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Patterns of mortality causes, concerning gender characteristics of the working-age population of the Republic of Tatarstan

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ABSTRACT. ***Background.*** Significant interregional differences in mortality rates among gender groups of the population from the main classes of causes of death determine the importance of research in the constituent entities of the Russian Federation for establishing priority areas for its reduction and the development of socio-demographic policy measures. ***Aim.*** To study mortality patterns, taking into account gender characteristics, among the urban and rural populations of the Republic of Tatarstan. ***Materials and methods.*** A comparative analysis of mortality rates for the rural and urban populations of the Republic of Tatarstan was conducted using statistical reporting data from the Republican Medical Information and Analytical Center of the Territorial Office of the Federal State Statistics Service for the Republic of Tatarstan for 2014–2023. The dynamics of these phenomena were assessed using the coefficient of determination (R^2). Data processing and analysis were performed using Microsoft Office application packages and the specialized statistical program SPSS STATISTICA 17.0. ***Results.*** An analysis of indicators for the study period in the Republic of Tatarstan shows that mortality rates among the working-age population in both gender groups are higher in rural areas than in urban areas, with higher rates for men than for women. In the structure of mortality from all causes, diseases of the circulatory system, neoplasms, and endocrine diseases occupy the top ranks. An analysis of mortality among men and women revealed that the average long-term rate for working-age women is significantly higher than for men. Over the specified period, mortality among women increased by 17.5% in urban areas and by 12% in rural areas. ***Conclusions.*** The study results demonstrate the need for more effective measures aimed at reducing mortality among the working-age population at the regional level, as well as for assessing their effectiveness and systematically monitoring them. Improving the accessibility of healthcare facilities and regional medical care for the rural population is an important area for determining healthcare system priorities for increasing life expectancy, taking into account the composition of gender groups.

KEYWORDS: causes of mortality, gender differences, working-age population, urban population, rural population, men, women

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Оригинальная статья

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Закономерности формирования смертности трудоспособного населения Республики Татарстан с учетом гендерных особенностей

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РЕЗЮМЕ. ***Введение.*** Существенные межрегиональные различия показателей смертности гендерных групп населения от основных классов причин смерти определяют значимость исследований в субъектах Российской Федерации для установления приоритетных направлений по ее снижению и развитию мер социально-демографической политики. ***Цель*** — исследование закономерностей смертности с учетом гендерных особенностей городского и сельского населения Республики Татарстан (РТ). ***Материалы и методы.*** Сравнительный анализ показателей смертности сельского и городского населения РТ проводили по данным статистических отчетных форм Республиканского медицинского информационно-аналитического центра территориального органа Федеральной службы государственной статистики по РТ за 2014–2023 гг. Динамику явлений оценивали по величине коэффициента детерминации (R^2). Обработку и анализ данных проводили с использованием программ Microsoft Office и статистической программы SPSS STATISTICA 17.0. ***Результаты.*** Анализ показателей за период исследования на территории РТ свидетельствует, что смертность трудоспособного населения в обеих гендерных группах в сельской местности выше аналогичного показателя для городского населения, при этом у мужчин выше, чем у женщин. В структуре смертности от всех причин первые ранговые места занимают болезни системы кровообращения, новообразования и болезни эндокринной системы. По результатам анализа смертности среди мужчин и женщин выявлено, что среднемноголетний показатель у женщин трудоспособного возраста существенно выше, чем у мужчин. За указанный период смертность у женщин выросла в городской местности на 17,5%, в сельской — на 12%. ***Выводы.*** Необходимо внедрять более эффективные мероприятия, направленные на снижение смертности населения трудоспособного возраста на региональном уровне, оценку их эффективности и проводить систематический мониторинг. Повышение доступности учреждений здравоохранения и территориальной медицинской помощи для сельского населения — одно из важных направлений определения приоритетов системы здравоохранения по увеличению ожидаемой продолжительности жизни с учетом состава гендерных групп населения.

КЛЮЧЕВЫЕ СЛОВА: причины смертности, гендерные различия, трудоспособное население, городское население, сельское население, мужчины, женщины

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INTRODUCTION

The mortality rate is the most important indicator of the population's medical, social, demographic, and economic well-being [1].

The Concept of Demographic Policy of the Russian Federation (RF) defines the main objectives of stabilizing the population size, creating conditions for its growth, improving public health, reducing mortality rates, as well as improving quality of life and increasing life expectancy[1] [2]. The national projects "Health" and "Healthcare," aimed at modernizing the healthcare system, improving people's health and quality of life, and enhancing the social well-being of society, have significantly contributed to the achievement of the RF's demographic policy goals.

Despite positive trends toward a decline in mortality among the working-age population in the period prior to the COVID-19 pandemic (2018 and 2019) [3], an analysis of current mortality data for men and women in the age group under study "indicates that negative trends persist and that Russia lags behind a number of countries"[2, 3] [3]. According to the World Health Organization (WHO), primary efforts should be directed toward reducing the burden of morbidity, mortality, and disability caused by preventable and avoidable noncommunicable diseases (NCD). At the same time, the set of actions and measures must be adapted at the regional and national levels, taking into account regional specifics and in accordance with legislation and priorities[4].

In the Russian Federation, life expectancy (LE) is low compared to developed countries, "due to high mortality from external causes and from diseases of the circulatory system (DCS)"[5] [4, 5]. Currently, the Russian Federation ranks 32nd in Europe in terms of mortality rates, while the Republic of Tatarstan (RT) ranks 18th among the regions of the Russian Federation [4, 5].

At the final meeting of the RT Ministry of Health on "The Results of the Republic of Tatarstan's Healthcare System in 2024," it was announced that RT ranks first in the Volga Federal District (VFD) in terms of low rates of overall mortality and natural decrease per 1,000 population, at 11. 27 and –2.5, respectively, and ranks 22nd among the constituent entities of the Russian Federation in terms of mortality and 20th in terms of natural decrease. Despite the rise in mortality in the Republic of Tatarstan, the life expectancy of the republic's population increased to 74.59 years, allowing it to maintain its leading position in the Volga Federal District and 15th place in the Russian Federation (life expectancy in the Volga Federal District is 72.02 years; in the Russian Federation, 73.11 years). In the structure of overall mortality, cardiovascular diseases (CVD) rank first at 39.8% (450.6 per 100,000 population), followed by mortality from neoplasms (16.5%), and mortality from external causes(8%)[6].

The National Project "Healthcare" (2019) focused on modifiable risk factors for NCD, such as smoking, alcoholism, and poor diet[7]. The latter, according to foreign and domestic authors, directly influences the development of NCD [6, 7], including cardiovascular diseases [8], which remain the leading cause of death in the Russian Federation and the Republic of Tatarstan[8] [9, 10].

AIM

The aim is to conduct a study of mortality trends among the working-age urban and rural populations of the Republic of Tatarstan, taking gender differences into account, from 2014 to 2023.

MATERIALS AND METHODS

An assessment and analysis of mortality rates among the working-age rural and urban

[1] Ministry of Health of the Russian Federation. National Project "Healthcare". Available at: https://minzdrav.gov.ru (accessed: September 10, 2025)..

[2] Federal State Statistics Service. Demographic Indicators of the Russian Federation. Available at: https://rosstat.gov.ru (accessed: September 10, 2025).

[3] World Health Organization. Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020. Available at: https://apps.who.int/iris/handle/10665/94384 (accessed: September 10, 2025).

[4] Ibid.

[5] Federal State Statistics Service. Demographic Indicators of the Russian Federation. Available at: https://rosstat.gov.ru (accessed on 10.09.2025).

[6] Ministry of Health of the Republic of Tatarstan. Report on the results of the healthcare system of the Republic of Tatarstan in 2024. Kazan. Available at: https://minzdrav.tatarstan.ru (accessed: 10.09.2025).

[7] Ministry of Health of the Russian Federation. National Health Project. Available at: https://minzdrav.gov.ru (accessed: 10.09.2025).

[8] Ministry of Health of the Republic of Tatarstan. Report on the results of the healthcare system of the Republic of Tatarstan in 2024. Kazan. Available at: https://minzdrav.tatarstan.ru (accessed: 10.09.2025).

populations of the Republic of Tatarstan was conducted based on data from the Federal State Statistics Service of the Russian Federation and the Ministry of Health of the Republic of Tatarstan regarding the number of medical death certificates issued during the period 2014–2023, in accordance with the regulatory documents in effect during the respective periods: until 2021 — Forms No. 106/u-08 and No. 106-2/u-08, approved by Order No. 782n of the Ministry of Health and Social Development of the Russian Federation dated December 26, 2008; from 2021 — Forms No. 106/u and No. 106-2/u, approved by Order of the Ministry of Health of the Russian Federation No. 352n dated April 15, 2021.

Data processing and analysis were performed using Microsoft Office software packages and the specialized statistical software SPSS STATISTICA 17.0.

RESULTS

An analysis of long-term trends in mortality rates among the working-age population of the Republic of Tatarstan indicates an upward

Fig. 1. General dynamics of mortality among men and women in urban areas of the Republic of Tatarstan from 2014 to 2023 per 100,000 population (the figure is prepared by the authors based on data from their own research)

Рис. 1. Общая динамика смертности среди мужчин и женщин в городской местности Республики Татарстан с 2014 по 2023 гг. на 100 тыс. населения (рисунок подготовлен авторами по результатам собственного исследования)

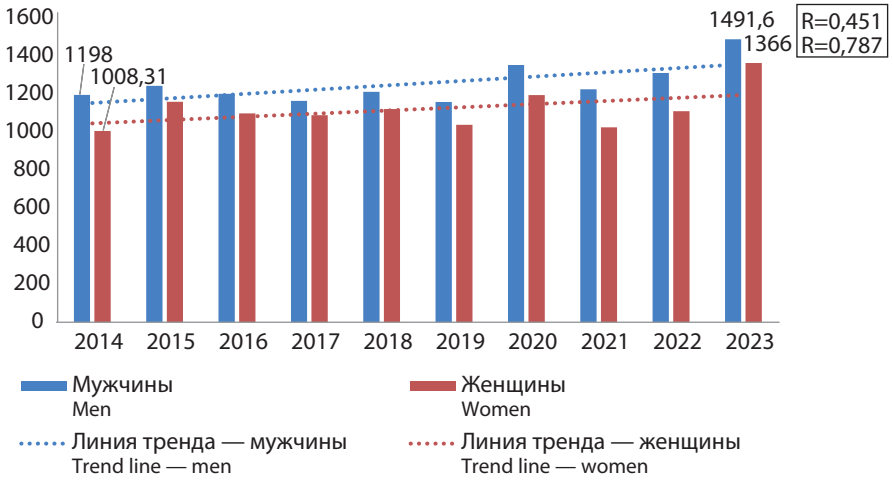
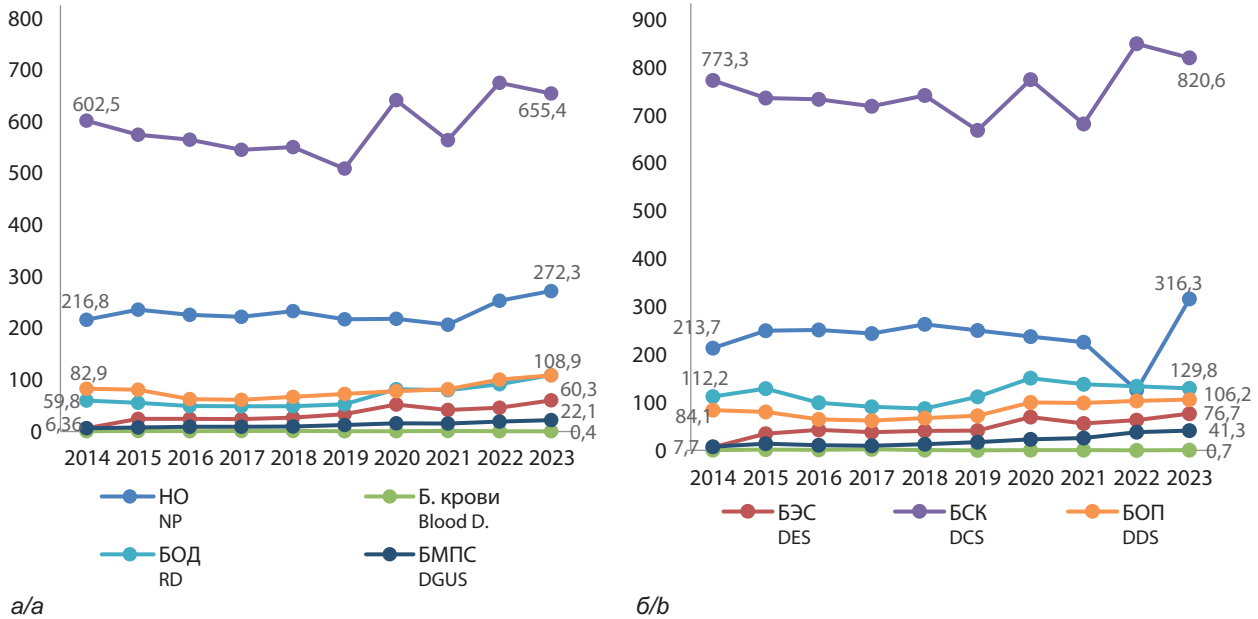


Fig. 2. General dynamics of mortality among men and women in rural areas of the Republic of Tatarstan from 2014 to 2023 per 100,000 population (the figure is prepared by the authors based on data from their own research)

Рис. 2. Общая динамика смертности среди мужчин и женщин в сельской местности Республики Татарстан с 2014 по 2023 гг. на 100 тыс. населения (рисунок подготовлен авторами по результатам собственного исследования)

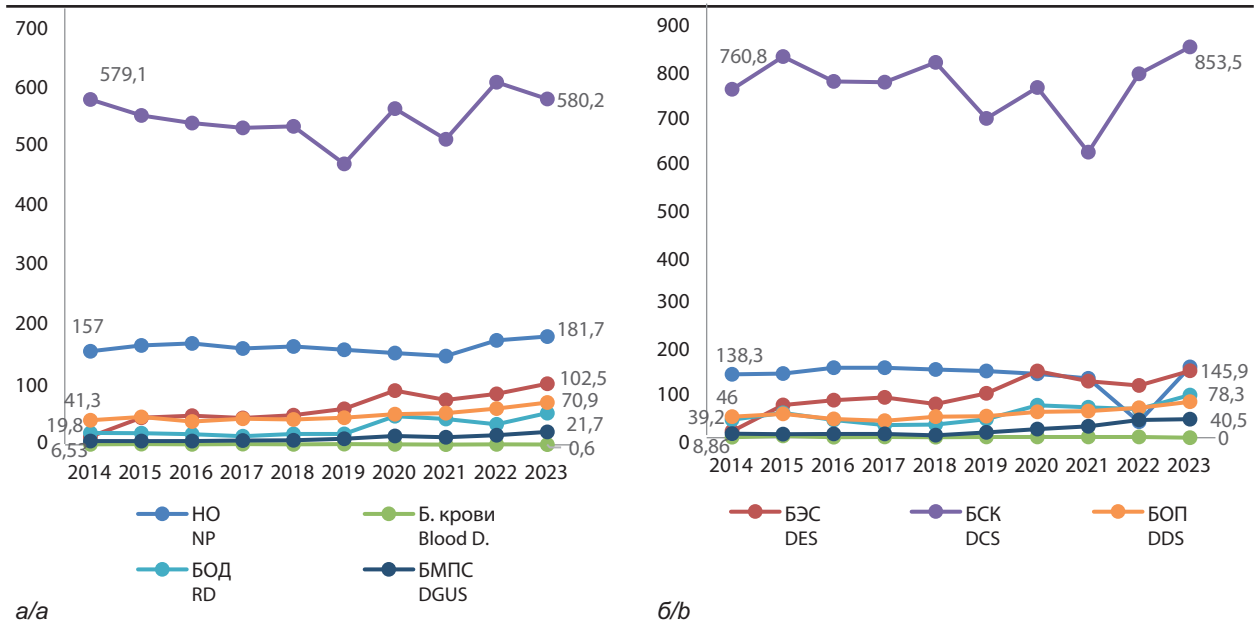
trend in this indicator in both rural and urban areas, with a high degree of statistical significance among women (R^2=0.78 and R^2=0.98, respectively) and a decline in the forecast level among men (R^2=0.45 and R^2=0.5, respectively). At the same time, the mortality rate of the population of the Republic of Tatarstan showed an upward trend among both rural men and women, exceeding that of the urban population by 21.4–22.8% and 23.2–35%, respective-



а/a *б/b*

Fig. 3. Long-term dynamics of mortality among men in urban (*a*) and rural (*b*) areas of the Republic of Tatarstan for 2014–2023: DGUS — diseases of the genitourinary system; RD — respiratory diseases; DDS — diseases of the digestive system; DCS — diseases of the circulatory system; DES — diseases of the endocrine system; blood D. — blood diseases; NP — neoplasms (here and further in the pictures) (the figure is prepared by the authors based on data from their own research)

Рис. 3. Многолетняя динамика смертности среди мужчин в городской (*а*) и сельской (*б*) местности Республики Татарстан за 2014–2023 гг.: БМПС — болезни мочеполовой системы; БОД — болезни органов дыхания; БОП — болезни органов пищеварения; БСК — болезни системы кровообращения; БЭС — болезни эндокринной системы; Б. крови — болезни крови; НО — новообразования (здесь и далее на рисунках) (рисунок подготовлен авторами по результатам собственного исследования)



а/a *б/b*

Fig. 4. Long-term dynamics of mortality among women in urban (*a*) and rural (*b*) areas of the Republic of Tatarstan for 2014–2023 (the figure is prepared by the authors based on data from their own research)

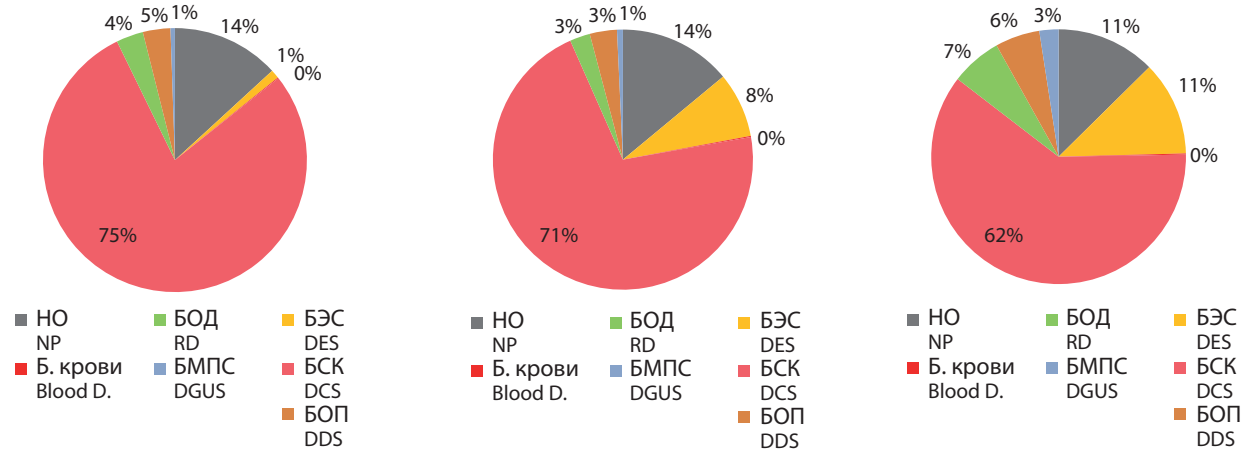
Рис. 4. Многолетняя динамика смертности женщин в городской (*а*) и сельской (*б*) местности Республики Татарстан за 2014–2023 гг. (рисунок подготовлен авторами по результатам собственного исследования)

ly, with higher rates among men than among women during the study period by 9.2–21.5% (Figs. 1, 2).

The long-term trend in mortality among men in urban areas of the Republic of Tatarstan during the study period is characterized by a significant increase across categories of causes of death: diseases of the genitourinary system (GSD), trend line approximation R^2=0.94; respiratory diseases (RD) R^2=0.67; and endocrine system diseases (ESD) R^2=0.86; and among men in rural areas of the Republic of Tatarstan by category: GSD (R^2=0.84), diseases of the digestive system (DDS) (R^2=0.5), and ESD (R^2=0.81) (Fig. 3).

At the same time, among women living in urban areas of the Republic of Tatarstan, there is an upward trend by cause of death category: ESD (R^2=0.87) and GSD (R^2=0.84), DDS (R^2=0.73), RD (R^2=0.63), while in rural areas of the Republic of Tatarstan, the trend is observed across the following categories: ESD (R^2=0.77), GSD (R^2=0.75), DDS (R^2=0.62), and RD (R^2=0.52) (Fig. 4).

The steady downward trend in mortality rates up to 2019, against the backdrop of the spread of COVID-19, has been replaced by a significant increase in mortality rates; the growth rate increased 21.4% among men and 28.0% among women [3].



а/a *б/b* *в/c*

Fig. 5. Mortality structure among women of the rural population of the Republic of Tatarstan for 2014 (*a*), 2017 (*b*), 2023 (*c*) (the figure is prepared by the authors based on data from their own research)

Рис. 5. Структура смертности среди женщин сельского населения Республики Татарстан за 2014 (*а*), 2017 (*б*), 2023 гг. (*в*) (рисунок подготовлен авторами по результатам собственного исследования)

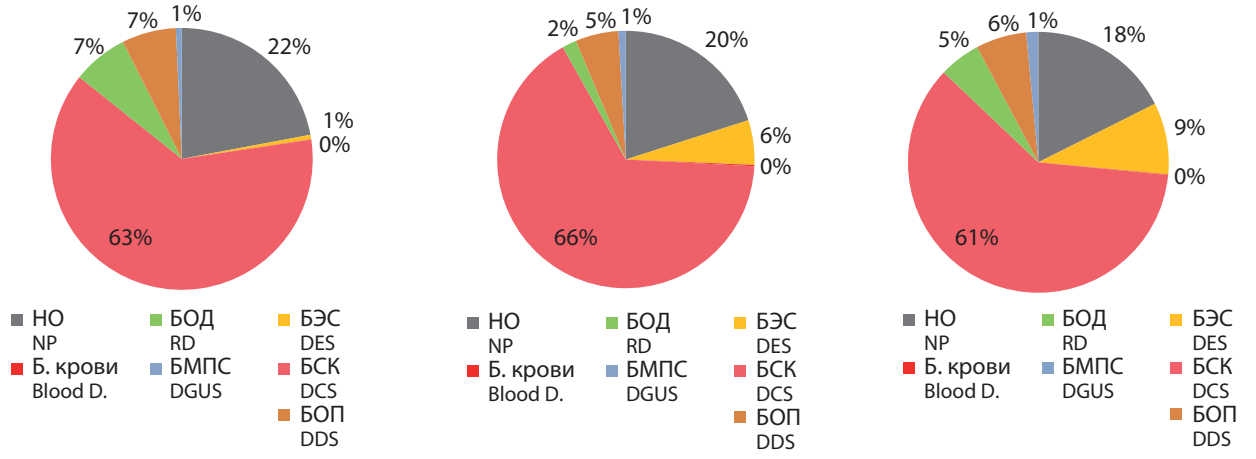


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Fig. 6. Mortality structure among women of the urban population of the Republic of Tatarstan for 2014 (*a*), 2017 (*b*), 2023 (*c*) (the figure is prepared by the authors based on data from their own research)

Рис. 6. Структура смертности среди женщин городского населения РТ за 2014 (*а*), 2017 (*б*), 2023 гг. (*в*) (рисунок подготовлен авторами по результатам собственного исследования)

Thus, an analysis of the mortality structure among women of working age in rural areas in 2014, 2017, and 2023 showed that CVD ranked first — 75, 71, and 62%, respectively — while NCD ranked second at 11–14%. In 2014, DDS ranked third at 5%, whereas since 2017, the share of ESD has increased from 8 to 11% in 2023 (Fig. 5).

During this period, mortality among women in the urban population of the Republic of Tatarstan is characterized by a different distribution: CVD ranks first — 63, 66, and 61%, respectively. The share of deaths from NO decreases to 18% by 2023 and ranks second; in 2014, the third place is shared by mortality from DDS and RD — 7% each; starting in 2017, this position is occupied by the share of ESD, mortality from which increased from 6% in 2017 to 9% in 2023 (Fig. 6).

In the structure of male mortality in rural areas in 2014, 2017, and 2023, CVD ranked first, accounting for 65, 62, and 55%, respectively; second place was held by NO at 18–21%; third place by RD at 8–9%; and fourth place by DDS at 5–7% (Fig. 7).

The mortality structure among urban men in 2014, 2017, and 2023 showed that the leading cause of death was cardiovascular disease — 62,

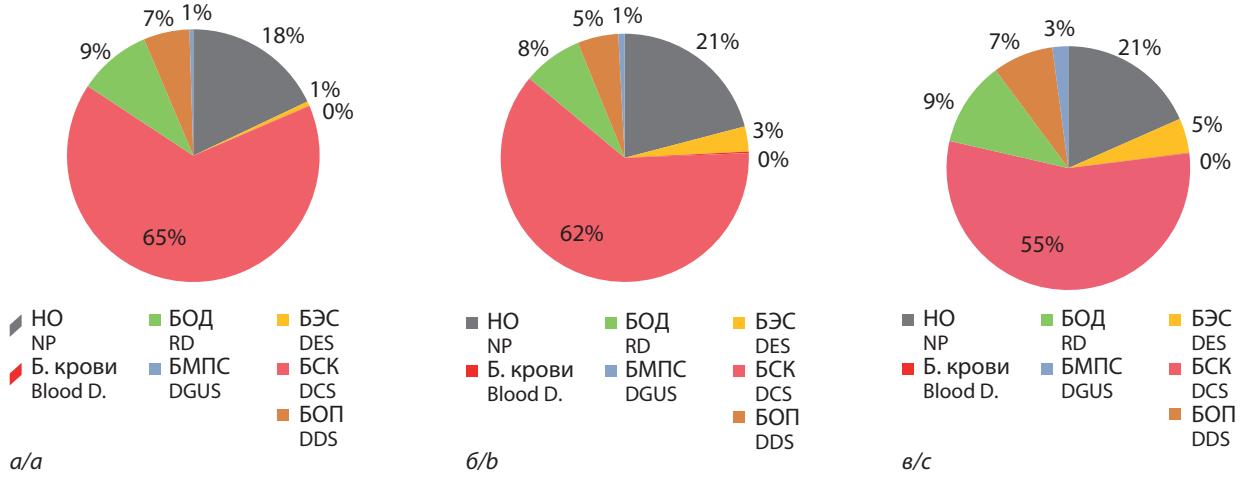

Fig. 7. Mortality structure among men of the rural population of the Republic of Tatarstan for 2014 (*a*), 2017 (*b*), 2023 (*c*) (the figure is prepared by the authors based on data from their own research)

Рис. 7. Структура смертности среди мужчин сельского населения Республики Татарстан за 2014 (*а*), 2017 (*б*), 2023 гг. (*в*) (рисунок подготовлен авторами по результатам собственного исследования)

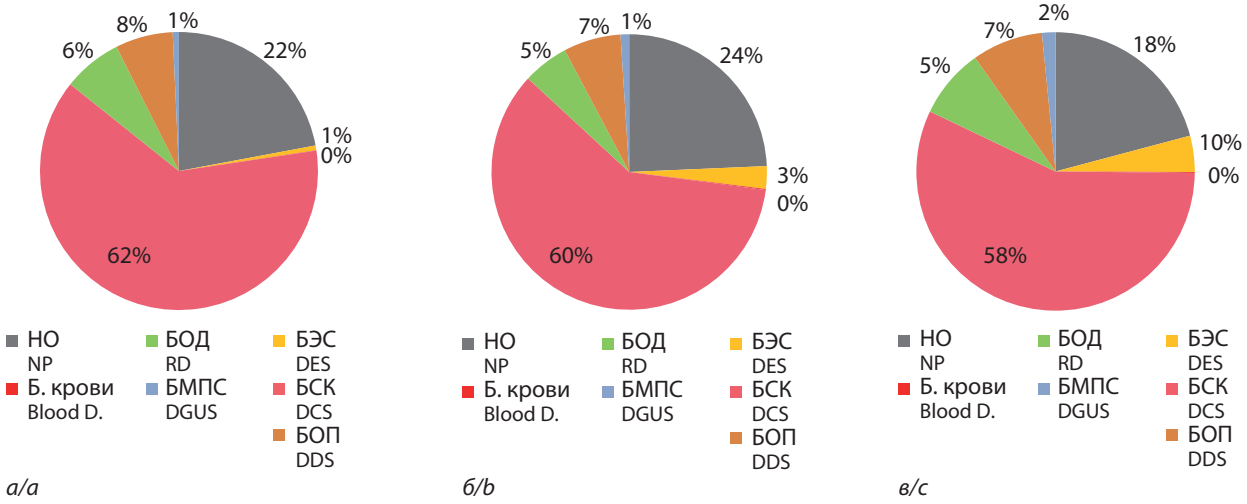

Fig. 8. Mortality structure among men of the urban population of the Republic of Tatarstan for 2014 (*a*), 2017 (*b*), 2023 (*c*) (the figure is prepared by the authors based on data from their own research)

Рис. 8. Структура смертности среди мужчин городского населения Республики Татарстан за 2014 (*а*), 2017 (*б*), 2023 гг. (*в*) (рисунок подготовлен авторами по результатам собственного исследования)

Table 1

Mortality rates of the efficient population of the Republic of Tatarstan in rural areas by classes of causes of death for the period 2014–2023 per 100,000 population

Таблица 1

Показатели смертности трудоспособного населения Республики Татарстан в сельской местности по классам причин смертности за период 2014–2023 гг. на 100 тыс. населения

Классы Classes	2014		2017		2023		Прирост/убыль Gain/decrease, %	
	мужчины men	женщины women	мужчины men	женщины women	мужчины men	женщины women	мужчины men	женщины women
Новообразования Neoplasms	213,7	138,3	244,1	152,6	316,3	154,6	48	11,8
Болезни эндокринной системы Diseases of the endocrine system	6,33	14,1	38,1	88,2	76,7	145,9	1117	934
Болезни крови Blood disorders	0,68	1,05	2,27	1,5	0,7	0	2,9	–100
Болезни системы кровообращения Diseases of the circulatory system	773,3	760,8	719	776,3	820,6	853,5	6,1	12,2
Болезни органов дыхания Respiratory diseases	112,2	39,2	90,8	27,5	129,8	93,2	15,7	137,7
Болезни органов пищеварения Diseases of the digestive system	84,1	46	62,2	36,9	106,2	78,3	26,3	70,2
Болезни мочеполовой системы Diseases of the genitourinary system	7,69	8,86	9,76	7,94	41,3	40,5	436,4	360,2
Всего Total	1198	1008,31	1166,23	1090,94	1491,6	1366	24,5	35,5

Таблица составлена по данным собственного исследования авторов / The table is based on data from the authors' own research

Table 2

Mortality rates of the efficient population of the Republic of Tatarstan in urban areas by classes of causes of death for the period 2014–2023 per 100,000 population

Таблица 2

Показатели смертности трудоспособного населения Республики Татарстан городской местности по классам причин смертности за период 2014–2023 гг. на 100 тыс. населения

Классы Classes	2014		2017		2023		Прирост/убыль / Gain/decrease, %	
	мужчины men	женщины women	мужчины men	женщины women	мужчины men	женщины women	мужчины men	женщины women
Новообразования Neoplasms	216,8	157	222,1	161,6	272,3	181,7	25,6	15,7
Болезни эндокринной системы Diseases of the endocrine system	6,28	13,7	24,3	45,2	60,3	102,5	857	648
Болезни крови Blood disorders	0,82	0,94	1,03	1,29	0,4	0,6	-50	–33,3
Болезни системы кровообращения Diseases of the circulatory system	602,5	579,1	546	531,7	655,4	580,2	8,8	0,2
Болезни органов дыхания Respiratory diseases	59,8	19,8	49,2	14,5	109,5	53,3	83,1	169,2
Болезни органов пищеварения Diseases of the digestive system	82,9	41,3	61,5	43,7	108,9	70,9	31,4	71,7
Болезни мочеполовой системы Diseases of the genitourinary system	6,36	6,53	9,26	7,4	22,1	21,7	247,5	232,3
Всего Total	975,46	818,37	913,39	805,39	1228,9	1010,9	25,9	23,5

Таблица составлена по данным собственного исследования авторов / The table is based on data from the authors' own research

60, and 58%, respectively; 2nd place — from NCD, with a decrease in the share from 22% in 2014 to 18% in 2023, 3rd place — from DDS 7–8% (Fig. 8).

Among the rural population, the highest growth rate in 2023 compared to 2014 was observed among working-age men due to deaths from NCD, ESD, and GSD, and among women — from ESD, RD, DDS, and GSD (Table 1).

An analysis of mortality among the working-age urban population shows a higher growth rate for 2014–2023 among men in the ESD, RD, and GSD categories, and among women in the ESD, RD, DDS, and GSD categories (Table 2).

The study results indicate significant changes in the structural and quantitative characteristics of mortality among men and women in both urban and rural populations.

CONCLUSION

Significant interregional differences in mortality rates among the working-age population underscore the importance of studies conducted in the constituent entities of the Russian Federation for identifying priority areas for reducing mortality. In the Republic of Tatarstan, mortality rates among the working-age population have increased over the study period, while the overall mortality rate for the entire population remains at an average level[1] [4, 5].

A comparative analysis of indicators within the Republic of Tatarstan shows that mortality rates among the working-age population in both gender groups are higher in rural areas than in urban areas. It has been established that this indicator is higher among men than among women. In the structure of all-cause mortality, diseases of the circulatory system, neoplasms, and diseases of the endocrine system occupy the top ranks. Analysis of mortality among men and women revealed that the average annual rate for women of working age is higher than that for men: by 17.5% in urban areas and by 12% in rural areas.

An examination of the structure of causes of death showed that the proportion of deaths due to leading disease categories (circulatory system diseases, endocrine system diseases) is, on average, higher among women, while the proportion due to neoplasms is higher among men. The results obtained indicate the need to implement more effective measures aimed at reducing mortality among the working-age population at the regional level, monitoring mortality rates while taking into account the gender composition of the population, and setting priorities for the healthcare system to increase life expectancy and develop specialized programs aimed at improving the quality of life of the population.

[1] Ministry of Health of the Republic of Tatarstan. Report on the Results of the Healthcare System Performance in the Republic of Tatarstan in 2024. Kazan. Available at: https://minzdrav.tatarstan.ru (accessed: September 10, 2025).

ADDITIONAL INFORMATION

Authors' contribution. Gaifullina R.F. — concept definition, data processing, manuscript revision and editing; Mukhutdinova G.M. — visualization, manuscript revision and editing; Fayzullin I.F. — visualization, manuscript draft writing; Valeeva E.R. — concept definition, validation, manuscript revision and editing; Stepanova N.V. — manuscript validation, revision and editing; Imamov A.A. — manuscript revision and editing; Zalyalov R.R. — data processing, manuscript revision and editing; Khamitov D.D. — manuscript draft writing.

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Вклад авторов. Гайфуллина Р.Ф. — определение концепции, работа с данными, пересмотр и редактирование рукописи; Мухутдинова Г.М. — визуализация, пересмотр и редактирование рукописи; Файзуллин И.Ф. — визуализация, написание черновика рукописи; Валеева Э.Р. — определение концепции, валидация, пересмотр и редактирование рукописи; Степанова Н.В. — валидация, пересмотр и редактирование рукописи; Имамов А.А. — пересмотр и редактирование рукописи; Залялов Р.Р. — работа с данными, пересмотр и редактирование рукописи; Хамитов Д.Д. — написание черновика рукописи.

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