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EVALUATION CHANGES IN INDICATORS OF ONCOLOGICAL SERVICE IN COLORECTAL CANCER IN EAST KAZAKHSTAN REGION

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About 3.15 million new cases of colorectal cancer (CRC) are predicted and it is expected that about 1.62 million human will die from this pathology, according to the forecasts of the International Agency for Research on Cancer in 2040. To this aim, an analysis studying the indicators of the oncological service for CRC also makes it possible to evaluate the ongoing anti-cancer measures in East Kazakhstan region.

Aim. Evaluate some indicators of the oncological service at CRC in East Kazakhstan region in 2009 to 2018.

Materials and methods. The research material was data from the Ministry of Health of the Republic of Kazakhstan – annual form No. 7 and 35 regarding CRC (ICD 10 – C18-21) for 2009-2018 in East Kazakhstan region – incidence, mortality, early diagnosis, neglect, morphological verification. A retrospective study using descriptive and analytical methods of biomedical statistics was used as the main method.

Results and discussion. For 2009-2018, 3,661 new cases of CRC were registered in East Kazakhstan region for the first time. The incidence of CRC was 25.3‰ and in dynamics tended to increase from 21.9‰ (2009) to 25.7‰ in 2018, the difference was statistically significant ($t=1.99$ and $p=0.047$). The mortality rate from CRC tended to decrease from 15.5‰ to 14.7‰ ($p=0.591$), and the average annual mortality rate from CRC was 15.6‰. The indicators of early diagnosis (the proportion of patients with stage I-II) improved from 58.8% (2009) to 62.3% in 2018, and, accordingly, the indicators of the proportion of neglected patients significantly decreased with stage III (from 25.5% to 20.8%), while with stage IV (from 15.7% to 16.9%) there is a slight increase. The indicators of morphological verification in CRC improved from 90.5% to 98.6% during the studied years.

Conclusion. An improvement in the indicators of morphological verification and early diagnosis of CRC was found. The obtained results are recommended to be used for monitoring anti-cancer measures in the region.

Keywords: colorectal cancer, incidence, mortality, early diagnosis, neglect, morphological verification.

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Т Ұ Ж Ы Р Ы М

ҚАЗАҚСТАНДАҒЫ КОЛОРЕКТАЛЬДЫ ҚАТЕРЛІ ІСІГІНЕ БАЙЛАНЫСТЫ ОНКОЛОГИЯЛЫҚ ҚЫЗМЕТТІҢ КЕЙБІР КӨРСЕТКІШТЕРІНІҢ ДИНАМИКАСЫ

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Обырды зерттеу жөніндегі халықаралық агенттіктің болжамы бойынша 2040 жылы колоректальды қатерлі ісігінің (КҚІ) 3,15 миллионға жуық жаңа жағдайы болжануда және 1,62 миллионға жуық адам осы патологиядан қаза болады деп күтілуде. Осы мақсатта Қазақстан Республикасында КҚІ бойынша онкологиялық қызмет көрсеткіштеріне талдау жүргізілді, ол жүргізілген обырға қарсы іс-шараларды бағалауға мүмкіндік береді.

Зерттеудің мақсаты. 2009-2018 жж. Шығыс-Қазақстан облысындағы КҚІ байланысты онкологиялық қызметтің кейбір көрсеткіштерін бағалау.

Материал және әдістері. Зерттеу материалдары Қазақстан Республикасы Денсаулық сақтау министрлігінің деректері – Шығыс Қазақстан облысындағы КҚІ-не (АХЖ 10 – С18-21) қатысты 2009-2018 жж. жылдық № 7 және 35 нысандар – аурушаңдық, өлім, ерте диагностика, асқыну, морфологиялық верификация. Негізгі әдіс ретінде медициналық-биологиялық статистиканың дескриптивтік және аналитикалық әдістерін қолдана отырып ретроспективті зерттеу қолданылды.

Нәтижелері және талқылауы. 2009-2018 жылдары Шығыс-Қазақстан облысында 3 661 КҚІ жаңа жағдайлары тіркелген. КҚІ аурушаңдығының орташа жылдық дәрежі көрсеткіші $25,3 \pm 0,7\text{‰}$ (95% СИ=24,0-26,7) құрады және динамикада $21,9 \pm 1,3\text{‰}$ -тен (2009 ж.) $25,7 \pm 1,4\text{‰}$ -ке дейін (2018 ж.) жоғарылау үрдісіне ие болды, айырмашылық статистикалық маңызды болды ($t=1,99$ және $p=0,047$). КҚІ-нен болатын өлім-жітім $15,5\text{‰}$ -ден $14,7\text{‰}$ -ге дейін ($p=0,591$) төмендеді, ал КҚІ-нен болатын өлім-жітімнің орташа жылдық көрсеткіші $15,6\text{‰}$ құрады. Ерте диагностика көрсеткіштері (I-II сатысы бар науқастардың үлес салмағы) 2018 жылы 58,8%-дан (2009 ж.) 62,3%-ға дейін жақсарды және тиісінше асқынған науқастардың үлес салмағының көрсеткіштері III сатымен (25,5%-дан 20,8%-ға дейін) айтарлықтай төмендеді, ал IV сатымен (15,7%-дан 16,9%-ға дейін) аздаған өсім байқалады. КРР кезінде морфологиялық верификация көрсеткіштері зерттелген жылдары 90,5%-дан 98,6%-ға дейін жақсарды.

Қорытынды. Морфологиялық верификация және КҚІ-нің ерте диагностикасы көрсеткіштерінің жақсаруы анықталды. Алынған нәтижелерді облыстағы обырға қарсы іс-шараларды мониторингтеу үшін пайдалану ұсынылады.

Негізгі сөздер: колоректальды қатерлі ісік, аурушаңдық, өлім-жітім, ерте диагностика, асқыну, морфологиялық верификация.

РЕЗЮМЕ

ИЗМЕНЕНИЯ ПОКАЗАТЕЛЕЙ ОНКОЛОГИЧЕСКОЙ СЛУЖБЫ ПРИ КОЛОРЕКТАЛЬНОМ РАКЕ В ВОСТОЧНО-КАЗАХСТАНСКОЙ ОБЛАСТИ

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По прогнозам Международного агентства по изучению рака в 2040 году прогнозируется около 3,15 миллиона новых случаев колоректального рака (КРР) и ожидается, что около 1,62 миллиона человек погибнут от данной патологии. Цель данной работы - провести анализ показателей онкологической службы при КРР в Восточно-Казахстанской области.

Цель исследования. Оценить некоторые показатели онкологической службы при КРР в Восточно-Казахстанской области за 2009-2018 гг.

Материал и методы. Материалом исследования послужили данные Министерства здравоохранения Республики Казахстан – годовые формы №7 и №35, касающиеся КРР (МКБ 10 – С18-21) за 2009-2018 гг. по Восточно-Казахстанской области – заболеваемость, смертность, ранняя диагностика, запущенность, морфологическая верификация. В качестве основного метода использовалось ретроспективное исследование с применением дескриптивных и аналитических методов медико-биологической статистики.

Результаты и обсуждение. За 2009-2018 гг. в Восточно-Казахстанской области был впервые зарегистрирован 3 661 новый случай КРР. Заболеваемость КРР составила $25,3\text{‰}$ и в динамике имела тенденцию к росту с $21,9\text{‰}$ (2009 г.) до $25,7\text{‰}$ в 2018 году, различие было статистически значимым ($t=1,99$ и $p=0,047$). Смертность от КРР имела тенденцию к снижению

с 15,5‰ до 14,7‰ ($p=0,591$), а среднегодовой показатель смертности от КРР составил 15,6‰. Показатели ранней диагностики (удельный вес больных с I-II стадией) улучшились с 58,8% (2009 г.) до 62,3% в 2018 году, и соответственно показатели удельного веса запущенных больных значительно уменьшились с III стадией (с 25,5 до 20,8%), в то время как с IV стадией (с 15,7 до 16,9%) наблюдается небольшой рост. Показатели морфологической верификации при КРР за изучаемые годы улучшились с 90,5 до 98,6%.

Выводы. Установлено улучшение показателей морфологической верификации и ранней диагностики КРР. Полученные результаты рекомендуются использовать для мониторинга противораковых мероприятий в области.

Ключевые слова: колоректальный рак, заболеваемость, смертность, ранняя диагностика, запущенность, морфологическая верификация.

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According to the International Agency for Research on Cancer, about 3.15 million new cases of colorectal cancer (CRC) are predicted in 2040 and about 1.62 million people are expected to die from this pathology [1, 2, 3].

Epidemiological studies of cancer incidence in many regions of the world indicate an increase in the incidence of CRC [1, 4, 5], including in our country [6]. Consequently, CRC remains a global problem, occupying a leading position in the structure of malignant neoplasms both in terms of the frequency of new cases and the causes of death [4, 7]. Various exogenous and endogenous factors influence the development of CRC [8, 9, 10]. Most of the increase in the incidence of CRC occurred simultaneously with technological and economic progress, which led to changes in the way food is produced and stored, as well as in the eating habits of the population [11, 12]. Screening strategies in regions with a high incidence of CRC are designed to reduce mortality from colorectal cancer [13, 14]. Thus, the analysis of changes in the indicators of the cancer service in the CRC allows us to evaluate the ongoing anti-cancer measures.

The purpose of the study - to evaluate some indicators of the oncological service on CRC in the East Kazakhstan region for 2009-2018.

MATERIAL AND METHODS

The material of the study was the data of the Ministry of

Health of the Republic of Kazakhstan – annual form No. 7 and 35 concerning CRC (ICD 10 – C18-21) for 2009-2018 in the East Kazakhstan region – morbidity, mortality, early diagnosis, neglect, morphological verification. The main method used was a retrospective study using descriptive and analytical methods of biomedical statistics. Extensive and intensive indicators were calculated according to the generally accepted methods of medical and biological statistics [15, 16]. The average value (M), the mean error (m), the 95% confidence interval (95% CI) and the average annual growth/decline rate were determined (Tg/d, %).

RESULTS AND DISCUSSION

In 2009-2018, 3,661 new cases of CRC were registered for the first time in the East Kazakhstan region, which accounted for 13.1% of all cases in the republic. The average annual crude rate of incidence of CRC was $25.3 \pm 0.7‰$ (95% CI=24.0-26.7) and in dynamics tended to increase from $21.9 \pm 1.3‰$ in 2009 to $25.7 \pm 1.4‰$ in 2018, the difference was statistically significant ($t=1.99$ and $p=0.047$). In dynamics, the mortality rates from CRC tended to decrease from $15.5 \pm 1.1‰$ in 2009 to $14.7 \pm 1.0‰$ in 2018 ($p=0.591$), and the average annual crude rate was $15.6 \pm 0.3‰$ (95% CI=15.0-16.2).

Trends in the equalized indicators of morbidity and mortality from CRC in the East Kazakhstan region are presented in Figure 1.

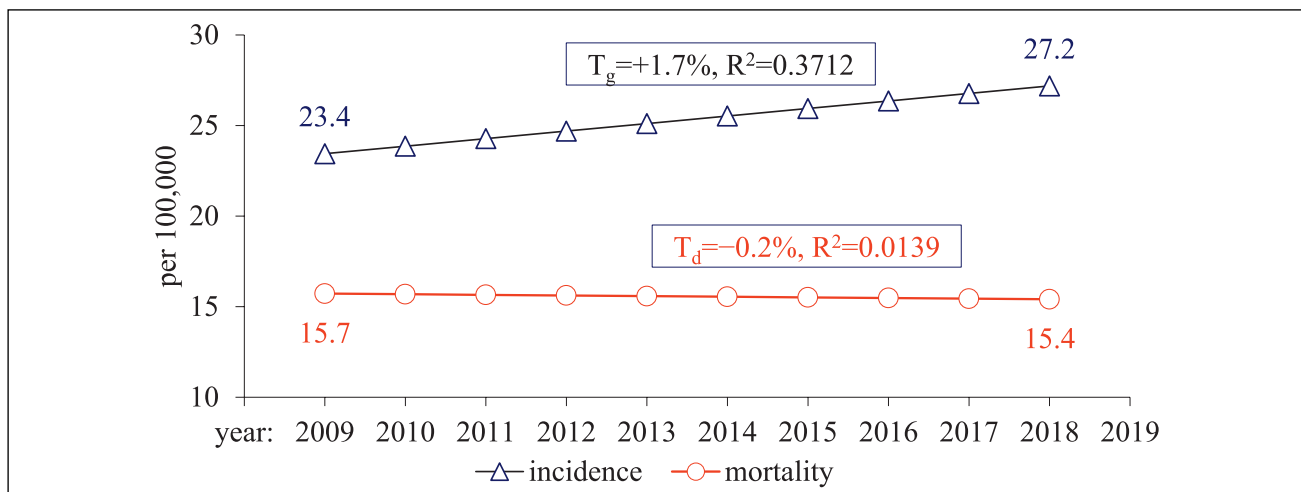


Figure 1 – Trends in the equalized indicators in incidence of CRC in the East Kazakhstan region for 2009-2018

It was found that the average annual growth rate of the equalized indicators of the incidence of CRC was $T_g=+1,7\%$ ($R^2=0.6502$), and the rate of decline when the mortality indicators were equalized was not pronounced $T_d=-0.2\%$ ($R^2=0.0139$) (Figure 1).

Trends in the equalized incidence rates by stage indicate an increase in the incidence of CRC with I-II and IV stages, as well as a decrease in the incidence with III stage, while the rates of growth/decline were pronounced (Figure 2).

In dynamics, the proportion of patients with CRC at I-II stages increased from 58.8% in 2009 to 62.3% in 2018 (Table 1), while the average annual growth rate of the equalized indicator was $T_g=+1.2\%$.

The proportion of patients with stage III of the disease decreased from 25.5% (2009) to 20.8% in 2018 (Table 1), and the average annual rate of loss with equalization was $T_d=-2.9\%$.

In dynamics, the share of CRC stage IV increased from 15.7% (2009) to 16.9% in 2018 (Table 1), and the average annual rate of decline with equalization was $T_d=-0.3\%$.

Morphological verification of CRC improved during the study period and the indicators increased from 90.5% in 2009 to 98.6% in 2018 (Figure 3).

Findings:

1. The absolute number of people with a first-time diagnosis of CRC increased by 26.3% in the East Kazakhstan region during the studied years.

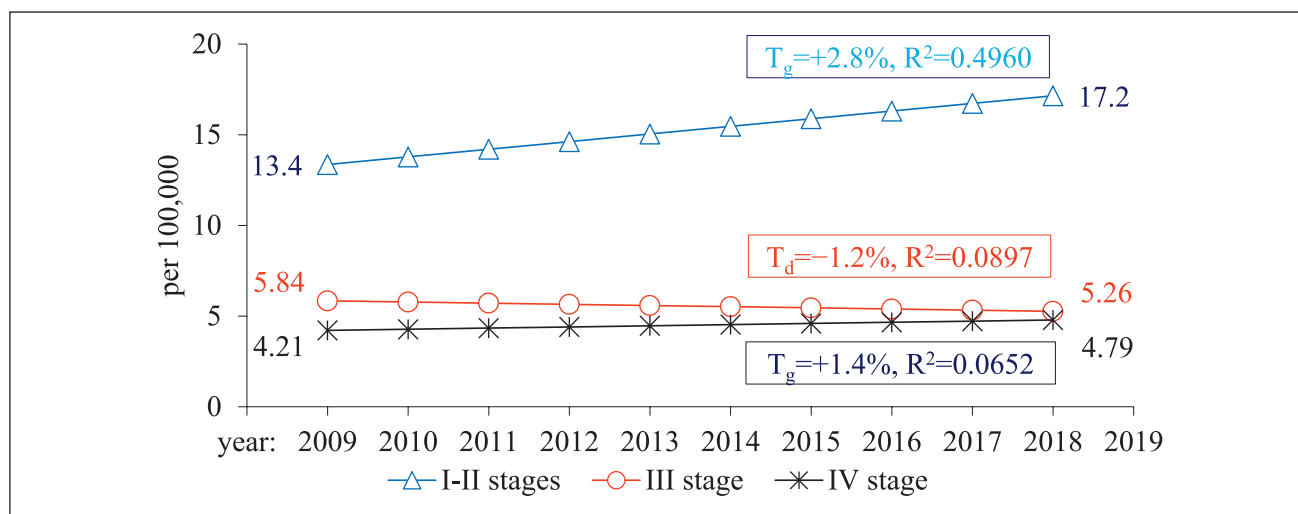


Figure 2 – Trends of equalized indicators of the incidence of CRC, considering the stage of the disease in the East Kazakhstan region for 2009-2018

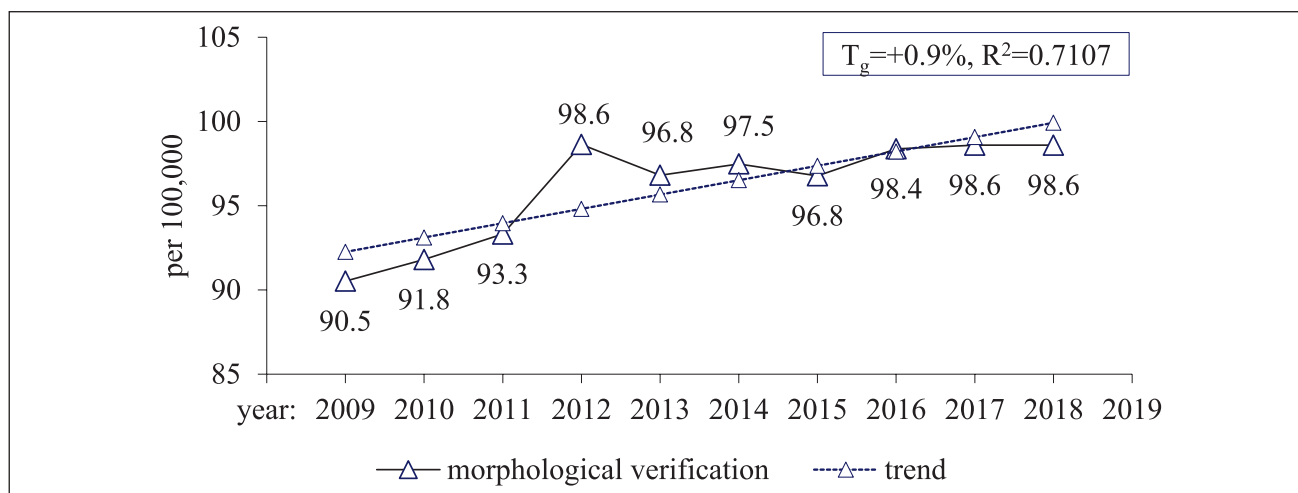


Figure 3 – Dynamics of morphological verification indicators in the CRC in the East Kazakhstan region for 2009-2018

Table 1 – The specific weight of the CRC by stages in the East Kazakhstan region for 2009-2018

Stage	Years										P±m	Tg/d, %
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		
I-II	58.8	52.5	59.9	60.4	60.0	62.0	59.9	60.7	64.5	62.3	60.1±1.0	+1.2
III	25.5	23.9	25.3	22.1	22.9	20.2	17.5	24.4	17.7	20.8	22.0±1.0	-2.9
IV	15.7	23.3	14.5	17.5	17.1	17.9	22.6	14.9	17.7	16.9	17.8±1.0	-0.3

2. The incidence of CRC per 100,000 of the total population increased by 17.1% over 10 years. At the same time, the trend in the incidence of CRC at stage I-II and IV increases, and the trends in the incidence of stage III decrease.

3. In 2009-2018, the absolute number of people who died from CRC in the region decreased by 6.0%. The death rate from CRC per 100,000 population of the region for 10 years decreased by 5.1%.

4. During the study period, the number of patients diagnosed at stages I-II increased by 22.8%, with stage III decreased by 5.1% and with stage IV increased by 25.0%.

CONCLUSION

Evaluating the obtained data, it should be noted that in the East Kazakhstan region there is an increase in the incidence, particularly due to the I-II stages. There are positive changes in the indicators of the oncological service: the indicators of morphological verification and early diagnosis increase, the proportion of patients with III stage decreases. But the increase in the specific weight of stage IV is alarming. In addition, there is a tendency of decline of mortality from this pathology in the studied area. The obtained results are recommended for use in the monitoring and evaluation processes of ongoing anti-cancer measures in the region.

REFERENCES

- 1 Ferlay J, Ervik M, Lam F, Colombet M, et al. (2018). Global Cancer Observatory: Cancer Today. Lyon, France: International Agency for Research on Cancer. Available from: <https://gco.iarc.fr/today>, дата обращения 2 декабря 2020.
- 2 Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2018 Nov; 68(6):394-424. DOI: 10.3322/caac.21492
- 3 Ferlay J, Colombet M, Soerjomataram I, et al. Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and methods. *Int J Cancer.* 2019 Apr 15;144(8):1941-1953. DOI: 10.1002/ijc.31937
- 4 Mattiuzzi C, Sanchis-Gomar F, Lippi G. Concise update on colorectal cancer epidemiology. *Ann Transl Med.* 2019;7(21):609. DOI: 10.21037/atm.2019.07.91
- 5 Siegel RL, Fedewa SA, Anderson WF, et al. Colorectal Cancer Incidence Patterns in the United States, 1974-2013. *J Natl Cancer Inst.* 2017;109(8):djw322. DOI: 10.1093/jnci/djw322
- 6 Zhabagin K, Igissinov N, Manambayeva Z, et al. Temporal Epidemiological Assessment of Colorectal Cancer Incidence and Mortality in East Kazakhstan, 2004-2013. *Asian Pac J Cancer Prev.* 2015;16(15):6413-6416. DOI: 10.7314/apjcp.2015.16.15.6413
- 7 Douaiher J, Ravipati A, Grams B, Chowdhury S, Alatis O, Are C. Colorectal cancer-global burden, trends, and geographical variations. *J Surg Oncol.* 2017;115(5):619-630. DOI: 10.1002/jso.24578
- 8 Baena R, Salinas P. Diet and colorectal cancer. *Maturitas.* 2015;80(3):258-264. DOI: 10.1016/j.maturitas.2014.12.017
- 9 Boland PM, Yurgelun MB, Boland CR. Recent progress in Lynch syndrome and other familial colorectal cancer syndromes. *CA Cancer J Clin.* 2018;68(3):217-231. DOI: 10.3322/caac.21448
- 10 Johnson CM, Wei C, Ensor JE, et al. Meta-analyses of colorectal cancer risk factors. *Cancer Causes Control.* 2013;24(6):1207-1222. DOI: 10.1007/s10552-013-0201-5
- 11 Kearney J. Food consumption trends and drivers. *Philos Trans R Soc Lond B Biol Sci.* 2010;365(1554):2793-2807. DOI: 10.1098/rstb.2010.0149

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Authors' contribution

Yerkezhan Zhadykova – data summary, primary processing of the material, writing the text of the article.

Nurbek Igissinov – concept and design of the study, approval of the final version of the article.

Saken Kozhakhmetov – editing, approval of the final version of the article.

Dulat Turebayev – writing the text of the article (introduction, conclusions).

Sauirbay Sakhanov – writing the text of the article (results).

Zarina Bilyalova – statistical processing of the material, writing the text of the article (material and methods, conclusion).

Dariyana Kulmirzayeva – writing the text of the article, editing.

Saltanat Urazova – processing of the material, editing.

Akmaral Amanshayeva – writing the text of the article (results), editing.

Conflict of interest

The authors declare no conflict of interest.

СПИСОК ЛИТЕРАТУРЫ

- 1 Ferlay J, Ervik M, Lam F, Colombet M., Mery L., Piñeros M., Znaor A., Soerjomataram I., Bray F. (2018). Global Cancer Observatory: Cancer Today. Lyon, France: International Agency for Research on Cancer. <https://gco.iarc.fr/today>, accessed 2 December 2020.
- 2 Bray F, Ferlay J, Soerjomataram I, Siegel R.L., Torre L.A., Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries // *CA Cancer J Clin.* – 2018. – Vol. 68 (6). – P. 394-424. DOI: 10.3322/caac.21492
- 3 Ferlay J, Colombet M., Soerjomataram I., Mathers C., Parkin D.M., Piñeros M., Znaor A., Bray F. (2019). Estimating the global cancer incidence and mortality in 2018: GLOBOCAN sources and methods // *Int J Cancer.* – 2019. – Vol. 144 (8). – P. 1941-1953. DOI: 10.1002/ijc.31937
- 4 Mattiuzzi C., Sanchis-Gomar F., Lippi G. Concise update on colorectal cancer epidemiology // *Ann Transl Med.* – 2019. – Vol. 7 (21). – P. 609. DOI: 10.21037/atm.2019.07.91.
- 5 Siegel R.L., Fedewa S.A., Anderson W.F. et al. Colorectal Cancer Incidence Patterns in the United States, 1974-2013 // *J Natl Cancer Inst.* – 2017. – Vol. 109 (8). – P. djw322. DOI: 10.1093/jnci/djw322
- 6 Zhabagin K., Igissinov N., Manambayeva Z. et al. Temporal Epidemiological Assessment of Colorectal Cancer Incidence and Mortality in East Kazakhstan, 2004-2013 // *Asian Pac J Cancer Prev.* – 2015. – Vol. 16 (15). – P. 6413-6416. DOI: 10.7314/apjcp.2015.16.15.6413
- 7 Douaiher J., Ravipati A., Grams B., Chowdhury S., Alatis O., Are C. Colorectal cancer-global burden, trends, and geographical variations // *J Surg Oncol.* – 2017. – Vol. 115 (5). – P. 619-630. DOI: 10.1002/jso.24578
- 8 Baena R., Salinas P. Diet and colorectal cancer // *Maturitas.* – 2015. – Vol. 80 (3). – P. 258-264. DOI: 10.1016/j.maturitas.2014.12.017
- 9 Boland P.M., Yurgelun M.B., Boland C.R. Recent progress in Lynch syndrome and other familial colorectal cancer syndromes // *CA Cancer J Clin.* – 2018. – Vol. 68 (3). – P. 217-231. DOI: 10.3322/caac.21448

12 Orlien V, Bolumar T. Biochemical and Nutritional Changes during Food Processing and Storage. *Foods*. 2019;8(10):494. Published 2019 Oct 14. DOI: 10.3390/foods8100494

13 Rex DK, Boland CR, Dominitz JA, et al. Colorectal Cancer Screening: Recommendations for Physicians and Patients From the U.S. Multi-Society Task Force on Colorectal Cancer. *Gastroenterology*. 2017;153(1):307-323. DOI: 10.1053/j.gastro.2017.05.013

14 Lauby-Secretan B, Vilahur N, Bianchini F, Guha N, Straif K; International Agency for Research on Cancer Handbook Working Group. The IARC Perspective on Colorectal Cancer Screening. *N Engl J Med*. 2018;378(18):1734-1740. DOI: 10.1056/NEJMsrl714643

15 Merkov AM, Polyakov LE. *Sanitarnaya statistika* [Sanitary statistics]. Leningrad: Medicine; 1974. 384 p.

16 Glanc S. *Mediko-biologicheskaya statistika* [Biomedical statistics]. Moscow: Practice; 1999. 460 p.

10 Johnson C.M., Wei C., Ensor J.E. et al. Meta-analyses of colorectal cancer risk factors // *Cancer Causes Control*. – 2013. – Vol. 24 (6). – P. 1207-1222. DOI: 10.1007/s10552-013-0201-5

11 Kearney J. Food consumption trends and drivers // *Philos Trans R Soc Lond B Biol Sci*. – 2010. – Vol. 365 (1554). – P. 2793-2807. DOI: 10.1098/rstb.2010.0149

12 Orlien V., Bolumar T. Biochemical and Nutritional Changes during Food Processing and Storage // *Foods*. – 2019. – Vol. 8 (10). – P. 494. DOI: 10.3390/foods8100494

13 Rex D.K., Boland C.R., Dominitz J.A. et al. Colorectal Cancer Screening: Recommendations for Physicians and Patients From the U.S. Multi-Society Task Force on Colorectal Cancer // *Gastroenterology*. – 2017. – Vol. 153 (1). – P. 307-323. DOI: 10.1053/j.gastro.2017.05.013

14 Lauby-Secretan B., Vilahur N., Bianchini F., Guha N., Straif K.; International Agency for Research on Cancer Handbook Working Group. The IARC Perspective on Colorectal Cancer Screening // *N Engl J Med*. – 2018. – Vol. 378 (18). – P. 1734-1740. DOI: 10.1056/NEJMsrl714643

15 Мерков А.М., Поляков Л.Е. Санитарная статистика. – Л.: Медицина; 1974. – 384 с.

16 Стентон Гланц. Медико-биологическая статистика. – М.: 1999. – 460 с.