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Review

Epidemiological Profile of Colorectal Cancer: Global Perspectives and Current Dynamics in Kazakhstan

Zhanar Orazbekova

PhD Student, Department of Epidemiology and Biostatistics, Astana Medical University, Astana, Kazakhstan.
E-mail: zhorazbekova8@gmail.com

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Abstract

Colorectal cancer (CRC) is the third most commonly diagnosed cancer and the second leading cause of cancer-related mortality worldwide. Its burden is increasingly shifting toward middle-income countries, including Kazakhstan, where CRC has become one of the leading malignancies. A comprehensive synthesis of Kazakhstan's epidemiological profile within the global CRC context has been lacking.

Objective. To review the global epidemiology of colorectal cancer and evaluate current incidence, mortality, screening, and survival trends in the Republic of Kazakhstan.

Methods. A narrative review with systematic elements integrated international evidence from IARC/GLOBOCAN 2020 and 2022, the Global Burden of Disease 2019 and 2021, and other authoritative global sources with Kazakhstan-specific data on cancer registration, screening, survival, and behavioral factors published between 2001 and 2025. PubMed/PMC, IARC Cancer Today, WHO NCD Country Profiles, and reports from the Kazakhstan Ministry of Healthcare were searched between March 2024 and February 2026.

Results. Globally, CRC accounted for approximately 1.93 million new cases and 935,000 deaths in 2020. Although age-standardized rates have declined in many high-income countries, the absolute burden continues to increase because of population growth and aging. In Kazakhstan, crude CRC incidence increased from 14.79 to 17.72 per 100,000 between 2009 and 2018, whereas crude mortality declined from 11.2 to 7.7 per 100,000. Following the introduction of organized screening in 2011, early-stage (I–II) detection increased from 35.0% to 67.4%, while stage III and IV disease decreased. Survival analysis of 37,871 patients diagnosed during 2014–2023 identified older age and greater comorbidity burden as major predictors of poorer outcomes.

Conclusions. Kazakhstan demonstrates the characteristic CRC epidemiological transition of rising incidence accompanied by slower mortality reduction.

Keywords: colorectal cancer, epidemiology, incidence, mortality, Kazakhstan. screening.

1. Introduction

Colorectal cancer (CRC) is one of the defining malignancies of the ongoing global epidemiological transition. As countries industrialize, urbanize, and undergo dietary westernization, CRC burden tends to rise through the combined effects of population aging, adiposity, physical inactivity, tobacco and alcohol use, and improved case ascertainment through organized screening [1–3]. Global estimates for 2020 placed CRC as the third most commonly diagnosed cancer and the second leading cause of cancer-related death worldwide, with approximately 1.93 million new cases and 935,000 deaths annually [1,4]. International Agency for Research on Cancer (IARC) GLOBOCAN 2022 country estimates confirmed the persistence of

colorectum among the top three cancer sites in Kazakhstan, with 3,514 incident cases and 1,968 deaths reported for that year [2,3].

Kazakhstan's engagement with CRC epidemiology has a specific historical arc. Through the late Soviet period and the first post-independence decade, CRC was consistently reported at low crude rates relative to more urbanized parts of Eurasia, reflecting both a younger age structure and incomplete case ascertainment. From the mid-2000s onward, a series of health-system reforms, the maturation of the national cancer registry, and the 2011 introduction of organized CRC screening began to change both the observed and the underlying epidemiology. The 2001–2025 window therefore captures a country moving from a low-observed-incidence baseline into a mid-transition profile with rising incidence and evolving mortality patterns.

The interpretation of national CRC dynamics requires two simultaneous lenses. The first is descriptive: what are the incidence, mortality, stage distribution, and survival patterns, and how are they changing over time? The second is comparative: where does the country sit within the broader global distribution of CRC burden, and what does that position imply for prevention, screening, and treatment priorities? For Kazakhstan, both questions have been addressed only partially in the published literature. National registry studies have documented the country's rising incidence and shifting stage distribution during the screening era, while regional and city-level analyses have highlighted the barriers to consistent program delivery [5–11]. What has been missing is an integrated account that links the domestic epidemiology to the global picture in a manner useful for planning and comparative benchmarking, and which places the country within the wider Central and North Asian regional context [12-14].

This need is not merely academic. Kazakhstan combines several characteristics that make its CRC trajectory particularly informative: upper-middle-income economic status, substantial internal geographic and demographic heterogeneity, a legacy of environmental and occupational exposures, more than a decade of organized CRC screening, and a large-scale national electronic oncology registry that has begun to yield rigorous survival analyses [5–9]. Together, these features position Kazakhstan as a natural case study for how transition-country CRC epidemiology evolves under real-world conditions, and how the National Oncology Care Development Program (approved 2023) and the ongoing modernization of the screening infrastructure may reshape that trajectory over the next decade [15].

This review aims to provide a comprehensive analysis of the global epidemiological profile of CRC and critically evaluate its current dynamics, incidence, and mortality trends within the Republic of Kazakhstan. Specifically, we synthesize (i) the global burden landscape and its regional and demographic subpatterns, (ii) the modifiable and non-modifiable drivers of CRC risk that shape the transition trajectory, (iii) Kazakhstan's incidence, mortality, stage, and survival dynamics between 2001 and 2025, and (iv) Kazakhstan's comparative positioning within the global CRC landscape and the implications for the country's next decade of prevention and control.

2. Materials and Methods

Review approach

This work was structured as a narrative review with systematic elements, integrating international and Kazakhstan-specific epidemiological evidence on CRC. A narrative synthesis was chosen because the underlying sources are heterogeneous in design, outcome definitions, and reporting periods, and because the review objective is to characterize a coherent epidemiological picture rather than to pool point estimates through meta-analysis. To enhance transparency, the source selection process, databases, search window, and included-source counts are reported explicitly (Table 1).

Information sources and search

Four resources were searched between March 2024 and February 2026: PubMed/PMC (biomedical literature), IARC Cancer Today / GLOBOCAN online (international burden estimates), World Health Organization (WHO) Noncommunicable Diseases (NCD) Country Profiles and STEPS survey reports (national risk-factor context), and the Kazakhstan Ministry of Healthcare oncology annual reports (Kazakhstan-specific administrative data). Search terms combined ("colorectal cancer" OR "colon cancer" OR "rectal cancer") with ("epidemiology" OR "incidence" OR "mortality" OR "survival" OR "screening" OR "burden") and — for Kazakhstan-specific searches — with ("Kazakhstan" OR "Central Asia"). Reference chaining and forward citation search were used to identify additional eligible sources.

Eligibility and selection

Eligible sources included original research, national registry analyses, evidence syntheses, and authoritative international burden reports that presented extractable descriptive epidemiological outcomes — incidence, mortality, prevalence, stage distribution, survival, or screening performance. Priority was given to sources with clear temporal

coverage of the 2001–2025 window and to Kazakhstan-specific data. Single-patient reports, purely mechanistic laboratory studies, and non-empirical opinion pieces were excluded. Table 1 summarizes the source-selection flow.

Table 1 - Source selection summary

Element	Detail
Search window	**March 2024 – February 2026**
Databases and resources	PubMed/PMC; IARC Cancer Today / GLOBOCAN; WHO NCD Country Profiles and STEPS; Kazakhstan Ministry of Healthcare oncology reports
Records identified	168
Duplicates removed	24
Records screened by title/abstract	144
Records excluded (off-topic, mechanistic, opinion)	87
Full-text sources assessed	57
Sources included in final synthesis	45
— Kazakhstan-specific	12
— International burden and projections	11
— Guidelines and screening	6
— Regional / Central & North Asia	4
— Risk factors and modifiable drivers	8
— Methodology and reference syntheses	4

Data organization

Extracted data were organized around two structural axes. The first axis addresses the global epidemiological profile of CRC: burden magnitude, regional differentiation, demographic patterns, and modifiable drivers. The second axis addresses the Kazakhstan trajectory across five interlinked dimensions: incidence, mortality, stage migration, survival, and screening delivery. A comparative positioning section then integrates both axes to place Kazakhstan within the global landscape (Table 3).

3. Results

Global epidemiological profile of colorectal cancer

Global burden and recent trajectory. CRC is one of the largest contributors to the global cancer burden. In 2020, IARC estimated 1.93 million new CRC cases and 935,000 CRC-related deaths worldwide, positioning the disease as the third most incident and second most lethal malignancy overall [1,4]. Updated GLOBOCAN 2022 estimates confirmed CRC's continued position among the leading cancers globally [2,3]. The Global Burden of Disease (GBD) 2019 and 2021 analyses documented a marked increase in worldwide incident cases, deaths, and disability-adjusted life-years (DALYs) attributable to CRC over the preceding decades, reflecting the combined effects of population growth and aging [12,16]. Age-standardized incidence rates have risen slightly at the global level, whereas age-standardized mortality and DALY rates have declined, indicating measurable — if uneven — improvements in early detection and treatment across the world [12,16,17].

The apparent decoupling of absolute and age-standardized dynamics is central to understanding contemporary CRC epidemiology. In many high-income countries, age-standardized incidence and mortality have been declining for at least two decades, driven by the maturation of organized screening, wider access to colonoscopy, improvements in adjuvant therapy, and reductions in tobacco use [17-19]. In many low- and middle-income countries, absolute case counts are rising and age-standardized rates are trending upward, driven by demographic transition, urbanization, and dietary and behavioral change [1,5,12,20]. As a result, the epicenter of new CRC diagnoses is shifting toward middle-income Asia, Eastern Europe, and parts of Latin America — regions that combine substantial population size with recently accelerating exposure to Westernized risk profiles [1,12,18,20]. Projections based on demographic momentum alone imply that global CRC incident cases could rise substantially by 2040, even under optimistic assumptions about age-standardized rate compression [17,18,21].

Regional patterns and disparities

Between-country variation in CRC burden is among the largest observed for any solid tumor. Age-standardized incidence exceeds 40 per 100,000 in parts of Europe, Australia, and North America, but remains below 10 per 100,000 in parts of South Asia and sub-Saharan Africa [1,4,17]. Mortality-to-incidence ratios (M:I) are markedly less favorable in countries with limited access to timely diagnostics and treatment, so that some middle-income countries carry a disproportionately high fatal burden relative to their incident case counts [1,17,22].

Within-country disparities are also substantial. In the United States, African American individuals experience higher CRC incidence and mortality than most other racial and ethnic groups, with disparities persisting after adjustment for access to care [19,23]. Structural factors — differential exposure to risk factors, uneven access to screening, and heterogeneity in treatment quality — jointly reproduce these gaps. Similar within-country gradients have been described in relation to socioeconomic status, rurality, and health-system access in a range of high- and middle-income settings [18,22].

Asia now bears a disproportionate share of the global CRC burden, and within Asia the trajectory is not uniform [18,20]. High-income Asian settings such as Japan, South Korea, and Singapore have seen incidence increases followed by mortality plateaus and M:I compression consistent with mature population screening [20,24]. Middle-income Asian settings, including much of Central Asia, are earlier in the transition and typically show rising incidence with slower mortality improvement [13,14,18,20]. Kazakhstan's trajectory is best interpreted against this intermediate Asian pattern rather than against fully developed screening systems, and is examined in detail in Section 5 (Table 3).

Age, sex, and early-onset dynamics

Age remains the dominant non-modifiable determinant of CRC risk. Incidence has traditionally doubled in each five-year interval up to age 50 and increased more gradually thereafter [1,18,19]. However, the aggregate epidemiological picture is now more complex. The median age at CRC diagnosis in the United States has fallen from the early 70s in the early 2000s to the mid-60s in recent cohorts, driven by a striking rise in early-onset disease [19,25]. Cases diagnosed before age 50 have nearly doubled since the early 1990s in the United States and have shown similar directional increases in multiple other high- and middle-income countries [25-27]. Projections suggest that by 2030, approximately one in ten colon cancers and one in four rectal cancers may be diagnosed in adults under age 50 in some Western populations [26]. Asian data are consistent in direction if not always in magnitude: early-onset CRC incidence has increased in China, Japan, and South Korea over the past two decades, with the steepest relative rises among adults aged 30–39 years in urban populations [20,24].

Sex differences are consistent but moderate. Age-standardized CRC incidence is generally higher in men than in women, and males typically have moderately higher mortality after age 50 [1,4,18]. Survival differences favor women in most cohorts, particularly in younger age strata [18,19]. These patterns imply that any national screening strategy that fails to account for both early-onset trends and sex-specific presentation risks systematically missing preventable cases and preventable deaths.

Modifiable drivers and the transition dynamic

The transition toward higher CRC burden in middle-income countries is driven by a coherent cluster of modifiable factors. Excess adiposity, sedentary behavior, high consumption of red and processed meats, low intake of dietary fiber, tobacco use, and heavy alcohol consumption each independently increase CRC risk, and their aggregate effect explains a large share of between-country variation in incidence [28-33]. Comorbid conditions, particularly type 2 diabetes, further elevate risk and complicate treatment decisions [32]. Modeled attributable-fraction analyses suggest that combined modifiable risk factors account for a large share of preventable CRC in most high- and middle-income populations [31].

In Kazakhstan, the WHO STEPS survey documented a substantial burden of these exposures. The national STEPS 2021 report described high prevalences of overweight and obesity among adults, elevated red and processed meat intake relative to WHO dietary guidance, sustained tobacco use particularly among men, and a mean sodium intake well above the recommended threshold [34]. Central Asian regional analyses have reached similar conclusions and have highlighted low awareness of CRC risk factors as a compounding element [13,14]. This constellation of exposures, rather than any single dominant factor, is the principal driver of the emerging CRC burden in Kazakhstan and in comparable transition settings [13,28,31,34].

Non-modifiable determinants — family history, hereditary syndromes such as Lynch syndrome and familial adenomatous polyposis, inflammatory bowel disease, and specific germline susceptibility loci — contribute a smaller share of aggregate incidence but a disproportionate share of early-onset cases and of cases with adverse molecular profiles [33,35].

In an epidemiological review, these determinants are relevant primarily because they justify risk-stratified screening approaches that complement population-level programs and are increasingly incorporated into international guidance [36-39].

Current dynamics of colorectal cancer in Kazakhstan (2001–2025)

The Kazakhstan evidence base underlying this section is summarized in Table 2, which lists the twelve principal national and regional sources by design, temporal coverage, and outcome domain.

Table 2 - Principal Kazakhstan-specific evidence base for CRC epidemiology, 2001–2025

Source	Design	Period	Coverage	Outcome domain
Mauyenova et al. 2021 [5]	Registry analysis	2009–2018	National	Incidence, ASIR, sex/age structure
Mauyenova et al. 2022 [6]	Spatiotemporal registry analysis	2009–2018	National (regional resolution)	Mortality, ASMR
Zhylkaidarova et al. 2021 [7]	Registry analysis	2004–2018	National	Stage distribution, prevalence, screening effect
Abdukhakimova et al. 2025 [8]	Retrospective cohort (ERCP)	2014–2023	National (n=37,871)	Survival, comorbidity gradients
Shamsutdinova et al. 2024 [9]	Program coverage analysis	2021–2023	National	Screening coverage, detection yield
Zholmurzayeva et al. 2023 [10]	Program evaluation, quasi-experimental	2021–2022	Almaty (n=5,370)	Modified vs standard screening response
Kassymbekova et al. 2024 [11]	City burden analysis	2017–2021	Almaty	DALYs, cancer burden composition
Ishkinin et al. 2025 [40]	Time-series analysis	2017–2022	National	COVID-era screening disruption
Dutta et al. 2023 [13]	Regional systematic review	≤2023	North & Central Asia	CRC situation and screening
Akanbi et al. 2023 [14]	Regional narrative review	≤2023	North & Central Asia	Community awareness, KABs
WHO / MoH KZ STEPS 2021 [34]	Population survey	2021	National	Modifiable risk factors
Ministry of Healthcare RK 2023 [15]	Program strategy	2023–2030	National	National Oncology Care Development Program

Incidence trajectory

The most comprehensive national analysis of Kazakhstan's CRC incidence covered the period 2009–2018 and identified 28,950 newly diagnosed cases over that interval [5]. Crude incidence rose from 14.79 per 100,000 in 2009 to 17.72 per 100,000 in 2018, and the overall age-standardized rate averaged 18.1 per 100,000. The sex gap in age-standardized rates favored men — 21.9 per 100,000 in males versus 15.9 per 100,000 in females — despite similar crude rates by sex [5]. Component analysis attributed the rise primarily to population growth, aging, and increased underlying risk of disease acquisition, rather than to a single dominant factor.

The 2014–2023 national retrospective cohort from the Electronic Registry of Oncological Patients extended the picture forward, identifying 37,871 CRC cases and confirming that crude incidence remained broadly stable through 2019, with a temporary dip in 2020–2021 during the pandemic period [8]. Prevalence has continued to increase over the observation window. GLOBOCAN 2022 estimates of 3,514 incident cases correspond to a crude rate of approximately 17.9 per 100,000 on the 2022 mid-year population, closely matching the terminal value of the 2018 national series and indicating that the incidence trajectory has effectively plateaued at the transitional level rather than continuing to accelerate in the near term [2,3,5]. Overall, Kazakhstan's incidence during the 2000s and 2010s fits the transition pattern of upward movement toward levels typical of upper-middle-income countries, consistent with broader Asian trends [5,8,18,20].

Mortality dynamics

Mortality data reinforce the interpretation that Kazakhstan is not yet in a mature post-screening equilibrium. The national spatiotemporal mortality analysis recorded 15,200 CRC deaths between 2009 and 2018 [6]. Although crude mortality declined from 11.2 to 7.7 per 100,000 over the period, the average annual age-standardized mortality rate remained

approximately 10.2 per 100,000 — high enough to keep CRC among the country's major fatal malignancies [6]. Regional variation in mortality was substantial, reflecting differences in access, awareness, and case mix across oblasts. GLOBOCAN 2022 estimates of 1,968 CRC deaths correspond to a crude mortality of approximately 10.0 per 100,000 on the 2022 population, materially higher than the 2018 crude value and consistent with a partial rebound during and after the pandemic period [2,3,6,40]. The 2014–2023 survival analysis further showed that all-cause mortality and prevalence exhibited overall increasing patterns across the full period, indicating that changes in underlying burden, case ascertainment, survivorship, and age structure are occurring simultaneously [8]. Crude mortality trends alone therefore risk understating the service burden of CRC on the Kazakhstani health system, and they should be interpreted alongside age-standardized rates and stage-adjusted survival estimates.

Stage migration and screening effects

The stage-distribution shift during the organized screening era is one of the strongest and most internally consistent findings in the Kazakhstan CRC literature (Figure 1). Between 2004 and 2018, the share of stage I–II diagnoses at first detection rose from 35.0% to 67.4% — approximately a twofold relative increase — while the share of stage III fell from 45.7% to 19.5% and the share of stage IV fell from 19.3% to 13.1% [7]. Organized CRC screening was introduced in Kazakhstan in 2011 and expanded in phased fashion over the following years. The stage migration is compatible with a population-level screening effect, though secular improvements in diagnostic access and clinical awareness likely also contributed [7,9,10].

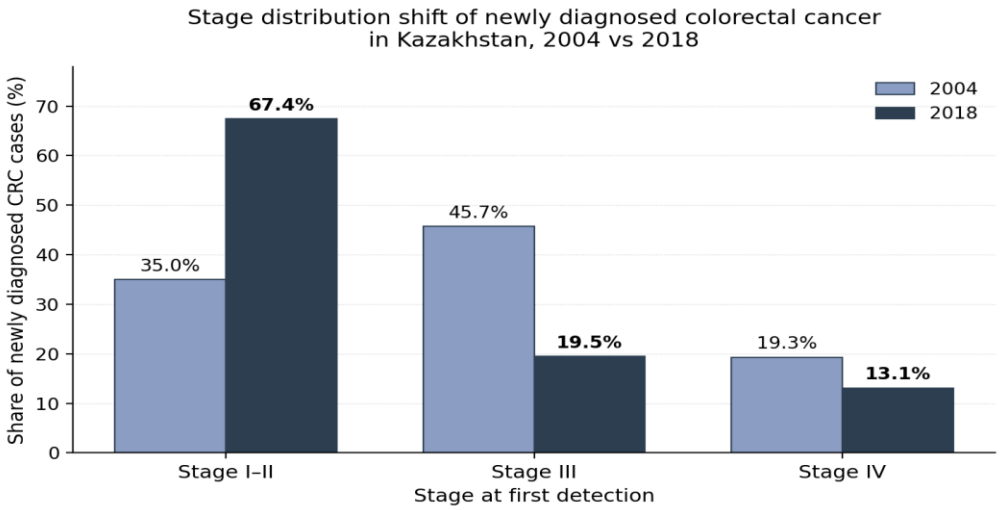

Figure 1 - Stage distribution shift of newly diagnosed colorectal cancer in Kazakhstan, 2004 vs 2018. Data from Zhylkaidarova et al. (2021) [7]

More recent nationwide screening data reveal both encouraging reach and troubling volatility. In the nationwide screening coverage analysis for 2021–2023, 2,548,068 people participated in CRC screening. Reported coverage was 95.9% in 2021, 96.6% in 2022, and 68.5% in 2023 among eligible populations [9]. Coverage values approaching 96% are not typical of mature organized programs internationally — where sustained target-population participation of 60–70% is considered strong performance [36,37] — and are more consistent with administrative denominators (registered eligible individuals reached by any component of the screening pathway) than with population-level true participation. Independent auditing of coverage definitions, denominator construction, and completion of the diagnostic cascade is therefore essential before the 96% figure can be interpreted as evidence of program success. Cancer cases detected through screening totaled 197 in 2021, 296 in 2022, and 259 in 2023, while the CRC detection rate declined from 4.23% in 2021 to 3.64% in 2022 and 3.28% in 2023 [9]. High administrative coverage did not, therefore, translate into stable screening yield.

The Almaty modified-screening evaluation of 5,370 adults aged 50–70 years demonstrated that program-level improvements are feasible: the modified pathway achieved a first-stage response rate of 82.6% versus 78.9% under standard practice (χ^2 = 12.12; P = 0.001) [10]. The absolute improvement was modest (approximately 4 percentage points) and confined to a single city, so the finding should be interpreted as proof-of-concept rather than as evidence of a nationally

scalable intervention. Nonetheless, it supports the interpretation that a nontrivial share of underperformance in the wider system is attributable to modifiable service design rather than to cultural factors alone.

Survival and prognostic heterogeneity

The 2014–2023 national survival cohort of 37,871 CRC cases from the Electronic Registry of Oncological Patients provides the strongest survival dataset yet available for Kazakhstan [8]. Stage II was the most commonly diagnosed stage in the cohort, and stage IV carried the worst mortality profile. Women showed slightly better overall survival than men. Substantially worse survival was documented among adults aged 75 years or older and among patients with a heavier Charlson comorbidity burden, emphasizing that future service planning must address not only incidence growth but also case complexity and geriatric oncology demand [8].

At city level, the 2017–2021 Almaty burden analysis found CRC to be among the leading cancer types in women and a material contributor to the local DALY burden [11]. Mortality accounted for the majority of cancer DALYs in Almaty, reinforcing the point that simple counts of detected cases understate the societal cost of late diagnosis and suboptimal outcomes.

Behavioral barriers and pandemic-era volatility

Behavioral barriers remain a central explanation for why observed screening effects in Kazakhstan are real but incomplete. A 2020–2021 multicity cross-sectional survey of 486 adults quantified these barriers: approximately half of respondents did not know that CRC can occur without symptoms; a majority did not know that CRC is a widespread disease; around 60% reported fear of developing CRC in the future; a similar share reported fear of unfavorable examination results; and around two-thirds identified low knowledge itself as a screening barrier [29,30]. Regional evidence for North and Central Asia is consistent with these findings, describing low community awareness, inadequate risk understanding, and persistent stigma or fear around diagnostic procedures [13,14]. Numerically expanding coverage will therefore not be sufficient unless invitation systems, counseling quality, and clinician endorsement improve in parallel.

The pandemic interrupted what would otherwise have been a more gradual trajectory. The Kazakhstan COVID-era oncology analysis for 2017–2022 concluded that cancer screening activity and case detection fell during the restriction period, with plausible downstream effects on stage at diagnosis and prognosis [40]. The 2023 drop in CRC screening coverage after two years of very high administrative coverage is consistent with unresolved post-pandemic disruption in program continuity [9,40]. The 2023 National Oncology Care Development Program explicitly identifies screening consolidation, digital registry integration, and downstream treatment capacity as priorities for the 2023–2030 horizon [15], providing a policy anchor against which post-pandemic recovery can be measured.

Comparative positioning of Kazakhstan within the global CRC landscape

The synthesized evidence positions Kazakhstan within the intermediate zone of the global CRC epidemiology map. Age-standardized incidence — approximately 18 per 100,000 during 2009–2018 — is well below the highest-burden European and Australasian settings but substantially above the lowest-burden regions of South Asia and sub-Saharan Africa [1,4,5,17]. Table 3 places Kazakhstan against representative benchmarks spanning the transition spectrum, using GLOBOCAN 2022 country estimates where available and rounded to the nearest whole unit; the intent is comparative orientation rather than precise ranking.

Table 3 - Comparative CRC burden and screening context: Kazakhstan against selected benchmarks (approximated to nearest whole unit; sources GLOBOCAN 2022 and national reports

Country	ASIR (both sexes, /100,000)	ASMR (both sexes, /100,000)	M:I ratio	Organized CRC screening (start)
Kazakhstan	~18	~10	~0.56	Yes (2011) [5,6,9]
Russian Federation	~30	~15	~0.50	Regional / opportunistic [2,3]
Uzbekistan	~8	~5	~0.63	No organized [2,3]
Turkey	~21	~10	~0.48	Yes (2013) [2,3]
China	~24	~11	~0.46	Opportunistic [2,3,20]
South Korea	~44	~10	~0.23	Yes (2004) [2,3,20,24]
Japan	~40	~13	~0.32	Yes (1992) [2,3,20,24]
World (average)	~19	~9	~0.47	Mixed [1,2,3,4]

Three features of the country's trajectory align closely with the international transition pattern. First, incidence is rising while age-standardized mortality is falling — the canonical decoupling seen when screening and treatment capacity partially outpace incidence growth [5,6,17]. Second, mortality gains are lagging relative to incidence gains, and Kazakhstan's mortality-to-incidence ratio (~0.56) is substantially worse than the M:I ratios of mature East Asian programs (0.23–0.32), consistent with a treatment-capacity gap rather than an incidence-detection artefact [8,20,24]. Third, the stage distribution has shifted favorably in the screening era, reproducing on a national scale the stage-migration effect documented earlier in higher-income adopters [7,18].

Two features distinguish Kazakhstan's trajectory. The first is the unusual magnitude of the administrative screening coverage reported for 2021–2022, followed by an abrupt decline in 2023 [9]. Coverage of 95–96% is inconsistent with international mature-program benchmarks and almost certainly reflects an administrative denominator rather than true target-population participation; the decline to 68.5% in 2023 is consistent with either denominator recalibration, pandemic after-effects, or genuine implementation fluctuation, and requires transparent auditing before it can be interpreted [9,36,37]. The second is the pronounced age and comorbidity gradient in survival documented in the 2014–2023 national cohort, which underscores the growing intersection of oncology and geriatric multimorbidity in a rapidly aging population [8].

By international standards, the strategic implications are relatively clear. Kazakhstan is at the stage of the CRC transition at which sustained investment in program stability, invitation quality, colonoscopy capacity, downstream treatment quality, and behavioral communication produces the largest marginal population-health returns [10,13,14,36]. Countries that have navigated this stage successfully — including several in East Asia — did so not by expanding the nominal scope of screening indefinitely, but by consolidating existing programs, improving service architecture, and reducing behavioral and geographic gaps in participation [18,20,24,36].

4. Discussion

The value of an integrated global-plus-Kazakhstan account is that it enables interpretive claims that neither perspective supports alone. This Discussion focuses on those interpretive claims rather than restating the descriptive findings in Sections 3 and 4.

The transition signature is genuine

The rise in Kazakhstan's CRC incidence between 2009 and 2018 is unlikely to be an artefact of improved case ascertainment alone. Three lines of evidence converge. First, the rise aligns with contemporaneous demographic aging, which independently increases expected incidence [5,8]. Second, it coincides with a well-documented rise in modifiable risk factor prevalence — overweight and obesity, dietary composition change, and sustained tobacco exposure — that has been shown internationally to shift population CRC risk on a decadal timescale [28,29,31,34]. Third, the pattern reproduces the sequence observed in other middle-income countries during the same phase of the epidemiological transition [18,20]. The transition signature is therefore genuine, and future incidence should be expected to remain at or above the current level in the near term unless modifiable risk exposure and organized screening capacity both improve in parallel.

The mortality-to-incidence gap points to treatment capacity, not detection

The most policy-relevant finding of the comparative section is Kazakhstan's mortality-to-incidence ratio of approximately 0.56, which is roughly twice the ratio seen in mature East Asian screening programs [1,2,3,20,24]. A gap of this magnitude cannot be explained by screening intensity alone; it points to downstream treatment capacity, referral speed, endoscopy quality, and adherence to guideline-concordant management. The 2014–2023 survival analysis reinforces this reading, since the strongest survival gradients are seen in older adults and multimorbid patients — precisely the groups for whom multidisciplinary care coordination, geriatric assessment, and treatment individualization are most consequential [8]. Improving stage at diagnosis is necessary but not sufficient; the marginal return on further screening investment will be limited unless matched by treatment-capacity investment.

The 96% coverage figure needs auditing, not celebration

The reported national screening coverage of 95.9%–96.6% in 2021–2022 [9] should be treated with epistemic caution. Sustained target-population participation at that level is not observed in any mature organized program internationally; even in high-performing settings, participation of 60–70% is considered strong [36,37]. The most parsimonious interpretation is that the reported coverage reflects an administrative denominator — for example, the share of registered eligible individuals reached by any component of the screening pathway — rather than the share of the biologically eligible population that

completed screening. The abrupt decline to 68.5% in 2023 is consistent with denominator recalibration, pandemic after-effects, real implementation fluctuation, or all three [9,40]. A public audit of coverage definitions, denominator construction, and diagnostic-cascade completion is a precondition for treating the coverage figure as either a success indicator or a failure indicator.

Behavioral barriers are quantified and modifiable

The KABs evidence base for Kazakhstan and for Central Asia is consistent in direction and magnitude: knowledge of CRC's asymptomatic phase is low, disease-familiarity is limited, and fear-based avoidance is prevalent [13,14]. These are not marginal moderators of program performance; they are the mechanism through which invitations translate — or fail to translate — into completed screening episodes. The Almaty modified-screening pilot [10] demonstrates that changes to invitation and navigation architecture can produce measurable response gains at the margin. Scaling that lesson requires investment in invitation quality, primary-care counseling, and locally tailored communication, all of which are within the remit of the 2023 National Oncology Care Development Program [15].

Kazakhstan as a case study for the transition zone

Read together, these interpretive claims cast Kazakhstan not as an exceptional case but as an informative one. The country combines features that are typical of the transition zone — rising incidence, favorable stage migration, moderate mortality reduction, high administrative coverage with uncertain population-level meaning — with the analytical asset of a large national registry that can be interrogated at the level of individual survival [8]. For other middle-income countries entering or in the middle of the same transition, Kazakhstan's decade offers a useful comparison. For Kazakhstan itself, the value of the comparative exercise is diagnostic: it identifies treatment capacity, denominator transparency, and behavioral communication as the leverage points on which the next decade's outcomes will most depend.

Policy and program priorities

The review supports four practical priorities. First, preserve and stabilize screening delivery after the pandemic, including transparent, auditable denominators and continuous participation monitoring; the 2023 volatility in coverage [9] should be treated as a signal to strengthen measurement rather than to defend a headline number. Second, strengthen invitation, counseling, and navigation to reduce fear-driven non-participation, building on the Almaty pilot [10] and on the KABs (Knowledge, Attitudes, and Behaviors) evidence base [13,14]. Third, invest in colonoscopy capacity, endoscopist quality, and downstream treatment quality so that earlier diagnosis translates into survival gains proportionate to those achieved in mature Asian programs [8,20,24]. Fourth, improve national data publication practices — including consistent age-standardized reporting and public release of annual incidence and mortality series after 2018 — so that future analyses can be performed on complete, verifiable data.

Strengths and limitations

The main strength of this review is integration. It combines international burden estimates with Kazakhstan-specific incidence, mortality, stage, survival, screening, and behavioral evidence into a single interpretive account, and it explicitly positions Kazakhstan within the global CRC landscape using a comparative benchmark table. The evidence base is drawn from the most recent authoritative sources available at the time of writing, including the 2014–2023 national survival cohort [8] and the 2021–2023 national screening coverage analysis [9].

The limitations are equally important. The review is narrative with systematic elements rather than a formal meta-analysis, because outcome definitions and study designs are heterogeneous. Some of the most policy-salient Kazakhstan datasets are recent and have not yet accumulated large independent replication literatures. Annual national incidence and mortality series have not been fully published for the period after 2018, which constrains any independent trend analysis. Comparative benchmarks in Table 3 are approximated to the nearest whole unit and should be confirmed against the most recent GLOBOCAN country factsheets at the time of use. Finally, literature indexed in local languages may remain underrepresented despite explicit efforts to include regional evidence.

5. Conclusions

The balance of evidence indicates that Kazakhstan is transitioning toward a higher-incidence CRC profile with incomplete mortality gains. Organized screening has produced a real and measurable stage-migration effect, but its downstream translation into survival is limited by treatment-capacity constraints, coverage-denominator opacity, behavioral barriers, and post-pandemic disruption. Positioned within the intermediate zone of the global CRC landscape — with a mortality-to-incidence ratio substantially worse than that of mature East Asian programs — Kazakhstan's next decade of CRC control should be approached as a window for consolidation rather than complacency. Better participation quality, better follow-up, better downstream treatment quality, and better public reporting are all required if earlier detection is to translate into durable population survival benefit.

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Колоректалды қатерлі ісіктің эпидемиологиялық профилі: Жаһандық перспективаларсы және Қазақстандағы заманауи динамикасы

Оразбекова Ж.О.

PhD докторант, Эпидемиология және биостатистика кафедрасы, Астана медицина университеті, Астана, Қазақстан.
E-mail: zhorazbekova8@gmail.com

Түйіндеме

Колоректалды қатерлі ісік (КРҚІ) әлемде ең жиі диагноз қойылатын қатерлі ісіктер қатарында үшінші, онкологиялық өлім себептері арасында екінші орында тұр. Оның ауыртпалығы эпидемиологиялық өтпелі кезеңдегі орта табысты елдерде барған сайын шоғырлануда. Қазақстан осы трансформацияның қатерлі ісіктер арасында КРҚІ жетекші орындардың біріне шыққан кезеңіне енді, дегенмен елдің КРҚІ жаһандық ауыртпалық ландшафтындағы орнын біріктірілген түрде сипаттайтын шолу әлі жасалған жоқ.

Шолудың мақсаты: колоректалды қатерлі ісіктің жаһандық эпидемиологиялық профилін жан-жақты талдау және Қазақстан Республикасындағы оның қазіргі динамикасын, аурушаңдық пен өлім-жітім көрсеткіштерін сын тұрғысынан бағалау.

Әдістері. IARC/GLOBOCAN 2020 және 2022, Global Burden of Disease 2019 және 2021 деректерін, жетекші халықаралық шолуларды 2001–2025 жылдардағы Қазақстанның ұлттық тіркелімі, скрининг бағдарламалары, өмір сүру көрсеткіштері және мінез-құлықтық зерттеулерінің деректерімен біріктіретін нарративтік шолу жүргізілді. PubMed/PMC, IARC Cancer Today, Дүниежүзілік денсаулық сақтау ұйымы жұқпалы емес аурулар бойынша ел профильдері және Қазақстан Республикасы Денсаулық сақтау министрлігінің онкологиялық есептері 2024 жылғы наурыздан 2026 жылғы ақпанға дейін зерделді. Дереккөздер сипаттамалы эпидемиологияға сәйкестігі, ұлттық ауқымы және әдіснамалық ашықтығы бойынша сұрыпталды.

Нәтижелері. 2020 жылғы бағалау бойынша, әлемде шамамен 1,93 миллион жаңа КРҚІ жағдайы және 935 000 өлім тіркелген; жалпы ауыртпалық халықтың қартаюы есебінен өсуде, ал стандартталған көрсеткіштер негізінен жоғары табысты елдерде төмендеуде. Қазақстанда КРҚІ бойынша жалпы аурушаңдық 2009 жылы 100 000 халыққа шаққанда 14,79-дан 2018 жылы 17,72-ге дейін өсті (орташа стандартталған көрсеткіш — 18,1), ал жалпы өлім-жітім 11,2-ден 7,7-ге дейін төмендеді. 2011 жылы ұйымдастырылған скрининг енгізілгеннен кейін кезеңдер бойынша үлестіру ерте анықтауға қарай ауысты: I–II кезеңдер үлесі 35,0%-дан 67,4%-ға дейін өсті, III кезең — 45,7%-дан 19,5%-ға, IV кезең — 19,3%-дан 13,1%-ға дейін азайды. 2014–2023 жылдардағы ұлттық когорттық талдау (37 871 жағдай) 75 жастан асқан науқастарда және коморбидтілігі жоғары адамдарда өмір сүру көрсеткіштерінің нашар екенін көрсетті.

Қорытынды. Қазақстандағы КРҚІ траекториясы эпидемиологиялық өтпелі елге тән классикалық профильді көрсетеді: аурушаңдық өсіп жатыр, ал өлім-жітім төмендеуі одан кейінгі жүреді. Ел жаһандық КРҚІ ауыртпалық ландшафтының орта аймағында орналасқан.

Түйінді сөздер: колоректалды қатерлі ісік, эпидемиологиялық динамика, аурушаңдық, өлім-жітім

Эпидемиологический профиль колоректального рака: Мировые перспективы и текущая динамика в Казахстане

Оразбекова Ж.О.

PhD докторант, кафедра эпидемиологии и биостатистики, Медицинский университет Астана, Астана, Казахстан.
E-mail: zhorazbekova8@gmail.com

Резюме

Колоректальный рак (КРР) занимает третье место среди наиболее часто диагностируемых злокачественных новообразований и второе место среди причин онкологической смертности в мире. Его бремя все более концентрируется в странах со средним уровнем дохода, находящихся в фазе эпидемиологического перехода. Казахстан вошел в тот этап трансформации, на котором КРР входит в число ведущих онкологических заболеваний страны, однако интегрированной картины положения Казахстана в глобальном ландшафте бремени КРР до настоящего времени не сформировано.

Настоящий обзор направлен на комплексный анализ глобального эпидемиологического профиля колоректального рака и критическую оценку его текущей динамики, показателей заболеваемости и смертности в Республике Казахстан.

Методы. Проведен нарративный обзор с элементами систематического подхода, объединяющий международные оценки бремени болезни (IARC/GLOBOCAN 2020 и 2022, Global Burden of Disease 2019 и 2021, ведущие международные аналитические обзоры) с казахстанскими данными национальных регистров, программ скрининга, показателей выживаемости и поведенческих исследований за период 2001–2025 гг. Поиск в PubMed/PMC, IARC Cancer Today, в профилях стран по неинфекционным заболеваниям Всемирной организации здравоохранения и в отчетах Министерства здравоохранения Республики Казахстан проводился с марта 2024 г. по февраль 2026 г. Источники ранжированы по релевантности к описательной эпидемиологии, масштабу национального охвата и методологической прозрачности.

Результаты. По оценкам за 2020 год, в мире зарегистрировано около 1,93 млн новых случаев КРР и 935 000 смертей; при этом абсолютное бремя растет за счет демографического старения, а стандартизованные показатели снижаются преимущественно в странах с высоким уровнем дохода. В Казахстане грубый показатель заболеваемости КРР вырос с 14,79 на 100 000 населения в 2009 г. до 17,72 на 100 000 в 2018 г. (средний стандартизованный показатель — 18,1 на 100 000), тогда как грубый показатель смертности снизился с 11,2 до 7,7 на 100 000. После внедрения организованного скрининга (2011 г.) распределение стадий сместилось в сторону раннего выявления: доля стадий I–II возросла с 35,0 % до 67,4 %, доля стадии III снизилась с 45,7 % до 19,5 %, доля стадии IV — с 19,3 % до 13,1 %. Национальный когортный анализ выживаемости (2014–2023 гг., 37 871 случай) выявил худшие исходы у пациентов старше 75 лет и лиц с высоким индексом коморбидности.

Выводы. Траектория КРР в Казахстане отражает классический профиль страны эпидемиологического перехода: рост заболеваемости при отстающем снижении смертности. Страна находится в средней зоне глобального ландшафта бремени КРР.

Ключевые слова: колоректальный рак, динамика эпидемиологии, заболеваемость, смертность.