

Dynamics of deaths and mortality rate in Kazakhstan population

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Abstract

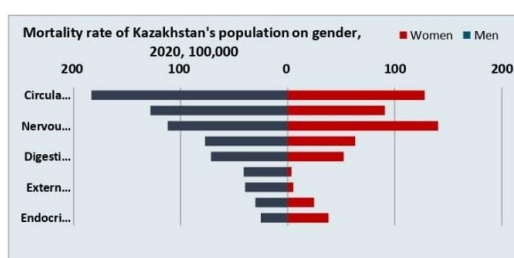
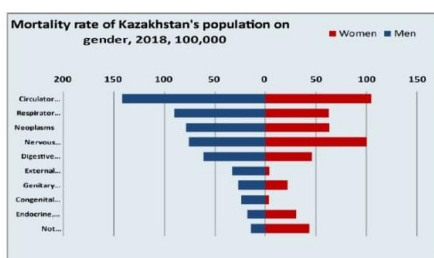
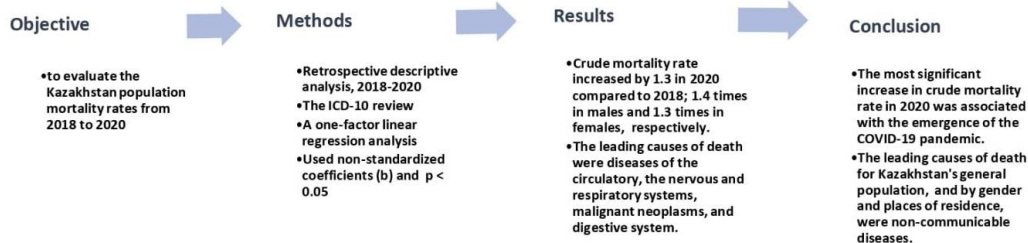
Objective: To evaluate the Kazakhstan population's mortality dynamics on the number of deaths and rates from 2018 to 2020, according to region of residence, and gender.

Methods: Overall, retrospective analysis of 389 674 deaths of Kazakhstan residents from 2018 to 2020 was conducted using the ICD-10 version. The sources of information were official data on the size and deaths from the RPN database "Register of Death Certificates," the Statistics Agency of the Republic of Kazakhstan. We used a one-factor linear regression analysis of the main trends of deaths and mortality rate by place, gender, and country level. The results of the regression analysis were presented in the form of non-standardized coefficients (b) and the level of statistical significance (p).

Results: There was a statistically significant increase in the total mortality rate of Kazakhstan's population (regression statistics $b=17938.0$, $p=0.302$) and by gender during the period under study in 2018-2020. Among the male population, the mortality rate increased by 1.4 times (regression statistic $b=9827.5$, $p=0.292$) and the female population – 1.3 times (regression statistics $b=8110.5$, $p=0.313$) in the same years. The leading causes of death for the population of Kazakhstan and by gender were non-communicable diseases (the circulatory system ("I"), diseases of the nervous system ("G"), respiratory diseases ("J"), malignant neoplasms ("C") and digestive diseases ("K") during the period from 2018-2020. While for women, nervous system diseases ranked first, and unclassifiable diseases ranked fifth.

Conclusion: Thus, the increase in Kazakhstan's population mortality rate was determined in general and by disease classes during the studied time from 2018 to 2020. The leading causes of death for Kazakhstan's general population and by gender were non-communicable diseases despite of effects of COVID-19. Kazakhstan's Northern and Eastern regions had the highest mortality rates in the country and by sex.

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Key words: dynamics, mortality rate, death, Kazakhstan, region, male, female, ICD-10 review.

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Introduction

The population mortality rate is a famous indicator in the Sustainable Development Goals, related to Goal 3 and objectives to ensure good health and promote well-being for all ages (1). The annual Global Burden of Disease, Injury, and Risk Factor (GBD) surveys quantify health losses due to a sex and geographic region of the world at specific points in time using a mortality rate (2). Moreover, WHO (GHE) also conducts health estimates on global population mortality, region, country, age, sex, and cause. The results of these studies are a tool for national public health programs to support informed decisions about health policy and resource allocation. According to WHO, there has been a decline in the global mortality rate over the past decade (3, 4), but in 2019 the excessive number of deaths observed during the COVID-19 pandemic became a global public health problem (5).

More than 6.5 million deaths registered from confirmed cases of coronavirus infection (6). In order to assess the epidemic situation, continuous monitoring of the dynamics of the number of cases and the medico-statistical mortality rate was carried out (7). This assessment allows the development of effective management-oriented measures (health care planning) for the population's medical health aimed at mortality reduction (8). Since the pandemic emerged, several studies have been conducted in Kazakhstan to assess mortality from coronavirus infection (9). At the same time, there is a shortage of work assessing the dynamics and structure of regional mortality in Kazakhstan.

The current research studied the dynamics of death outcomes and mortality rate in the Republic of Kazakhstan (a population study).

Methods

The retrospective analysis of death data was conducted. The depth of the study was from 2018 to 2020. The primary source of information was official data on deaths (RPN database, "Register of Death Certificates") of the Republic of Kazakhstan. We used the population size from the Statistics Agency of the Republic of Kazakhstan to calculate the mortality rate in 2018-2020.

Mortality data were classified into ICD-10 reviews using a three-digit alphanumeric coding system of

diseases, injuries, and accidents (10). Analyses of 389 674 deaths of Kazakhstan residents from 2018 to 2020 were conducted. The following variables were included in the analysis: number of deaths, gender, the ICD-10 codes, regions of Kazakhstan, and years of study. Indicators of crude mortality rate, cause-specific, and sex-specific rates were calculated.

Statistical analysis

The dynamics of deaths are assessed by determining trends (ascending or descending). The method of single-factor linear regression in the IBM SPSS 26 version (New York, USA) was used to assess the statistical significance of the obtained trends. The results of the regression analysis were presented as non-standardized coefficients (b) and the level of statistical significance (p).

Results

Table 1 presents data on the number of deaths and mortality rate of Kazakhstan's population, considering disease class forms, excluding gender. The deaths in Kazakhstan's population were 105 304 cases, 107 314 cases, and 141 180 cases in 2018, 2019, and 2020; mortality rates were 576.06 per 100,000 population, 579, 76 per 100,000 population, and 752.56 per 100,000 population, respectively.

There is a tendency for an increase in death outcomes; however, the trend is statistically insignificant (regression statistic $b=17938.0$, $p=0.302$). According to the averaged data (\bar{X}) and the mortality rate for 2018-2020, the first five leading causes of death in the Kazakhstan population (without regard to gender) were diseases of the circulatory system (I), diseases of the nervous system (G), diseases of respiratory organs (J), malignant neoplasms (C), and diseases of the digestive organs (K).

The deaths from infectious and parasitic diseases (B), from diseases associated with pregnancy, childbirth, and the postpartum period (O), from diseases not classified under other headings (R), other headings (R), from respiratory diseases (J) and diseases of the nervous system (G) increased by 1.5 times in 2020 compared with 2018. The progress of the number of death outcomes was as follows: 2018 - 53993 cases, 2019 - 55415 cases, and 2020 r. - 73648 cases. The trend of increasing deaths is statistically insignificant (regression statistic $b=9827.5$, $p=0.292$).

Table 1. Deaths and crude mortality rate in Kazakhstan’s population to the ICD-10 codes per 100,000 population, 2018-2020

A primary cause of death in ICD-10 diagnosis	Years					
	2018		2019		2020	
	Total	Per 100 000	Total	Per 100 000	Total	Per 100 000
A	725	3.91	736	3.89	761	3.97
B	355	1.92	401	2.12	1568	8.17
C	13051	70.42 ⁴	13214	69.85 ⁴	13425	69.98 ⁴
D	486	2.62	431	2.28	574	2.99
E	4512	24.35	4630	24.48	6106	31.83
F	2576	13.90	2147	11.35	2088	10.88
G	16397	88.48 ²	18255	96.50 ²	24338	126.87 ²
H	9	0.05	7	0.04	8	0.04
I	22703	122.51 ¹	22087	116.76 ¹	29680	154.71 ¹
J	14071	75.93 ³	14099	74.53 ³	20902	108.96 ³
K	9917	53.51 ⁵	10085	53.31 ⁵	11814	61.58 ⁵
L	170	0.92	190	1.00	244	1.27
M	1565	8.44	1481	7.83	1587	8.27
N	4524	24.41	4503	23.80	5233	27.28
O	58	0.31	46	0.24	95	0.50
P	731	3.94	750	3.96	779	4.06
Q	745	4.02	683	3.61	749	3.90
R	6308	34.04	7126	37.67	10114	52.72
S	1660	8.96	1843	9.74	2177	11.35
T	3903	21.06	4051	21.41	4783	24.93
U	0	0.00	0	0.00	3440	17.93
V	166	0.90	103	0.54	102	0.53
W	184	0.99	132	0.70	199	1.04
X	377	2.03	261	1.38	338	1.76
Y	91	0.49	36	0.19	57	0.30
Z	20	0.11	17	0.09	19	0.10
Ranking of mortality rate per 100,000 population ^{1.2.3.4.5}						

Gender characteristics (Table 2) revealed an increase in deaths among the male population of Kazakhstan: in 2018 - 53993 cases. in 2019 - 55415 cases and in 2020 - 73648 cases. The trend of increasing deaths is statistically insignificant (regression statistic $b=9827.5$. $p=0.292$).

The first five leading causes of death in Kazakhstan's male population, according to averaged data (\bar{X}) and the mortality rate in 2018 -2020 years were circulatory system diseases (I), respiratory system diseases (J), nervous system diseases (G), malignant neoplasms (C) which had third of the top 10 leading causes of death in 2018, fourth place in 2019 and third place in 2020; digestive system diseases (K). Deaths among men from infectious and parasitic diseases increased by 1.5 or more times in 2020 compared to 2018. The first five causes of deaths among men are: from infectious and parasitic diseases (B), from diseases not classified under other headings (R), from diseases of the skin and subcutaneous tissue

(L), diseases of the nervous system (G), and diseases of the respiratory organs (J).

In the female population, the number of death outcomes was as follows: in 2018 - 51311 cases, in 2019 - 51899 cases, and in 2020 - 67532 cases. The dynamics of deaths showed an increasing trend; however, unreliable (regression statistics $b=8110.5$, $p=0.313$). The first five leading causes of death in the Kazakhstan female population, according to averaged data (\bar{X}) and the mortality rate for 2018-2020 years were nervous system diseases (G), circulatory system diseases (I), respiratory system diseases (J), malignant neoplasms (C), and diseases not classified in other headings (R). Circulatory system diseases changed mortality rate ranking from first in 2018 to second in 2019-2020, while nervous system diseases raised from second in 2018 to 2019-2020. The number of deaths from infectious diseases in the female population increased by 1.5 or more times in 2020 compared to 2018.

Table 2. Kazakhstan's population deaths and mortality rate on gender and the ICD-10 codes per 100,000 population, 2018-2020

A primary cause of death in ICD-10 diagnosis	Men						Women					
	2018		2019		2020		2018		2019		2020	
	Total	Per 100 000	Total	Per 100 000	Total	Per 100 000	Total	Per 100 000	Total	Per 100 000	Total	Per 100 000
A	443	4.97	460	5.05	503	5.44	282	2.93	276	2.82	258	2.60
B	249	2.79	242	2.66	893	9.65	106	1.10	159	1.62	675	6.80
C	6966	78.16 ³	7120	78.13 ⁴	7152	77.31 ⁴	6085	63.26 ³	6094	62.16 ³	6273	63.15 ⁵
D	246	2.76	211	2.32	275	2.97	240	2.50	220	2.24	299	3.01
E	1601	17.96	1683	18.47	2329	25.18	2911	30.26	2947	30.06	3777	38.02
F	821	9.21	732	8.03	716	7.74	1755	18.25	1415	14.43	1372	13.81
G	6723	75.43 ⁴	7514	82.46 ³	10376	112.16 ³	9674	100.57 ²	10741	109.56 ¹	13962	140.56 ¹
H	5	0.06	3	0.03	6	0.06	4	0.04	4	0.04	2	0.02
I	12603	141.40 ¹	12505	137.23 ¹	16972	183.46 ¹	10100	105.00 ¹	9582	97.74 ²	12708	127.94 ²
J	8054	90.36 ²	8190	89.88 ²	11873	128.34 ²	6017	62.55 ⁴	5909	60.27 ⁴	9029	90.90 ³
K	5466	61.33 ⁵	5562	61.04 ⁵	6631	71.68 ⁵	4451	46.27 ⁵	4523	46.13	5183	52.18
L	68	0.76	89	0.98	109	1.18	102	1.06	101	1.03	135	1.36
M	475	5.33	457	5.02	513	5.55	1090	11.33	1024	10.44	1074	10.81
N	2405	26.98	2372	26.03	2799	30.26	2119	22.03	2131	21.74	2434	24.50
O	412	4.62	441	4.84	470	5.08	58	0.60	44	0.45	92	0.93
P	420	4.71	347	3.81	389	4.20	319	3.32	309	3.15	309	3.11
Q	2136	23.96	2492	27.35	3808	41.16	325	3.38	336	3.43	360	3.62
R	1275	14.30	1418	15.56	1669	18.04	4172	43.37	4636	47.29 ⁵	6309	63.52 ⁴
S	2953	33.13	3129	34.34	3689	39.88	385	4.00	425	4.33	508	5.11
T	0	0.00	0	0.00	1901	20.55	950	9.88	922	9.40	1094	11.01
U	124	1.39	78	0.86	75	0.81	0	0.00	0	0.00	1539	15.49
V	148	1.66	112	1.23	164	1.77	42	0.44	25	0.25	27	0.27
W	318	3.57	218	2.39	280	3.03	36	0.37	20	0.20	35	0.35
X	72	0.81	24	0.26	45	0.49	59	0.61	43	0.44	58	0.58
Y	10	0.11	16	0.18	11	0.12	19	0.20	12	0.12	12	0.12
Z	443	4.97	460	5.05	503	5.44	282	2.93	276	2.82	258	2.60

Ranking of mortality rate per 100,000 population ^{1,2,3,4,5}

The first five causes of deaths in the female population are: from infectious and parasitic diseases (B), from diseases associated with pregnancy, childbirth, and the postpartum period (O), from diseases, not diseases not elsewhere classified (R), and respiratory diseases (J).

Table 3 presented deaths and crude mortality rates by regions of the Republic of Kazakhstan. The trend of increasing mortality in the country is statistically insignificant (regression statistic $b=83.85$, $p=0.336$).

The regions with the highest mortality rate (excluding gender) in the studied years were the North-Kazakhstan region, Kostanay region, Pavlodar region, East Kazakhstan region, and Akmola oblast. In Nur-Sultan and Mangistau oblast, the mortality rate is one of the lowest in the country. The highest male mortality rate for 2018-2020 was estimated in the

North Kazakhstan region, the Kostanay region, the Pavlodar region, the Kazakhstan region, and the West Kazakhstan region. The lowest "male" mortality rate was in Nur-Sultan, Mangistau oblast, and Shymkent City.

The highest female mortality rate was observed in the North Kazakhstan region, Kostanay region, East Kazakhstan region, Pavlodar region, and Akmola region, and the lowest - in Nur-Sultan, Mangistau region, and Kyzylorda region.

Discussion

Despite the slight decrease in all deaths worldwide (55,49 mln) (2), Kazakhstan mortality rates are increased by 1.34 times according to death data from 2018 to 2020, as our current study shows.

Table 3. Deaths and crude mortality rates in Kazakhstan’s population by region per 100, 000, 2018-2020

Region	years					
	2018		2019		2020	
	total	Per 100 000 pop.	total	Per 100 000 pop.	total	Per 100 000 pop.
Total	105304	568.2	107314	567.3	141180	735.9
Akmola	6375	822.7 ⁵	6261	798.8 ⁵	7652	970.0 ⁵
Aktobe	3556	411.8 ¹²	4433	503.7 ¹⁰	5893	658.7 ¹⁰
Almaty	11763	583.3 ⁷	11778	571.8 ⁸	14389	685.1 ⁸
Atyrau	2893	460.2 ¹⁰	2417	376.6 ¹³	4127	631.5 ¹¹
EKO	12363	885.4 ⁴	12346	881.1 ⁴	15057	1074.7 ⁴
Zhambyl	6202	555.9 ⁹	6250	552.8 ⁹	7782	677.1 ⁹
WKO	5270	782.6 ⁶	5199	764.0 ⁶	6472	942.2 ⁶
Karaganda	8159	574.9 ⁸	8974	626.6 ⁷	12569	875.2 ⁷
Kostanay	8210	945.8 ²	8372	962.1 ²	10061	1182.6 ²
Kyzylorda	2506	327.5 ¹⁶	2880	369.9 ¹⁴	4388	551.9 ¹⁴
Mangistau	2332	342.0 ¹⁵	2407	339.9 ¹⁶	3475	474.0 ¹⁶
Pavlodar	7217	917.6 ³	7223	909.4 ³	8648	1084.5 ³
NKO	6199	1067.6 ¹	6364	1096.9 ¹	7353	1274.6 ¹
Turkestan city	7919	416.9 ¹¹	8254	426.4 ¹¹	11191	566.7 ¹²
Almaty city	7823	402.9 ¹³	7680	379.8 ¹²	10795	525.5 ¹⁵
Nur-Sultan	2959	269.5 ¹⁷	2838	244.0 ¹⁷	5277	437.5 ¹⁷
Shymkent city	3558	348.1 ¹⁴	3638	345.1 ¹⁵	6051	557.9 ¹³

The leading causes of death worldwide are associated with three large groups of diseases: cardiovascular (coronary heart disease, stroke), respiratory (chronic obstructive pulmonary disease, lower respiratory tract infections), and neonatal pathological conditions (1, 2, 11-13).

According to the World Bank classification, countries on gross national income are divided into low-, lower-middle-, upper-middle- and high-income (3). In low-income countries (Afghanistan, Yemen, and others), infectious diseases prevail over noncommunicable diseases, among the causes of death. In lower-middle-income countries (Kyrgyz Republic, Uzbekistan, Tajikistan, and others), the top 10 causes include five noncommunicable diseases, four infectious diseases, and injury. Whereas in upper-middle-income countries (Kazakhstan, Russia, Turkmenistan, and others), the leading causes of death are noncommunicable diseases and one infectious disease (lower respiratory tract infections). In high-income countries (Canada, France, and others), the leading causes of death are noncommunicable diseases (Ischemic heart disease, stroke, chronic obstructive pulmonary disease, lower respiratory infections, neonatal conditions, trachea, bronchus, lung cancers, Alzheimer’s disease, and other dementias, diabetes). In the current study, the leading causes of Kazakhstan’s population cause-specific mortality rate

for 2018-2020 were diseases of the circulatory system (I), diseases of the nervous system (G), diseases of the respiratory organs (J), malignant neoplasms (C), and diseases of the digestive organs (K).

For death disaggregated by sex, annual global deaths among women were around 15% lower than for men vs 8.31% in Kazakhstan. Despite a decreased mortality rate in the world female population, Kazakhstan’s female death increased by 1.31 times from 2018 to 2020. The leading causes of death in women were nervous system diseases (g), circulatory system diseases (i), respiratory system diseases (j), malignant neoplasms (c), and diseases not classified in other headings (r). It correlated with the global tendency to prevail neurological disorders, Alzheimer’s disease, and other dementias as a reason for death in women worldwide.

The death rate in males increased by 1.36 times from 2018 to 2020, and the reasons for it were the same for all Kazakhstan's population.

The distribution of regions in terms of mortality rate determined predominantly Northern, Eastern, and central regions of Kazakhstan (North Kazakhstan, Kostanay, Pavlodar, East Kazakhstan, and Akmola regions) in 2018-2020. The study's findings supported global trends in causes of death with a preponderance of non-communicable diseases, which are characteristic of upper-middle-income countries.

Study limitations

The potential study limitation is its retrospective nature.

Conclusion

Thus, the study determined the growth of crude mortality rates in the population of Kazakhstan and by disease classes during the study period from 2018 to 2020. The most significant increase compared to the previous year of mortality rates was observed in 2020, associated with the emergence of the COVID-19 pandemic. The leading causes of death for Kazakhstan's general population and by gender were non-communicable diseases (circulatory, nervous, respiratory, malignant neoplasms, and digestive organs) which characteristically were in upper-middle-income countries. Despite the slightly low level of women's mortality rate compared to men, they died from diseases of the nervous system (first rank) and other diseases (circulatory and respiratory system, malignant neoplasms, and diseases not classified under other headings). Distribution of regions by the level of population mortality identified North Kazakhstan oblast, Kostanay oblast, Pavlodar oblast, East Kazakhstan oblast, and Akmola oblast as the regions with the highest indicators.

Ethics: Ethical approval was not required for retrospective study

Peer-review: Internal and external.

Conflict of interest: None to declare

Authorship: Z.U.T., F. A. I., K.A. equally contributed to study and preparation of manuscript

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