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PARAMETERS OF AVOIDABLE MORTALITY FROM RESPIRATORY DISEASE IN AKTOBE REGION IN 2019 – 2023

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Aim. To study the avoidable mortality from respiratory disease in Aktobe region in 2019 – 2023.

Materials and methods. To calculate avoidable mortality we used the methodology suggested by OECD and the Eurostat working group. The data collected from the National Research Center for Health Development in the Aktobe region. The data included number of deaths using International Classification of Diseases 10, also gender, and area as urban and rural. The preventable and treatable mortality, as well as absolute and relative changes and the average annual percentage change were included in analysis.

Results and discussion. Between 2019 and 2023, avoidable mortality from respiratory diseases showed a decline, with a notable decrease in urban areas and a slight increase in rural areas. Preventable mortality was higher in males than females, with chronic lower respiratory diseases being the leading cause, and rural areas experiencing significantly higher rates than urban areas. The trends in treatable mortality showed a consistent decline, particularly in urban areas, with rural females seeing the largest decrease. Preventable mortality from COVID-19 was higher in males overall, however in rural areas, females had higher rates.

Conclusion. The avoidable and preventable mortality from respiratory diseases declined overall from 2019 to 2023, though with significant regional and gender disparities. Urban areas had more improvements, while rural areas experienced slower progress and higher mortality rates, particularly among males. Continued targeted interventions, especially in rural areas, are necessary to reduce these disparities and improve health outcomes.

Key words: avoidable mortality; treatable mortality; preventable mortality; respiratory disease; health policy

INTRODUCTION

The Sustainable Development Goals (SDGs) are a set of 17 global objectives adopted by all United Nations member states in 2015, which interconnected and aim to balance the social, economic, and environmental dimensions of sustainable development [1, 2]. They are universal and apply to all countries, with an emphasis on leaving no one behind. In third SDG goal as «Good Health and Well-being», emphasizes the need to ensure healthy lives and promote well-being for all, recognizing that health is both a fundamental human right and essential for achieving other development goals. In these regards the Universal health coverage (UHC) is closely aligned with (SDG 3), which directly contributes to achieving SDG 3's objectives of improving health outcomes, reducing maternal and child mortality, and addressing diseases and targets the provision of essential health services to all people, without financial hardship [3]. To realize the UHC policy many countries improve primary healthcare that focuses on prevention, treatment, and addressing the majority of health needs in a community and acting as the first point of contact for individuals with the healthcare system [4].

Health productivity can be measured using the indicators for evaluating the efficiency and effectiveness of healthcare systems in improving population health. These indicators often include both health outcomes and system performance measures, reflecting the overall impact of healthcare investments on public health. These indicators usually used in all countries as life expectancy, mortality rates burden of disease as Disability-Adjusted Life Years (DALYs) which offering a comprehensive picture of the health burden from diseases, and others. In 1976, Rutstein et al. suggested to assess the quality of care through the avoidable mortality [5]. Currently these measures implemented in Canada, Australia, and other Organization for Economic Co-operation and Development (OECD) countries to assess the performance of the health system and made comparison between countries [6, 7, 8, 9]. Avoidable mortality is crucial due to it provides valu-

able insights into the effectiveness and equity of a healthcare system. It helps to identify gaps in healthcare services in primary and hospital levels, as well as helps in prioritizing health interventions and allocating resources where they are most needed , such as in disease prevention, health education, or improving access to quality healthcare services in underserved communities [10, 11]. In addition, Papanicolas et al. suggested using this indicator to track progress toward health-related global goals, such as SDGs [12].

There is an increasing burden of disease associated with respiratory diseases in the world. An analysis of chronic respiratory diseases from 1990 to 2019 revealed that this disease, despite its decline in recent years, was the third leading cause of death, responsible for 4.0 million deaths worldwide [13]. Another analysis of the global burden of chronic obstructive pulmonary disease (COPD) to 2050, adjusted for risk factors, found that the number of COPD cases worldwide among people aged 25 years and older will increase by 23% from 2020 to 2050, particularly among women and in low and middle income regions [14]. There is also an increase in COPD among working people, for example a study in the US showed that 40% of adults with COPD had never smoked, and of these, 24% of cases were related to occupational exposures, including dust, smoke, gases, fumes and others, therefore, in the group of people with COPD, there is a high increase in mortality. In Europe identified high level of treatable mortality among female with COPD [15, 16, 17].

The development of primary health care is also a priority area for Kazakhstan, and strengthening work on the prevention of the disease and its complications is one of its functions. In order to implement the UHC, Kazakhstan has revised a number of tasks in PHC over the past decade, introducing screening programs, disease management programs, and employee motivation by implementation of the incentive component for district services. Additional resources were also included, such as a full-time position of a psychologist, a social worker, a reduction in the workload of a general practitioner, and the distribution of the functions of doctors to nurses, in particular on issues of disease prevention [18]. In Kazakhstan, mortality rate from lower respiratory infections has similarly decreased from 1991 to 2019, but there has been an increase in the mortality rate, which has doubled among older age groups and among men [19]. To evaluate the influence of changes in health system and its performance we assessed the avoidable mortality from respiratory disease using OECD methods in Aktobe region by urban and rural area and gender.

Aim – to study the avoidable mortality from respiratory disease in Aktobe region.

MATERIALS AND METHODS

To calculate avoidable mortality the data collected from the National Research Center for Health Development in the Aktobe region. The data included number of deaths using International Classification of Diseases (ICD) 10, also gender: male and female; region: urban and rural. Additionally, population data categorized by age, along with death rates segmented by gender and five-year age intervals (0, 1-4, 5-9, 65-69), were included in the analysis. Time period included from 2019 to 2023, data which was available for authors. The evaluation of avoidable deaths was carried out using the methodology established by the expert group of the OECD and the Eurostat working group. The causes of avoidable deaths were determined based on the OECD/Eurostat list of preventable and treatable causes of death (January 2022 edition) and age-standardized death rates taken from the OECD (2015) [20, 21].

The analysis divided avoidable deaths into two categories: preventable and treatable mortality and its sum avoidable mortality. Preventable respiratory deaths included: J09-J11 – Influenza; J13- J14 – Pneumonia due to *Streptococcus pneumonia* or *Haemophilus influenza*; J40-J44 – Chronic lower respiratory diseases; J60-J64, J66-J70, J82, J92 – Lung diseases due to external agent; whereas treatable were J00-J06, J30-J39 – Upper respiratory infections; J12, J15, J16-J18 – Pneumonia, not elsewhere classified or organism unspecified; J20-J22 – Acute lower respiratory infections; J45-J47 (a) – Asthma and bronchiectasis; J80 – Adult respiratory distress syndrome; J81 – Pulmonary oedema; J85, J86 – Abscess of lung and mediastinum pyothorax; J90, J93, J94 – Other pleural disorders.

The following formula was applied to calculate avoidable deaths:

$$t_{preventable} = \sum_{i=1}^{m} t_{st_i}$$

for i=1. m causes of death included as preventable.

$$t_{treatable} = \sum_{i=1}^{m} t_{st_i}$$

for i=1. m causes of death included as treatable.

$$t_{avoidable} = \sum_{i=1}^{m} t_{st_i}$$

for i=1. m causes of death included as avoidable.

The standardized death rate is calculated as follows:

$$t_{st} = \sum_{j=1}^{n} p_{ej}/p_e * t_j$$

where «n» is number of age groups considered for adjustment;

Pej is standard population j_{th} age group (j=1, …, n)

$$p_e = \sum_{j=1}^{n} p_{ej}$$

Pe is the total standardized population; and

$t_j = c_j/p_j$ is a weight indicator j_{th} age group,

where c_j is the number of deaths in j_{th} age group (j = 1, · · ·, n);

p_j population j_{th} age group measured per 100 000 populations.

Corresponding 95% confidence intervals (95% CIs) were calculated for the age group 0-69 years and by gender. Moreover the Joinpoint regression calculated to identify the average annual percentage change (AAPC). The formula for calculating the AAPC is as follows [22]:

$$\text{AAPC} = \frac{1}{N} \sum_{i=1}^{N} \left(\frac{Y_i - Y_{i-1}}{Y_{i-1}} \times 100 \right)$$

where: Y_i is the value of the data point in year iii,

$Y_{i-}1$ is the value of the data point in the previous year,

N is the number of years for which you're calculating the average change.

The Local Committee on Bioethics, Marat Ospanov West-Kazakhstan Medical University NC JSC, Aktobe c., Republic of Kazakhstan (Protocol 9, No. 09.01/03, 29 September 2023) approved the study design.

RESULTS

The avoidable mortality rate from respiratory diseases increased from 70.80 to 96.70 during 2019 to 2021, after which it decreased to 67.46 per 100000 population. The preventable mortality rate from respiratory diseases was more than twice as high in male as it was in female. Throughout all the years studied, preventable mortality was notably higher than treatable mortality. The leading causes of preventable mortality were chronic lower respiratory diseases, which increased from 60.63 to 86.04 per 100000 population in the first two years. After that, the rate decreased to 57.25 per 100000 population by 2023, with the rate being three times higher in males compared to females. Among treatable mortality, the highest rate was associated with pneumonia, not elsewhere classified or organism unspecified, which increased from 8.64 to 25.94 per 100 000 population in the first year studied, then decreased to 8.98 per 100 000 population in 2023. The difference between males and females was twofold, where it prevailed in males.

Avoidable mortality in rural areas was more than twice as high as in urban. During the study period, the preventable mortality rate in rural areas increased from 141.21 to 206.17 per 100 000 population between 2019 and 2022, before decreasing to 144.05 by 2023. In contrast, in urban areas, per 100 000 population the rate rose from 41.10 to 74.02 in the first year, and then dropped to 42.98 by 2023. The trends of increase and decrease in preventable and treatable mortality occurred in similar years for urban areas. In rural areas, preventable mortality rose from 127.13 to 200.29 per 100 000 population in the first two years, followed by a decrease to 135.50 by 2023. Meanwhile, treatable mortality increased from 14.08 to 29.06 in the first year, then declined to 5.88, before rising again to 10.53 per 100 000 population by 2023.

When comparing preventable mortality between urban and rural areas, the difference among rural male was more than three times higher than among urban male, while for female of rural area, it was twice as high (table 1).

The AAPC in avoidable mortality declined by –4.9 (–21.9%; 15.9%) over the study period. In urban areas, the decline was more pronounced, with an average annual decrease of –8.3% (–31.7; 23.0). In contrast, rural areas showed a slight increase in avoidable mortality, with an AAPC 1.6 (–18.5; 26.7). For preventable mortality, there was a slight overall decline of –2.0% per year, with urban areas experiencing a more noticeable decrease (–3.8%) and rural areas showing a small increase (3.6%) over the study period, though with considerable variability in the data. Regarding treatable mortality, there was a significant overall decline of –21% per year. This trend was similar in both urban and rural areas, where urban areas saw a –21.5% reduction, and rural areas experienced a –20.8% decrease. However, the range of percentage changes indicates substantial fluctuations in the data for both areas, suggesting some years with more significant changes than others. In addition, there was a general decline in avoidable mortality, with female experiencing a more significant decrease than male, especially in urban areas. Rural areas present smaller changes or slight increases in avoidable mortality, particularly for male. Regarding the preventable mortality the AAPC in both genders showed a decrease in urban areas, with female experiencing a more substantial reduction. In rural areas, preventable mortality showed an increase, particularly for female. The AAPC avoidable treatable mortality significant decline for both genders, with rural female experiencing the largest decrease, although the fluctuations in the data were considerable, especially in urban areas (table 2).

The absolute change in avoidable deaths from respiratory diseases was –3.34 overall, with a decline of –2.21 for females and –3.29 for males. The absolute change in preventable mortality was –3.61 overall, with –2.47 for females and –3.57 for males, which means that preventable mortality also

Table 1 – Avoidable mortality from respiratory disease in Aktobe region by gender in 2019 – 2023

Year	Gender	J09-J11 (p)	J00-J06, J30-J39 (a)	J13-J14 (p)	J12, J15, J16- J18 (a)	J20-J22 (a)	J40-J44 (p)	J45-J47 (a)	J60-J64, J66-J70, J82, J92 (p)	J80 (a)	J81 (a)	J85, J86 (a)	J90, J93, J94 (a)	Preventable	Amenable	Avoidable	COVID-19
		Urban															
2019	male	0.00	0.00	0.76	9.49	0.00	55.58	0.00	0.00	0.00	2.01	0.00	0.00	56.34	11.49	67.83	
	female	0.17	0.17	0.36	5.03	0.00	17.31	0.00	0.00	0.00	0.36	0.00	0.00	17.84	5.56	23.40	
	both	0.08	0.08	0.49	6.94	0.00	32.56	0.00	0.00	0.00	0.94	0.00	0.00	33.13	7.97	41.10	
2020	male	0.18	0.18	0.00	28.42	0.00	66.76	0.53	0.00	0.00	8.00	0.46	0.00	66.94	37.58	104.52	
	female	0.17	0.55	0.00	23.76	0.00	25.99	1.52	0.00	0.00	2.32	0.00	0.00	26.16	28.15	54.31	
	both	0.17	0.36	0.00	25.85	0.00	41.70	1.16	0.00	0.00	4.57	0.20	0.00	41.87	32.15	74.02	
2021	male	0.00	0.00	0.00	14.71	0.00	65.83	0.43	0.00	0.00	0.00	0.00	0.00	65.83	15.14	80.97	69.12
	female	0.33	0.16	0.00	9.37	0.00	25.13	1.28	0.00	0.00	0.00	0.00	0.00	25.46	10.81	36.27	57.52
	both	0.16	0.08	0.00	11.55	0.00	40.75	0.97	0.00	0.00	0.00	0.00	0.00	40.91	12.60	53.51	61.63
2022	male	0.16	0.76	0.00	10.90	0.00	57.13	0.24	0.00	0.00	0.41	0.83	0.00	57.29	13.14	70.43	4.81
	female	0.00	0.00	0.00	4.07	0.00	13.87	0.75	0.00	0.00	0.00	0.00	0.00	13.87	4.82	18.69	0.66
	both	0.08	0.32	0.00	6.92	0.00	31.44	0.57	0.00	0.00	0.18	0.36	0.00	31.53	8.35	39.88	2.32
2023	male	0.15	0.15	0.00	11.78	0.00	56.59	0.00	0.00	0.00	0.33	0.00	0.00	56.74	12.25	68.99	
	female	0.00	0.00	0.00	8.22	0.00	18.00	0.33	0.00	0.00	0.00	0.00	0.00	18.00	8.54	26.54	
	both	0.08	0.08	0.00	9.52	0.00	32.97	0.18	0.00	0.00	0.16	0.00	0.00	33.05	9.93	42.98	

Table 1 – Avoidable mortality from respiratory disease in Aktobe region by gender in 2019 – 2023 (continue)

Year	Gender	J09-J11 (p)	J00-J06, J30-J39 (a)	J13-J14 (p)	J12, J15, J16- J18 (a)	J20-J22 (a)	J40-J44 (p)	J45-J47 (a)	J60-J64, J66-J70, J82, J92 (p)	J80 (a)	J81 (a)	J85, J86 (a)	J90, J93, J94 (a)	Preventable	Amenable	Avoidable	COVID-19
		Rural															
2019	male	0.00	0.00	0.00	15.84	0.00	197.34	0.00	0.00	0.00	0.00	0.00	0.00	197.34	15.84	213.18	
	female	0.00	0.00	0.00	10.71	0.00	73.07	0.74	0.00	0.00	1.76	0.00	0.00	73.07	13.21	86.28	
	both	0.00	0.00	0.00	12.69	0.00	127.13	0.35	0.00	0.00	1.04	0.00	0.00	127.13	14.08	141.21	
2020	male	0.00	0.00	0.00	31.58	0.00	177.26	0.00	0.00	0.00	0.00	0.00	0.00	177.26	31.58	208.84	
	female	0.49	0.49	0.00	22.27	0.00	58.95	0.00	0.00	0.00	4.19	0.00	0.00	59.44	26.95	86.39	
	both	0.24	0.24	0.00	26.32	0.00	109.38	0.00	0.00	0.00	2.50	0.00	0.00	109.62	29.06	138.67	
2021	male	0.00	0.00	0.00	6.20	0.00	292.03	2.02	1.08	0.00	0.00	0.00	0.00	293.11	8.21	301.33	58.49
	female	0.00	0.00	0.00	1.77	0.00	132.28	2.61	0.00	0.00	0.00	0.00	0.00	132.28	4.38	136.66	65.89
	both	0.00	0.00	0.00	3.63	0.00	199.78	2.25	0.51	0.00	0.00	0.00	0.00	200.29	5.88	206.17	61.12
2022	male	0.00	0.00	0.00	8.79	0.00	225.96	0.00	0.00	0.00	0.00	0.00	0.00	225.96	8.79	234.74	0
	female	0.00	0.00	0.00	5.34	0.00	97.02	3.50	0.00	0.00	0.00	0.00	0.00	97.02	8.84	105.87	5.82
	both	0.00	0.00	0.00	7.00	0.00	152.49	1.94	0.00	0.00	0.00	0.00	0.00	152.49	8.94	161.43	3.02
2023	male	0.93	0.93	0.00	11.33	0.00	214.51	3.78	0.00	0.00	0.00	0.00	0.00	215.44	16.04	231.48	
	female	0.00	0.00	0.00	4.27	0.00	73.99	2.04	0.00	0.00	0.00	0.00	0.00	73.99	6.31	80.30	
	both	0.48	0.48	0.00	7.55	0.00	133.02	2.52	0.00	0.00	0.00	0.00	0.00	133.50	10.55	144.05	

Table 1 – Avoidable mortality from respiratory disease in Aktobe region by gender in 2019 – 2023 (continue)

Year	Gender	J09-J11 (p)	J00-J06, J30-J39 (a)	J13-J14 (p)	J12, J15, J16- J18 (a)	J20-J22 (a)	J40-J44 (p)	J45-J47 (a)	J60-J64, J66-J70, J82, J92 (p)	J80 (a)	J81 (a)	J85, J86 (a)	J90, J93, J94 (a)	Preventable	Amenable	Avoidable	COVID-19
		Total															
2019	male	0.00	0.00	0.53	11.49	0.00	100.51	0.00	0.00	0.00	1.37	0.00	0.00	101.05	12.86	113.91	
	female	0.13	0.13	0.26	6.66	0.00	33.13	0.18	0.00	0.00	0.76	0.00	0.00	33.51	7.72	41.23	
	both	0.06	0.06	0.34	8.64	0.00	60.63	0.09	0.00	0.00	0.98	0.00	0.00	61.04	9.77	70.80	
2020	male	0.13	0.13	0.00	29.41	0.00	100.75	0.36	0.00	0.00	5.54	0.31	0.00	100.88	35.74	136.63	
	female	0.25	0.53	0.00	23.22	0.00	35.14	1.09	0.00	0.00	2.84	0.00	0.00	35.39	27.68	63.07	
	both	0.19	0.32	0.00	25.94	0.00	61.33	0.82	0.00	0.00	3.97	0.14	0.00	61.52	31.19	92.70	
2021	male	0.00	0.00	0.00	12.16	0.00	134.72	0.92	0.34	0.00	0.00	0.00	0.00	135.05	13.08	148.13	65.85
	female	0.24	0.12	0.00	7.28	0.00	54.16	1.59	0.00	0.00	0.00	0.00	0.00	54.41	8.99	63.40	59.74
	both	0.12	0.06	0.00	9.30	0.00	86.04	1.32	0.15	0.00	0.00	0.00	0.00	86.31	10.68	96.98	61.46
2022	male	0.12	0.56	0.00	10.31	0.00	101.59	0.18	0.00	0.00	0.29	0.59	0.00	101.71	11.94	113.65	3.52
	female	0.00	0.00	0.00	4.36	0.00	33.63	1.42	0.00	0.00	0.00	0.00	0.00	33.63	5.77	39.40	1.87
	both	0.06	0.24	0.00	6.91	0.00	61.54	0.92	0.00	0.00	0.13	0.27	0.00	61.60	8.47	70.07	2.48
2023	male	0.34	0.34	0.00	11.61	0.00	97.13	0.94	0.00	0.00	0.24	0.00	0.00	97.47	13.14	110.62	
	female	0.00	0.00	0.00	7.24	0.00	31.04	0.75	0.00	0.00	0.00	0.00	0.00	31.04	7.98	39.02	
	both	0.18	0.18	0.00	8.98	0.00	57.25	0.76	0.00	0.00	0.12	0.00	0.00	57.43	10.04	67.46	

J09-J11 (p) – Influenza; J00-J06, J30-J39 (a) – Upper respiratory infections; J13-J14 (p) – Pneumonia due to *Streptococcus pneumonia* or *Haemophilus influenza*; J12, J15, J16- J18 (a) – Pneumonia, not elsewhere classified or organism unspecified; J20-J22 (a) – Acute lower respiratory infections; J40-J44 (p) – Chronic lower respiratory diseases; J45-J47 (a) – Asthma and bronchiectasis; J60-J64, J66-J70, J82, J92 (p) – Lung diseases due to external agent; J80 (a) – Adult respiratory distress syndrome; J81 (a) – Pulmonary edema; J85, J86 (a) – Abscess of lung and mediastinum pyothorax; J90, J93, J94 (a) – Other pleural disorders

(p) – preventable mortality; (a) – treatable mortality

Table 2 – Absolute changes of avoidable deaths from respiratory disease in Aktobe region in 2019 – 2023

Area	Urban			Rural			Total		
Gender	male	female	both	male	female	both	male	female	both
J09-J11 (p)	0.15	-0.17	-0.01	0.93	0.00	0.48	0.34	-0.13	0.12
J00-J06.J30-J39 (a)	0.15	-0.17	-0.01	0.93	0.00	0.48	0.34	-0.13	0.12
J13-J14 (p)	-0.76	-0.36	-0.49	0.00	0.00	0.00	-0.53	-0.26	-0.34
J12.J15.J16- J18 (a)	2.29	3.18	2.57	-4.51	-6.44	-5.14	0.12	0.58	0.34
J20-J22 (a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J40-J44 (p)	1.01	0.69	0.41	17.17	0.92	5.89	-3.38	-2.09	-3.38
J45-J47 (a)	0.00	0.33	0.18	3.78	1.30	2.17	0.94	0.57	0.67
J60-J64.J66-J70.J82.J92 (p)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J80 (a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J81 (a)	-1.68	-0.36	-0.78	0.00	-1.76	-1.04	-1.13	-0.76	-0.86
J85.J86 (a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J90.J93.J94 (a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Preventable respiratory	0.40	0.16	-0.09	18.10	0.92	6.37	-3.57	-2.47	-3.61
Treatable respiratory	0.76	2.98	1.96	0.20	-6.90	-3.53	0.28	0.26	0.27
Avoidable respiratory	1.16	3.14	1.88	18.30	-5.98	2.83	-3.29	-2.21	-3.34
COVID-19 (p)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Preventable	7.30	-0.80	2.59	45.14	13.55	26.49	8.74	-0.58	3.02
Treatable	5.01	4.80	4.72	24.99	11.39	16.97	9.76	5.70	7.08
Total avoidable	12.31	4.00	7.31	70.13	24.94	43.45	18.50	5.12	10.10

J09-J11 (p) – Influenza; J00-J06, J30-J39 (a) – Upper respiratory infections; J13-J14 (p) – Pneumonia due to *Streptococcus pneumonia* or *Haemophilus influenza*; J12, J15, J16- J18 (a) – Pneumonia, not elsewhere classified or organism unspecified; J20-J22 (a) – Acute lower respiratory infections; J40-J44 (p) – Chronic lower respiratory diseases; J45-J47 (a) – Asthma and bronchiectasis; J60-J64, J66-J70, J82, J92 (p) – Lung diseases due to external agent; J80 (a) – Adult respiratory distress syndrome; J81 (a) – Pulmonary edema; J85, J86 (a) – Abscess of lung and mediastinum pyothorax; J90, J93, J94 (a) – Other pleural disorders
(p) – preventable mortality; (a) – treatable mortality

Table 3 – Relative changes of avoidable mortality from respiratory disease in Aktobe region from 2019 to 2023

Area	Urban			Rural			Total		
Gender	male	female	both	male	female	both	male	female	both
J09-J11 (p)		-1.00	-0.07					-1.00	1.92
J00-J06.J30-J39 (a)		-1.00	-0.07					-1.00	1.92
J13-J14 (p)	-1.00	-1.00	-1.00				-1.00	-1.00	-1.00
J12.J15.J16- J18 (a)	0.24	0.63	0.37	-0.28	-0.60	-0.41	0.01	0.09	0.04
J20-J22 (a)									
J40-J44 (p)	0.02	0.04	0.01	0.09	0.01	0.05	-0.03	-0.06	-0.06
J45-J47 (a)					1.76	6.19		3.17	7.36
J60-J64.J66-J70.J82.J92 (p)									
J80 (a)									
J81 (a)	-0.84	-1.00	-0.83		-1.00	-1.00	-0.82	-1.00	-0.88
J85.J86 (a)									
J90.J93.J94 (a)									
Preventable respiratory	0.01	0.01	0.00	0.09	0.01	0.05	-0.04	-0.07	-0.06
Treatable respiratory	0.07	0.54	0.25	0.01	-0.52	-0.25	0.02	0.03	0.03
Avoidable respiratory	0.02	0.13	0.05	0.09	-0.07	0.02	-0.03	-0.05	-0.05
COVID-19 (p)									
Preventable	0.05	-0.02	0.03	0.15	0.12	0.13	0.04	-0.01	0.02
Treatable	0.06	0.11	0.08	0.22	0.19	0.20	0.10	0.12	0.10
Total avoidable	0.05	0.04	0.05	0.17	0.14	0.15	0.06	0.04	0.05

J09-J11 (p) – Influenza; J00-J06, J30-J39 (a) – Upper respiratory infections; J13-J14 (p) – Pneumonia due to *Streptococcus pneumonia* or *Haemophilus influenza*; J12, J15, J16- J18 (a) – Pneumonia, not elsewhere classified or organism unspecified; J20-J22 (a) – Acute lower respiratory infections; J40-J44 (p) – Chronic lower respiratory diseases; J45 -J47 (a) – Asthma and bronchiectasis; J60-J64, J66-J70, J82, J92 (p) – Lung diseases due to external agent; J80 (a) – Adult respiratory distress syndrome; J81 (a) – Pulmonary edema; J85, J86 (a) – Abscess of lung and mediastinum pyothorax; J90, J93, J94 (a) – Other pleural disorders
(p) – preventable mortality; (a) – treatable mortality

Table 4 – Average annual percentage changes (95%CI) of Avoidable mortality from respiratory disease in Aktobe region from 2019 to 2023

Mortality	Male	Female	Both
	Total		
Preventable	-1.2 (-17.0; 17.5)	-3.2 (-29.3; 32.5)	-2.0 (-21.0; 21.7)
Treatable	-18.1 (-54.9; 48.5)	-23.7 (-65.0; 66.7)	-21 (-60.2; 56.6)
Avoidable	-3.2 (-16.9; 12.8)	-7.7 (-31.1; 23.5)	-4.9 (-21.9; 15.9)
	Urban		
Preventable	-2.1 (-10.8; 7.6)	-7.3 (-30.6; 23.8)	-3.8 (-16.8; 11.2)
Treatable	-19.3 (-56.8; 50.6)	-23.1 (-67.0; 78.9)	-21.5 (-62.0; 62.4)
Avoidable	-5.5 (-22.9; 15.7)	-12.8 (-45.2; 38.8)	-8.3 (-31.7; 23.0)
	Rural		
Preventable	3.7 (-18.0; 31.2)	4.0 (-31.3; 57.6)	3.6 (-22.7; 38.9)
Treatable	-14.4 (-53.5; 57.5)	-27.1 (-66.6; 58.9)	-20.8 (-59.6; 55.4)
Avoidable	2.6 (-14.9; 23.6)	0.6 (-25.3; 35.6)	1.6 (-18.5; 26.7)

decreased over the study period. Males experienced a slightly larger reduction in absolute changes of the preventable deaths compared to females, but the change for both genders is relatively close. The treatable absolute change of 0.27 overall, with urban females at 0.26 and urban males at 0.28, suggests a slight gender difference, with males experiencing a marginally greater improvement in outcomes treatable to intervention (table 3).

Both females and males presents small reductions in avoidable relative changes, with females showing a slightly larger decrease (–0.05 vs. –0.03 for males), indicating modest improvements from interventions. Preventable relative changes decreased overall by –0.06, with females experiencing a slightly higher reduction (–0.07 vs. –0.04 for males). The relative risk of treatable mortality is low for both genders (0.03 for females, 0.02 for males), with males having a marginally lower risk, suggesting slightly better outcomes for males (table 4).

In addition, we identify the preventable mortality from COVID-19 were 61.46, in male higher 65.85 comparison to female 59.74. In urban area the preventable mortality was higher among male whereas in rural area among females (table 1).

DISCUSSION

The observed increase in avoidable mortality during 2020 and 2021 in Aktobe region can be largely attributed to the COVID-19 pandemic, which caused a significant surge in respiratory-related deaths. This trend is consistent with findings from other studies, which highlight a notable rise in mortality from respiratory diseases, particularly among male populations [23, 24, 25].

The exacerbation of this mortality surge can be linked to the compounding effects of pre-existing chronic conditions, which were more prevalent among the elderly [26, 27]. The presence of comorbidities such as cardiovascular disease, diabetes, and respiratory disorders, which are common in older age groups, heightened the severity of COVID -19 infections, leading to poorer health outcomes and an increase in preventable deaths [28]. This multifactorial impact underscores the vulnerability of individuals with chronic health conditions, particularly in the context of a global health crisis, and emphasizes the need for targeted healthcare interventions for these high-risk populations [10].

Similar to trends observed in developed countries, preventable mortality from respiratory disease in the studied population and region was consistently higher than treatable mortality, highlighting a critical gap in health outcomes that necessitates a shift in public health strategies. This disparity underscores the urgent need for a stronger focus on primary prevention measures, which can reduce the incidence of preventable deaths before they progress to more severe stages. In particular, there is a pressing need to enhance the effectiveness of PHC systems, with a special emphasis on chronic obstructive lower respiratory disease. Strengthening PHC to offer early detection, education, and management of these conditions is crucial to prevent their escalation and reduce the overall burden of preventable mortality [10, 29, 30]. Moreover, investing in preventive health services that focus on lifestyle changes, such as smoking cessation programs and air quality improvements, would significantly reduce the future burden of respiratory diseases, thereby addressing the root causes of preventable deaths.

We found among male, the rate of avoidable mortality was higher, similar to the work of other authors, who associate it with the presence of risk factors that affect complications of the condition and mortality [31, 32].

Avoidable mortality in rural areas has been consistently higher compared to urban areas, which can be attributed to several socio-environmental factors. One potential explanation is the industrial nature of Aktobe region, where the presence of industries may contribute to environmental degradation, including poor air quality [33]. Long-term exposure to airborne pollutants such as particulate matter (PM), nitrogen dioxide (NO2), and sulfur dioxide (SO2), commonly found in industrial areas, has been well-documented as a significant risk factor for the deterioration of respiratory health and the exacerbation of chronic diseases. The deleterious effects of air pollution on public health are particularly pronounced in rural populations, who may have limited access to healthcare services, resulting in delayed diagnosis and treatment of preventable conditions [34, 35]. Thus, the combination of environmental pollution and socio-economic challenges in rural settings plays a critical role in the heightened risk of preventable deaths.

CONCLUSION

Avoidable and preventable mortality from respiratory diseases declined overall from 2019 to 2023, though with significant regional and gender disparities. Urban areas present improvements, while rural areas experienced slower progress and higher mortality rates, particularly among males. Preventable mortality, driven by chronic respiratory diseases, was consistently higher in males and in rural regions, with females showing relatively better outcomes in urban areas.

Additionally, the burden of COVID-19-related preventable deaths was notably higher in males, though rural females faced a higher rate in that context. Local decision makers need to continue targeted interventions, especially in rural areas, are necessary to reduce these disparities and improve health outcomes.

Limitation and future direction:

The study's five-year timeframe limits the ability to analyze long-term trends in avoidable mortality, and reliance on different data sources may affect the reliability of conclusions. Issues like un-

derreporting and inaccuracies in death registration further undermine the findings' generalizability. Future research should focus on factors such as socioeconomic status, urbanization, and risk factors at the primary healthcare level to develop more targeted interventions. A longitudinal approach, incorporating extended periods and multiple data points, is crucial for continuous monitoring and improving health strategies aimed at reducing avoidable deaths.

Author contributions:

D. Katasheva – conceptualization, project administration.

D. Katasheva, N. Alekenova, N. Akhtayeva, S. Tussupbekova – methodology.

D. Katasheva, N. Alekenova – validation.

D. Katasheva, A. Akhmetzhan, S. Tussupbekova – analysis.

D. Katasheva, N. Alekenova, N. Akhtayeva – investigation, data curation,.

D. Katasheva, N. Alekenova, N. Akhtayeva, A. Akhmetzhan – resources.

D. Katasheva, S. Tussupbekova, N. Akhtayeva – writing – original draft preparation.

S. Tussupbekova, N. Alekenova, A. Akhmetzhan – writing – review and editing.

A. Akhmetzhan, D. Katasheva – visualization.

N. Alekenova – supervision.

All authors have read and agreed to the published version of the manuscript.

Conflict of interest:

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ПОКАЗАТЕЛИ ПРЕДОТВРАТИМОЙ СМЕРТНОСТИ ОТ РЕСПИРАТОРНЫХ ЗАБОЛЕВАНИЙ В АКТЮБИНСКОЙ ОБЛАСТИ В ПЕРИОД 2019 – 2023 ГГ.

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Цель. Изучить показатели предотвратимой смертности от респираторных заболеваний в Актюбинской области за период 2019 – 2023 гг.

Материалы и методы. Для расчета предотвратимой смертности мы использовали методологию, предложенную ОЭСР и рабочей группой Евростата. Данные были получены в Национальном исследовательском центре развития здравоохранения Актюбинской области. Данные включали количество смертей с использованием Международной классификации болезней 10 пересмотра, а также пол и место проживания (городской и сельский). В анализ были включены показатели предотвратимой и излечимой смертности, а также абсолютные и относительные изменения и среднегодовые процентные изменения.

Результаты и обсуждение. В период с 2019 по 2023 год уровень предотвратимой смертности от респираторных заболеваний снизился, причем заметное снижение произошло в городе и незначительный рост - в сельской местности. Смертность, которую можно было предотвратить, была выше среди мужчин, чем среди женщин, при этом основной причиной были хронические заболевания нижних дыхательных путей, а в сельской местности показатели были значительно выше, чем в городах. Тенденции в отношении смертности, которую можно было предотвратить, показали постоянное

снижение, особенно в городе, при этом наибольшее снижение наблюдалось среди сельских женщин. Предотвратимая смертность от COVID-19 в целом была выше среди мужчин, однако в сельской местности этот показатель был выше у женщин.

Выводы. В период с 2019 по 2023 год смертность от респираторных заболеваний, которую можно было предотвратить, в целом снизилась, хотя и со значительными региональными и гендерными различиями. В городах улучшения были заметны в большей степени, в то время как в сельской местности прогресс был более медленным, а показатели смертности, особенно среди мужчин, более высокими. Для сокращения этих различий и улучшения показателей здоровья необходимы постоянные целенаправленные мероприятия, особенно в сельской местности.

Ключевые слова: предотвратимая смертность; излечимая смертность; предотвратимая смертность от респираторных заболеваний; политика в области здравоохранения

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2019 – 2023 ЖЫЛДАР КЕЗЕҢІНДЕ АҚТӨБЕ ОБЛЫСЫНДА РЕСПИРАТОРЛЫҚ АУРУЛАРДАН БОЛАТЫН АЛДЫН АЛУҒА БОЛАТЫН ӨЛІМ-ЖІТІМ КӨРСЕТКІШТЕРІ

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Зерттеу мақсаты. Ақтөбе облысында 2019 – 2023 жылдар кезеңінде респираторлық аурулардан болатын алдын алуға болатын өлім-жітім көрсеткіштерін зерделеу.

Материалдар және әдістер. Алдын алуға болатын өлім-жітімді есептеу үшін біз ЭЫДҰ мен Еуростаттың жұмыс тобы ұсынған әдістемені қолдандық. Ақтөбе облысының Денсаулық Сақтауды Дамыту Ұлттық Ғылыми-Зерттеу Орталығынан жиналған мәліметтер. Деректерге Аурулардың Халықаралық Классификациясын (ICD) қолдана отырып, өлім-жітім саны 10, сондай-ақ жынысы мен тұрғылықты жері бойынша қалалық және ауылдық болып бөлінді. Талдауға алдын алуға болатын және емделетін өлім, абсолютті және салыстырмалы өзгерістер, сондай-ақ орташа жылдық пайыздық өзгерістер енгізілді.

Нәтижелер және талқылау. 2019-2023 жылдар аралығында респираторлық аурулардан болатын алдын алуға болатын өлім төмендеді, қалалық жерлерде айтарлықтай төмендеді және ауылдық жерлерде аздап өсті. Алдын алуға болатын өлім ерлерде әйелдерге қарағанда жоғары болды, оның негізгі себебі төменгі тыныс жолдарының созылмалы аурулары болды, ал ауылдық жерлерде бұл көрсеткіш қалаға қарағанда айтарлықтай жоғары болды. Емдеуге болатын өлімнің тенденциялары, әсіресе қалалық жерлерде, тұрақты төмендеуді көрсетті, ең үлкен төмендеу ауылдық жерлердегі әйелдерде байқалды. Жалпы, covid-19-дан алдын алуға болатын өлім ерлерде жоғары болды, бірақ ауылдық жерлерде әйелдерде бұл көрсеткіш жоғары болды.

Қорытынды. Респираторлық аурулардан болатын алдын алуға болатын өлім 2019 жылдан 2023 жылға дейін айтарлықтай аймақтық және гендерлік айырмашылықтарға қарамастан жалпы төмендеді. Қалалық жерлерде көрсеткіш жақсарған, ал ауылдық жерлерде баяулады және өлім деңгейі жоғары болды, әсіресе ер адамдар арасында. Бұл айырмашылықтарды азайту және денсаулық көрсеткіштерін жақсарту үшін, әсіресе ауылдық жерлерде, мақсатты араласуды жалғастыру қажет.

Кілт сөздер: алдын алуға болатын өлім; емделетін өлім; респираторлық аурулардан алдын алуға болатын өлім; денсаулық сақтау саясаты