conditional mortality rate) among the female population of the Almaty region in 2015-2024 (per 100,000 women)

A comparative analysis of standardized incidence and mortality rates from breast cancer among women in the Almaty region for 2015-2024 revealed clear changes in the epidemiological picture of the disease. Over this period, the incidence increased from 34.2 to 39.1 per 100,000 women, while mortality decreased from 6.9 to 8.3 per 100,000 women. Against this background, the conditional case fatality rate decreased from 20.2% to 21.2%, despite a short-term increase to 35.1% in 2019. The minimum case fatality rate was recorded in 2022 – 20.4%, which coincided with the peak incidence rates. The overall dynamics indicate improved early detection and treatment accessibility, despite the persistently high cancer burden in the region (Figure 5).

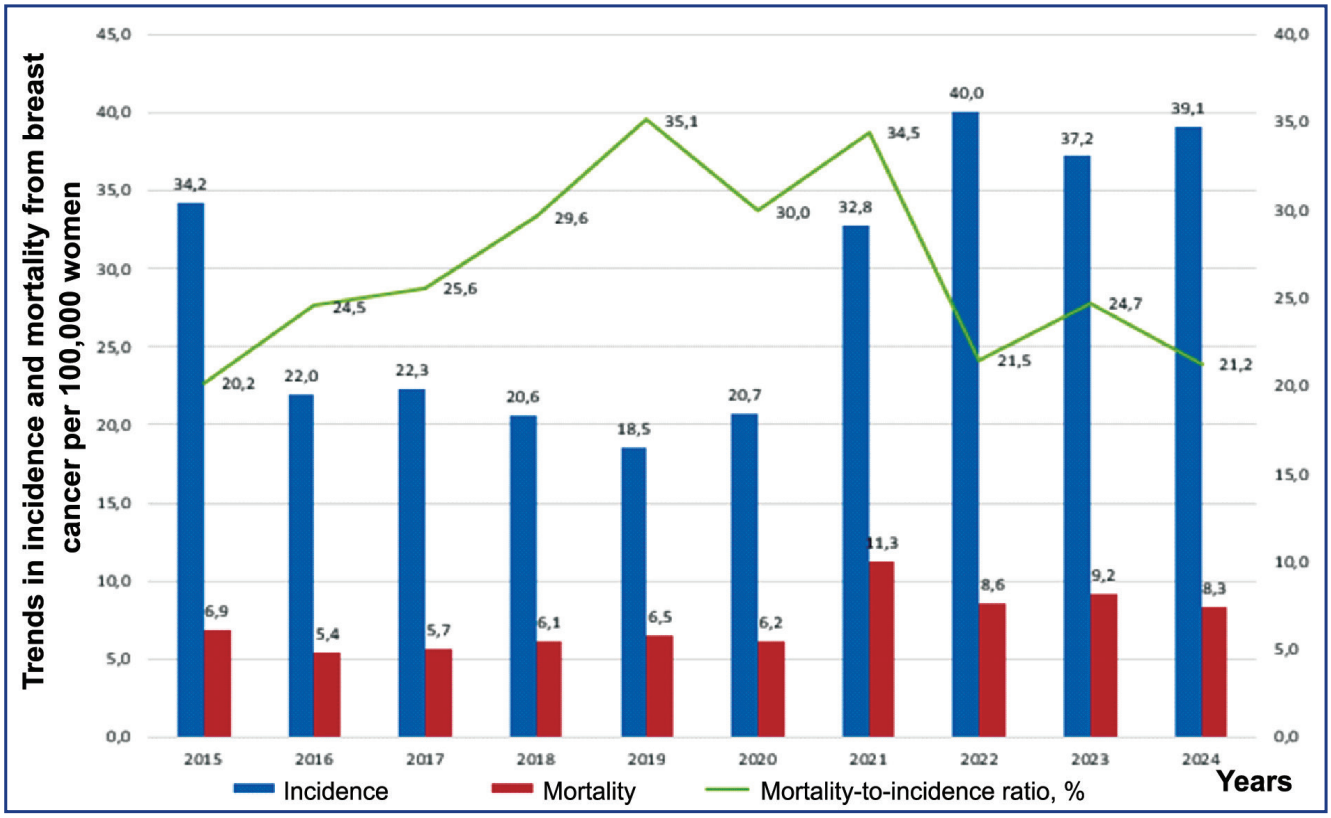

Figure 5 – Standardized incidence and mortality rates from breast cancer and their ratio (conditional case fatality rate) among the female population of the Almaty region in 2015-2024 (per 100,000 women)

The distribution of breast cancer cases by stages at initial detection demonstrated positive changes over the study period. In 2015, the proportion of patients with early-stage disease (I-II) was 74.1%, while by 2024, this figure had increased to 89.2%. This increase indicated a significant improvement in early diagnosis, likely due to expanded coverage by screening programs, increased awareness among healthcare professionals, and improved access to mammography. The proportion of stage III cancers decreased from 20.6% to 4.6%, also reflecting progress in reducing the incidence of advanced disease. A slight increase in stage IV cancers (from 5.3% to 6.2%) requires further investigation. However, given the overall increase in early detection, this indicator did not significantly impact the positive trend (Figure 6).

A comparative analysis of the age structure of identified breast cancer cases over two five-year periods (2015-2019 and 2020-2024) showed an increase in the number of cases in the age group of 60-64, from 31.8 to 52.6, and 65-69, from 24.4 to 41.2. The proportion of breast cancer among all malignant neoplasms in women in the Almaty region has also increased from 18.5% in 2015 to 21.6% in 2024. This increase could be due to both improved breast cancer diagnostics and a consistently high-risk level in this population (Figure 7).

Table 1 presents the epidemiological indicators for malignant neoplasms and breast cancer in the Almaty region for 2015-2024. During this period, the number of patients with oncopathology increased by 40.6% (from 8,207 to 11,541), as did the absolute number of patients registered for dispensary care with a diagnosis of breast cancer, which increased by 64.1% (from 1,520 to 2,494). The incidence of breast cancer continues to grow (intensive +22.1%; standardized +14.3%), while mortality rates from breast cancer are also increasing (intensive +21.4%; standardized +20.3%).

The staging structure reflects positive changes: the proportion of early stages (I-II) at detection increased by 20.4% (from 74.1% to 89.2%), the proportion of stage III decreased from 20.6% to 4.6% (-77.7%), while the pro-

portion of stage IV increased by 17% (from 5.3% to 6.2%). Overall, there has been an improvement in early breast cancer diagnosis rates, demonstrating the effectiveness of the interventions being implemented.

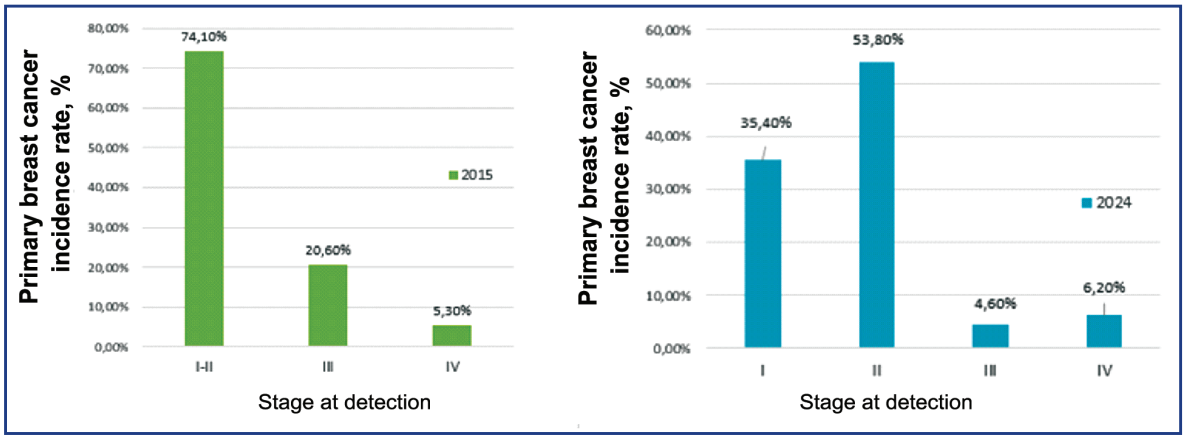

Figure 6 – Distribution of newly diagnosed cases of breast cancer by stage at the time of diagnosis among women in the Almaty region in 2015 and 2024 (%)

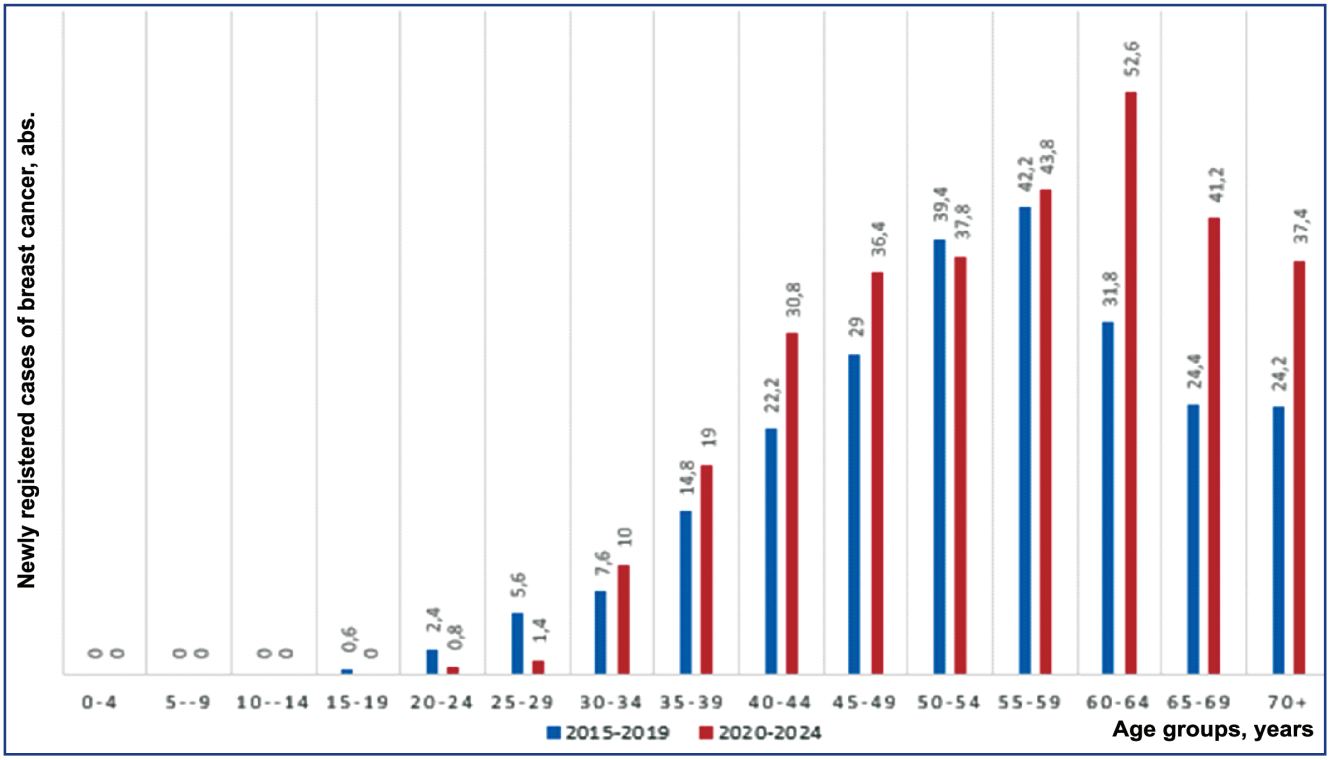

Figure 7 – Comparative distribution of newly registered cases of breast cancer by age group among women in the Almaty region in 2015-2019 and 2020-2024

Table 1 – Main epidemiological indicators of malignant neoplasms and breast cancer in the Almaty region, 2015 and 2024

Indicator	2015	2024
The number of patients with malignant neoplasms registered in the dispensa-ries	8207	11 541
The number of patients with breast cancer on the dispensary register	1520	2494
The proportion of breast cancer among all malignant neoplasms in women (%)	18.5%	21.6%
Breast cancer incidence (per 100,000)	34.8	42.5
Standardized incidence of breast cancer	34.2	39.1
Intensive mortality from breast cancer	7.0	8.5
Standardized mortality from breast cancer	6.9	8.3
The percentage of detection of stages I-II (%)	74.1%	89.2%
Proportion of stage III (%)	20.6%	4.6%
Proportion of stage IV (%)	5.3%	6.2%

Discussion: The study findings reveal significant changes in the epidemiological landscape of breast cancer in the Almaty region over a 10-year observation period. A distinct increase in incidence was established both by the intensive (from 34.8 to 42.5 per 100,000 women) and by the standardized indicator (from 34.2 to 39.1 per 100,000 women). The data are consistent with the results of a retrospective analysis covering large cities of Kazakhstan for 2009-2018. In the study by N. Igissinov et al., age-specific peaks in breast cancer incidence and mortality were identified, falling in the age groups 60-69 and 70 years and older, respectively, which confirms the observed shift in the oncological burden towards older age cohorts in the Almaty region. The authors also noted an increase in standardized morbidity rates, which was attributed to a decrease in mortality and was likely due to the expansion of screening programs and increased availability of specialized medical care [15].

The data obtained in this study on fluctuations in the breast cancer mortality rate, in particular the increase in the indicator in 2021 followed by a decrease, correlate with the findings of the aforementioned analysis, according to which the standardized mortality rate from breast cancer in the republic demonstrated a steady decline (APC = -4.0%, R^2 = 0.9218) during 2009-2018. The decrease in mortality is explained by increased coverage of mammography screening and improved treatment. The average age at death was 61.6 years, and the highest mortality was observed in the 70-84 age group, which is consistent with the age structure of mortality identified in this study. Additionally, pronounced interregional differences were observed, with the highest mortality rates noted in the Pavlodar and Almaty regions, as well as in Astana, and the lowest in the Mangistau and Turkestan regions. This highlights the need for further study of factors influencing the availability and quality of oncological care, including patient routing and the impact of environmental conditions [16]. Against the backdrop of an increase in the proportion of early detection of breast cancer in the Almaty region and an increase in incidence in the 40-49 age group, the international study by J. Rantala et al. (2025) deserves attention, as it established patterns of increasing breast cancer incidence in women under 50 years of age against the background of behavioral risk factors. In particular, the highest annual increase in incidence was recorded in women aged 40-49 who were overweight (AAPC = +4.0%), smokers (AAPC = +3.3%), and those leading a moderately active lifestyle (AAPC = +2.9%). These data partially explain the observed changes in the incidence structure in Kazakhstan and emphasize the importance of considering modifiable risk factors when developing preventive programs, especially for target age groups [17].

Conclusion: Between 2015 and 2024, the Almaty region saw a steady increase in breast cancer incidence, with a moderate decline in mortality rates and improved early diagnosis. The increase in detection rates at stages I and II, while simultaneously reducing the number of stage III cases, confirms the effectiveness of ongoing preventive and screening programs. The primary epidemiological focus is shifting toward older women, necessitating prioritization of this cohort in breast cancer control strategies.

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АҢДАТПА

2015-2024 ЖЫЛДАРЫ АЛМАТЫ ОБЛЫСЫНДА СҮТ БЕЗІ ҚАТЕРЛІ ІСІГІНІҢ ЭПИДЕМИОЛОГИЯЛЫҚ КӨРСЕТКІШТЕРІН ТАЛДАУ

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Өзектілігі: *Сүт безінің қатерлі ісігі (СБҚІ) — бүкіл әлемдегі әйелдер арасында қатерлі ісіктің ең көп таралған түрі. 2020 жылы 2,3 миллион жаңа жағдай және шамамен 685 000 өлім тіркелді. Науқастардың 80% - дан астамы 50 жастан асқан әйелдер. Дамушы елдерде өлім-жітім деңгейі жоғары. 2040 жылға қарай болжам-сырқаттанушылықтың 3 млн жағдайға дейін өсуі күтілуде. Бұл зерттеу СБҚІ-нің аурушаңдық, өлім-жітім, сатысын анықтау, 10 жыл ішінде кешенді аймақтық талдау жүргізетін бірінші зерттеу болып табылады.*

Зерттеудің мақсаты *– 2015-2024 жылдарға арналған сүт безі обырын ерте анықтау және емдеу бойынша Қазақстанның Алматы облысында жүзеге асырылып жатқан шаралардың аурушаңдық, өлім-жітім, сатысын анықтау.*

Әдістері: *2015-2024 жылдар аралығындағы кезеңде Алматы облысының әйелдер халқы арасында СБҚІ сырқаттанушылық пен өлім-жітім көрсеткіштерін жіктеу және үрдістерді бағалау. №7, №090/Е статистикалық есептілік нысандары және өңірлік онкорегистрдің деректері пайдаланылды. Демографиялық деректер ҚР Стратегиялық жоспарлау және реформалар агенттігінің Ұлттық статистика бюросының ресми ашық материалдарынан алынды. Көрсеткіштерді есептеу тікелей стандарттауды қолдана отырып және Microsoft Excel және SPSS Statistics 23.0 бағдарламаларын қолдана отырып, стандартты эпидемиологиялық формулалар бойынша жүргізілді.*

Нәтижелері: *СБҚІ ауруы 100 000-ға шаққанда 34,8-ден 42,5-ке дейін, ал стандартталған көрсеткіш 34,2-ден 39,1-ге дейін өсті. Өлім-жітім 2021 жылы (11,6) шарықтау шегіне жетіп, 2024 жылы 8,5-ке дейін төмендеді. Өлім-жітімнің шартты коэффициенті 20,1%-дан 35,1%-ға дейін болды. I-II кезеңдерді анықтау үлесі 74,1%-дан 89,2%-ға дейін өсті, III кезең 20,6%-дан 4,6%-ға дейін төмендеді.*

Қорытынды: *Өңірде СБҚІ кезінде ерте диагностика мен өмір сүрудің оң динамикасы байқалады. Алайда, өлім-жітімнің тұрақты деңгейі және IV сатысының тұрақты үлесі терапияның бағытталуы мен қол жетімділігін одан әрі жетілдіру қажеттілігін көрсетеді.*

Түйінді сөздер: *сүт безі қатерлі ісігі (СБҚІ), эпидемиология, сырқаттанушылық, өлім-жітім, өмір сүру деңгейі, Қазақстан, Алматы облысы.*

АННОТАЦИЯ

АНАЛИЗ ЭПИДЕМИОЛОГИЧЕСКИХ ПОКАЗАТЕЛЕЙ РАКА МОЛОЧНОЙ ЖЕЛЕЗЫ В АЛМАТИНСКОЙ ОБЛАСТИ ЗА 2015-2024 гг.

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Актуальность: *Рак молочной железы (РМЖ) – наиболее частая форма злокачественных новообразований среди женщин во всём мире. В 2020 году зарегистрировано 2,3 млн новых случаев и около 685 000 смертей. Более 80% заболевших – женщины старше 50 лет. В развивающихся странах отмечаются более высокие показатели смертности. Прогноз к 2040 году – рост заболеваемости до 3 млн случаев. В настоящем исследовании проведен комплексный региональный анализ заболеваемости, смертности и стадии выявления РМЖ за 10 лет.*

Цель исследования *– проанализировать влияние мероприятий по раннему выявлению и лечению РМЖ, реализуемых в Алматинской области Республики Казахстан, на динамику заболеваемости, смертности и стадии выявления за 2015-2024 годы.*

Методы: *Оценка тенденций и распределения показатели заболеваемости и смертности от РМЖ среди женского населения Алматинской области за период с 2015 по 2024 годы. Использованы формы статистической отчётности №7, №090/У и данные регионального онкорегистра. Демографические данные были получены из официальных открытых материалов Бюро национальной статистики Агентства по стратегическому планированию и реформам Республики Казахстан. Расчёт показателей осуществлялся по стандартным эпидемиологическим формулам, с применением прямой стандартизации и использованием программ Microsoft Excel и SPSS Statistics 23.0.*

Результаты: *Заболеваемость РМЖ увеличилась с 34,8 до 42,5 на 100 000 женщин, а стандартизованный показатель – с 34,2 до 39,1. Смертность колебалась, достигнув пика в 2021 году (11,6), затем снизилась до 8,5 в 2024 году. Условный коэффициент летальности варьировал от 20,1% до 35,1%. Доля выявления I-II стадий увеличилась с 74,1% до 89,2%, при снижении III стадии с 20,6% до 4,6%.*

Заключение: *В регионе отмечается положительная динамика ранней диагностики РМЖ. Однако сохраняющийся уровень летальности и стабильная доля IV стадии указывают на необходимость дальнейшего совершенствования маршрутизации и доступности терапии.*

Ключевые слова: *рак молочной железы (РМЖ), эпидемиология, заболеваемость, смертность, Казахстан, Алматинская область.*

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