Archives of the Balkan Medical Union
vol. 57, no. 3, pp. 222-230
September 2022

ORIGINAL PAPER

RURAL-URBAN DISPARITIES OF MORTALITY AND CAUSES OF DEATH IN THE REPUBLIC OF MOLDOVA

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Received August 24th, 2022, accepted September 12th, 2022
https://doi.org/10.31688/ABMU.2022.57.3.01

Abstract

Introduction. Evidence on disparities of mortality by place of residence based on reliable data is needed for appropriate public health programmes aimed at reducing high mortality in Moldova.
The objective of the study was to determine changes in mortality disparities for all causes and major groups of causes of death between rural and urban populations of the Republic of Moldova after independence.
Material and methods. The data were analysed by sex and place of residence for all causes and seven main groups of causes of death for two periods: 1991-93 and 2017-19. Abridged life tables and standardised death rates with 95% confidence intervals were computed. Mortality inequities between rural and urban areas were analysed in absolute and relative terms.
Results. Cardiovascular diseases and digestive system diseases in both sexes and external causes and respiratory system diseases among men accounted for the rural mortality disadvantage. Cancer mortality had a negative rural-urban gradient. During independence, the rural-urban gradient of all-cause mortality declined among women, but not among men. A more rapid reduction in mortality from circulatory system diseases and a more rapid growth of neoplasm mortality in

Résumé

Inégalités entre les zones rurale et urbaine en matière de mortalité et de causes de décès en la République de Moldova

Introduction. Les informations sur les disparités de la mortalité selon le lieu de résidence, fondées sur des données fiables, sont nécessaires pour des programmes de santé publique appropriés visant à réduire la mortalité globale élevée dans la République de Moldova.
L'objectif de l'étude était de déterminer les modifications dans les disparités de mortalité pour toutes causes et les principaux groupes de causes de décès entre les populations rurales et urbaines de la Moldavie après l'indépendance.
Matériel et méthodes. Les données ont été analysées par sexe et lieu de résidence pour toutes causes et sept principaux groupes de causes de décès pendant deux périodes : 1991-93 et 2017-19. Des tableaux de mortalité abrégées et des taux de mortalité standardisés avec des intervalles de confiance de 95 % ont été calculés. Les inégalités en matière de mortalité entre les zones rurales et urbaines ont été analysées en termes absolu et relatif.
Résultats. Les maladies cardiovasculaires et les maladies du système digestif chez les deux sexes et les causes

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rural areas than in urban areas narrowed the rural-urban disparities. For external causes and diseases of the respiratory system, inequalities in mortality between rural and urban areas increased over the study period.
Conclusions. Public health programmes aimed at reducing elevated cardiovascular mortality in rural areas are a key strategy for addressing mortality disparities between rural and urban populations.

Keywords: mortality, rural-urban gradient, disparities, causes of death, Eastern Europe.

Abbreviations list
ASDR – age-standardised death rate
CI – confidence interval
ICD – International Classification of Diseases and Causes of Death
NAPH – National Agency for Public Health of the Republic of Moldova
NBS – National Bureau of Statistics of the Republic of Moldova
RD – rate difference
RR – rate ratio

externes et les maladies du système respiratoire chez les hommes expliquaient le désavantage en matière de mortalité rurale. La mortalité par cancer avait un gradient rural-urbain négatif. Pendant l'indépendance, le gradient rural-urbain de mortalité de toutes causes a diminué chez les femmes, mais pas chez les hommes. Une réduction plus rapide de la mortalité due aux maladies du système circulatoire et une croissance plus rapide de la mortalité par cancer dans les zones rurales par rapports aux zones urbaines ont réduit les différences entre les zones rurales et urbaines. Pour les causes externes et les maladies du système respiratoire, les inégalités de mortalité entre les zones rurales et urbaines ont augmenté au cours de la période d'étude.
Conclusions. Les programmes de santé publique visant à réduire la mortalité cardiovasculaire élevée dans les zones rurales sont une stratégie clé afin de solutionner les disparités de mortalité entre les populations rurales et urbaines.

Mots-clés: mortalité, gradient rural-urbain, disparités, causes de décès, Europe de l'Est

Introduction

Health inequalities or health disparities are defined as differences in health outcomes such as mortality or morbidity rates or the distribution of health determinants across various population groups[1]. The differences in mortality between the urban and rural populations are some of them. In the literature, at least three types of health inequalities by place of residence are discussed. Some studies have pointed to an urban-rural mortality gradient, with higher mortality rates in urban areas than in rural areas in industrialized countries such as England, Ireland and the Netherlands[2]. Specific population subgroups in these countries tend to have poorer health status with the increasing level of industrialisation. For example, in Northern Ireland, urban areas were found to be less healthy than rural areas regarding the respiratory system diseases and lung cancer, suggesting pollution as a determinant factor[3]. At the same time, the inhabitants of the capital, for example, those living in London, can benefit from a protective „capital" effect[4]. Other studies have revealed an opposite mortality gradient when the rural population experienced poorer health compared to the urban population (a rural-urban gradient). This type of mortality disparities can be found in some post-communist countries such as Lithuania for all-cause and amendable mortality[5,6]. In the United States, there has been a growing discrepancy in mortality between rural and urban counties since the mid-1980s and a systematic rural mortality disadvantage for all causes and major causes of death[7,8]. Finally, there can be a complex differentiation characterized by a U-shaped relationship, with the lowest mortality rates in semi-rural and semi-urban areas and the highest in major cities and remote rural locations[2]. Urban-rural differences in mortality can vary across age groups. For example, recent evidence from Germany and England & Wales suggests that among the elderly, the urban excess mortality shifts towards the rural excess mortality with increasing age[9].

Past studies on mortality trends in the Republic of Moldova have shown a moderate increase in life expectancy since 2005, after decades of deterioration and stagnation in population health[10]. The lack of significant progress in life expectancy may reflect persistent differences in health status across the different sociodemographic subgroups of the population. From this point of view, analysis of mortality on the national level alone is insufficient to develop effective measures to overcome the current public health crisis. Evidence on mortality disparities by place of residence provides important information for public health policymakers. In the case of Moldova, such research became possible only recently after the National Bureau of Statistics published reliable data on the usual resident population by place of residence.

The objective of the study

The objective of this nationwide population-based study was to determine changes in mortality disparities for all causes and major groups of causes of death between rural and urban populations of the Republic of Moldova after independence.

Materials and methods

We used the depersonalized death records by sex, age, and place of residence (urban/rural) for 1991-1993 and 2017-2019 codified under the 9th revision (1991-1993) and the 10th revision (2017-2019) of the International Classification of Diseases and Causes of Death (ICD). For the first period, population counts were computed based on intercensal estimates produced at the national level[11] and the distribution of the population by place of residence in 1991-1993 according to official data[12]. In this way, we have reduced a possible bias that could result from an overestimation of official population numbers in the 1990s and, therefore, an underestimation of mortality rates (numerator-denominator bias). For the 2017-2019 period, we relied on the recently published official population estimates based on the corrected results of the 2014 Census, vital statistics, and border crossing migration data[13]. For the second period, mortality and population data did not cover the Transnistria region.

The following groups of causes of death were selected according to ICD-9 and ICD-10: all causes of death, infectious diseases (001-139; A00-B99), neoplasms (140-239; C00-D48), circulatory system diseases (390-459; I00-I99), respiratory system diseases (460-519; J00-J98), digestive system diseases (520-579; K00-K93), external causes of death (800-999; V01-Y98) and other diseases (240-389, 580-779; D50-H95, L00-Q99). The share of ill-defined causes of death in 1991-1993 (797-799 under ICD-9) in total mortality varied between 5% in urban males and 25% in rural females. More than 98% of ill-defined deaths were attributed to item 797 „Senility without mentioning of psychosis". We preliminary attributed these deaths to cardiovascular items as proposed in the previous study at the national level[10]. In 2017-2019, the share of ill-defined deaths (R00-R99 under ICD-10) was less than 1%, and these deaths were redistributed proportionally between other causes of death.

Age-specific death rates for all causes and seven main groups of causes of death were computed for two periods. Abridged life tables and 95% confidence intervals were computed by sex and place of residence[14]. A direct standardisation of mortality rates was used based on the European standard population[15]; 95% confidence intervals were computed for age-standardised death rates[16]. Mortality inequalities by place of residence were analysed in absolute and relative terms. Absolute difference or rate difference (RD) was computed as the difference between rural and urban standardised death rates. The relative difference or rate ratio (RR) was calculated as the ratio of rural to urban standardised death rates.

Results

Table 1 provides life expectancy at birth for men and women in urban and rural areas in 1991-1993 and 2017-2019. Given the 95% confidence intervals, the difference in life expectancy between urban and rural populations was statistically significant ($p<0.05$) for the two time periods analysed. For both sexes, the gap in life expectancy between rural and urban areas in the early 1990s was approximately three years, whereas in 2017-2019 it narrowed somewhat, but remained sufficiently large. Between 1991-1993 and 2017-2019, life expectancy grew slightly faster in rural regions than in urban regions. Female life expectancy at birth rose by 3.73 years (95% CI=3.41, 3.74) in rural areas and 3.28 years (95% CI=2.92, 3.28) in urban areas. In men, the corresponding figures were 2.79 years (95% CI=2.46, 2.82 years) and 2.40 years (95%

Table 1. Life expectancy at birth and 95% confidence intervals in urban and rural areas in 1991-1993 and 2017-2019, Republic of Moldova, by sex (years)

Period	*Urban*	*Rural*	*Total*	*Urban-rural difference*
		Males		
1991-93[1]	65.79 (65.6-65.97)	62.82 (62.66-63)	64.22 (64.1-64.35)	2.96*
2017-19	68.18 (67.97-68.38)	65.61 (65.43-65.78)	66.57 (66.43-66.71)	2.57*
		Females		
1991-93[1]	73.24 (73.08-73.42)	70.26 (70.09-70.42)	71.5 (71.39-71.61)	2.98*
2017-19	76.52 (76.32-76.7)	73.98 (73.82-74.14)	74.99 (74.86-75.11)	2.53*

[1] With Transnistria. * p-value < 0.05.
Source: author's calculations based on NBS, NAPH data.

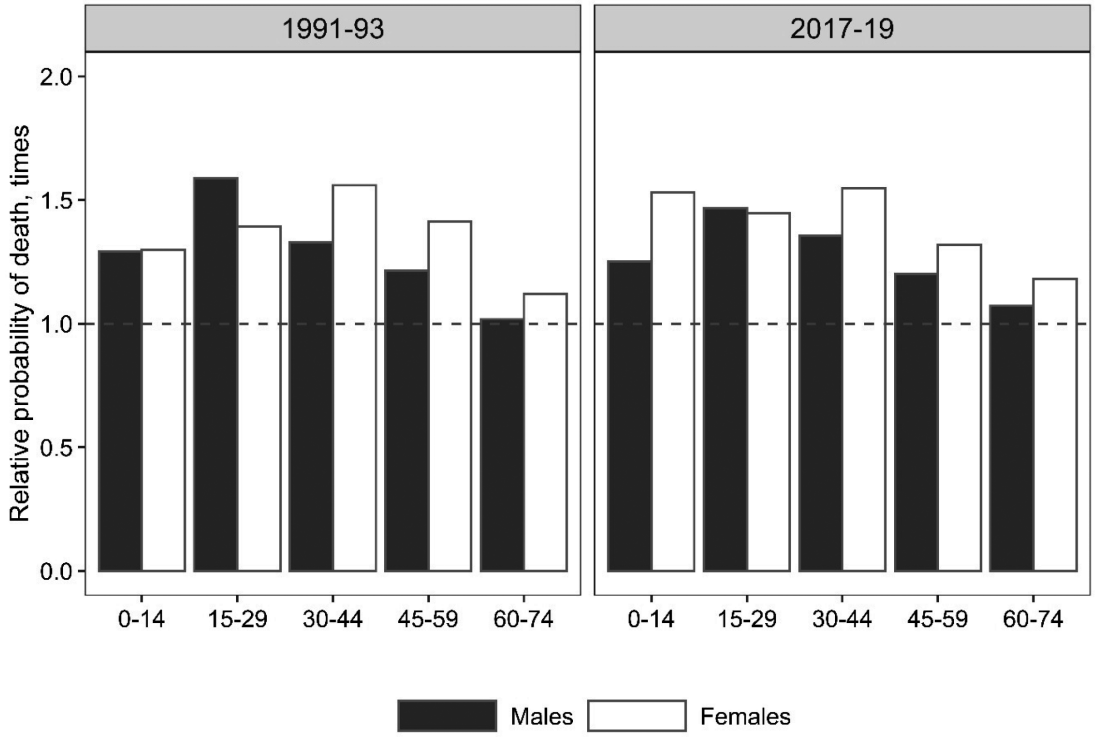

Figure 1. Age-specific ratios between rural and urban probabilities of dying in 1991-1993 and 2017-2019, Moldova, by sex (times).

Source: author's calculations based on NBS, NAPH data.

CI=1.99, 2.44), respectively. For both sexes, the progress was statistically significant ($p<0.05$).

Figure 1 represents the ratio of probabilities of dying (q_x) between rural and urban populations over the study periods. The probabilities of death were higher among children and adults aged 15-59 years for men and women in rural areas. Among those over the age of 60, inequalities in mortality were much less noticeable, if not absent. The greatest excess in rural mortality occurred in the 15-29 age group in males and the 30-44 age group in females in 1991-1993 (1.6 times).

Table 2 shows standardised death rates in 1991-1993 and 2017-2019 for all causes and seven main groups of causes of death by place of residence and changes in mortality differences between rural and urban areas. In 1991-1993 and 2017-2019, among men and women, mortality rates for all causes, diseases of the circulatory system, diseases of the respiratory system, diseases of the digestive system and external causes of death were higher in rural areas than in urban areas ($p<0.05$). Mortality from neoplasms was higher among urban males and females ($p<0.05$). Mortality rates were higher in urban areas than in rural areas for other diseases in 1991-1993 for both sexes and for infectious diseases in 2017-2019 among women ($p<0.05$).

Among men, in 2017-2019 compared to 1991-1993, mortality decline was statistically significant for all causes, diseases of the circulatory system and external causes in urban and rural areas and diseases of the respiratory system in urban areas ($p<0.05$). Among women, the decrease in death rates between 1991-1993 and 2017-2019 was statistically significant for all causes, diseases of the circulatory system, diseases of the respiratory system, diseases of the digestive system, external causes in both rural and urban areas and other diseases in urban areas ($p<0.05$). The progress in cardiovascular mortality among men and women was more prominent in rural areas than in urban areas (the change in mortality difference in Table 2 has a negative value). On the contrary, the decline in male mortality from external causes was more marked in urban areas than in rural ones (the change in mortality difference in Table 2 has a positive value). In both places of residence, mortality from neoplasms increased statistically significant after independence, more rapidly in rural areas than in urban areas (the change in mortality difference in Table 2 has a positive value).

Table 3 presents data on absolute and relative differences in standardised mortality rates between the rural and urban populations in 1991-1993 and 2017-2019. Among men, in 2017-2019 compared to 1991-1993, absolute and relative inequalities in mortality declined for diseases of the circulatory

Table 2. Age-standardised death rates by place of residence in 1991-1993 and 2017-2019 and change in mortality differences between rural and urban areas, Republic of Moldova, by cause and sex

	1991-1993		*2017-2019*		*Change (per 100000)*[1]
	ASDR, rural (95% CI)	*ASDR, urban (95% CI)*	*ASDR, rural (95% CI)*	*ASDR, urban (95% CI)*	
			Males		
Infectious diseases	18.87 (17.16; 20.69)	18.28 (15.89; 20.84)	21.62 (19.64; 23.73)	23.53 (20.48; 26.86)	–2.51
Neoplasms	260.3 (252.75; 268)*	375.47 (361.64; 389.62)	**370.8** (360.79; 380.99)*	**448.32** (433.03; 463.95)	37.65
Circulatory system diseases	1930.74 (1900.27; 1961.52)*	1518.88 (1481.99; 1556.3)	**1719.45** (1692.14; 1747.05)*	**1428.49** (1394.39; 1463.11)	–120.91
Respiratory system diseases	163.4 (156.64; 170.34)*	137.41 (127.71; 147.5)	154.43 (147.2; 161.87)*	**101.23** (93.51; 109.32)	27.21
Digestive system diseases	188.02 (181.78; 194.4)*	148.33 (140.18; 156.76)	191.9 (185.13; 198.83)*	147.45 (139; 156.22)	4.76
External causes	225.51 (219.18; 231.96)*	203.46 (195.03; 212.08)	**175.47** (169.47; 181.62)*	**128.45** (121.17; 136.01)	24.97
Other diseases	72.42 (68.64; 76.32)*	98.51 (91.57; 105.7)	78.86 (74.33; 83.56)	**75.26** (69.29; 81.54)	29.69
All causes	2859.25 (2825.62; 2893.13)*	2500.34 (2457.35; 2543.73)	**2712.52** (2680.75; 2744.52)*	**2352.74** (2312.3; 2393.62)	0.86
			Females		
Infectious diseases	5.39 (4.67; 6.19)	4.89 (4; 5.9)	**7.28** (6.21; 8.48)*	**11.44** (9.69; 13.38)	–4.66
Neoplasms	137.16 (132.82; 141.61)*	212.83 (205.44; 220.4)	**179.68** (174.08; 185.4)*	**237.78** (229.35; 246.42)	17.56
Circulatory system diseases	1536.62 (1517.79; 1555.62)*	1211.53 (1189.64; 1233.69)	**1334.26** (1316.59; 1352.09)*	**1112.67** (1090.63; 1135.03)	–103.52
Respiratory system diseases	66.64 (63.37; 70.01)*	51.29 (47.39; 55.39)	**52.65** (49.29; 56.17)*	**34.2** (30.72; 37.93)	3.10
Digestive system diseases	155.56 (150.95; 160.27)*	102.15 (97.06; 107.42)	**134.24** (129.46; 139.15)*	**86.87** (81.78; 92.17)	–6.03
External causes	70.33 (67.2; 73.56)*	62.31 (58.51; 66.25)	**38.57** (36; 41.27)*	**28.34** (25.52; 31.36)	2.20
Other diseases	47.7 (45.33; 50.16)*	63.59 (59.95; 67.37)	51.21 (48.24; 54.31)	**52.4** (48.57; 56.43)	14.70
All causes	2019.41 (1998.85; 2040.12)*	1708.58 (1683.96; 1733.44)	**1797.88** (1777.99; 1817.93)*	**1563.69** (1538.71; 1588.96)	–76.65

ASDR: age-standardised death rate, per 100000 population. CI – confidence interval.

* p-value < 0.05 compared to urban areas. Statistically significant differences compared to 1991-93 are marked in bold (p<0.05).

[1] Change in mortality difference between rural and urban areas was calculated[6]:

$(ASDR_{2017\text{-}19,\ rural} - ASDR_{1991\text{-}93,\ rural}) - (ASDR_{2017\text{-}19,\ urban} - ASDR_{1991\text{-}93,\ urban})$. If mortality decreases between 1991-93 and 2017-19, negative values mean that a decline was greater in rural areas. If mortality increases, positive values mean that an increase was higher in rural areas. Values near zero indicate similar changes in rural and urban areas.

Source: author's calculations based on NBS, NAPH data.

system and neoplasms (p<0.05). On the other hand, rural-urban disparities increased for mortality from respiratory diseases, digestive diseases and external causes of death (p<0.05). Due to multidirectional changes in rural-urban disparities for different causes of death, all-cause mortality among men did not change statistically significant concerning absolute and relative disparities (p>0.05). Among women, the rate difference for all-cause mortality dropped from 311 deaths to 234 deaths per 100,000 population or 25% (p<0.05), while the rate ratio decreased from 1.18 in 1991-1993 to 1.15 in 2017-2019 or by 21% (p<0.05). Like among men, absolute and relative disparities in mortality between rural and urban women

Table 3. Absolute (RD) and relative (RR) differences in age-standardised death rates between rural and urban populations in 1991-93 and 2017-19 and changes in RD and RR between 1991-1993 and 2017-2019, Republic of Moldova, by sex and cause.

	1991-1993		*2017-2019*		*Change (%)*	
	RD (95% CI)	*RR (95% CI)*	*RD (95% CI)*	*RR (95% CI)*	*RD*[1]	*RR*[2]
			Males			
Infectious diseases	0.59 (-0.15; 1.27)	1.03 (0.99; 1.08)	-1.92 (-3.13; –0.84)*	0.92 (0.88; 0.96)	-423.63	139.79
Neoplasms	-115.17 (-121.61; –108.89)	0.69 (0.69; 0.7)	-77.53 (-82.97; –72.25)*	0.83 (0.82; 0.83)	-32.69	-77.38
Circulatory system diseases	411.86 (405.22; 418.27)	1.27 (1.26; 1.28)	290.95 (283.94; 297.75)*	1.2 (1.19; 1.21)	-29.36	-33.13
Respiratory system diseases	25.99 (22.84; 28.92)	1.19 (1.15; 1.23)	53.2 (52.55; 53.69)*	1.53 (1.48; 1.57)	104.70	64.01
Digestive system diseases	39.69 (37.65; 41.6)	1.27 (1.24; 1.3)	44.45 (42.61; 46.13)*	1.3 (1.27; 1.33)	11.99	11.24
External causes	22.05 (19.88; 24.16)	1.11 (1.09; 1.12)	47.02 (45.61; 48.3)*	1.37 (1.34; 1.4)	113.23	70.39
Other diseases	-26.09 (-29.38; –22.93)	0.74 (0.72; 0.75)	3.6 (2.02; 5.04)*	1.05 (1.02; 1.07)	-113.78	654.20
All causes	358.92 (349.4; 368.27)	1.14 (1.14; 1.15)	359.77 (350.9; 368.46)	1.15 (1.15; 1.16)	0.24	6.13
			Females			
Infectious diseases	0.5 (0.29; 0.67)	1.1 (1.05; 1.17)	-4.16 (-4.9; –3.49)*	0.64 (0.63; 0.64)	-927.55	128.25
Neoplasms	-75.67 (-78.79; –72.62)	0.64 (0.64; 0.65)	-58.1 (-61.02; –55.27)*	0.76 (0.75; 0.76)	-23.21	-45.50
Circulatory system diseases	325.1 (321.93; 328.15)	1.27 (1.26; 1.28)	221.58 (217.06; 225.96)*	1.2 (1.19; 1.21)	-31.84	-34.75
Respiratory system diseases	15.35 (14.62; 15.99)	1.3 (1.26; 1.34)	18.45 (18.23; 18.56)*	1.54 (1.48; 1.6)	20.17	44.51
Digestive system diseases	53.41 (52.85; 53.89)	1.52 (1.49; 1.56)	47.38 (46.98; 47.68)*	1.55 (1.51; 1.58)	-11.30	4.13
External causes	8.03 (7.31; 8.69)	1.13 (1.11; 1.15)	10.23 (9.91; 10.47)*	1.36 (1.32; 1.41)	27.41	64.30
Other diseases	-15.89 (-17.22; –14.61)	0.75 (0.74; 0.76)	-1.19 (-2.12; –0.33)*	0.98 (0.96; 0.99)	-92.53	-1003.29
All causes	310.83 (306.68; 314.89)	1.18 (1.18; 1.19)	234.19 (228.98; 239.28)*	1.15 (1.14; 1.16)	-24.66	-21.47

RD: rate difference (rural-urban), per 100000 population. RR: rate ratio (rural / urban), times.
95% CI – 95% confidence interval. * p-value < 0.05 compared to the period 1991-93.
[1] change in RD was calculated[6]: (RD2017-19 – RD1991-93) / RD1991-93 x 100.
[2] change in RR was calculated[6]: (RR2017-19 – RR1991-93) / (RR2017-19 – 1) x 100.
Source: author's calculations based on NBS, NAPH data.

were reduced for diseases of the circulatory system and neoplasms ($p<0.05$) and increased for diseases of the respiratory system and external causes ($p<0.05$). Changes in female mortality inequalities associated with digestive system diseases were not statistically significant in terms of rate ratios ($RR_{1991-93}$=1.52, $RR_{2017-19}$=1.55; $p>0.05$). Mortality from infectious diseases did not have statistically significant differences by place of residence in the early 1990s. In 2017-2019, this group of diseases became more widespread in urban areas, particularly in females (RR=0.64, $p<0.05$). The inverse situation was observed for the category „other diseases" which was more frequent in urban areas in the early 1990s (RR in males=0.74; RR in females=0.75; $p<0.05$) and had a rate ratio very close to one in 2017-2019.

Table 4 shows the impact of differences in mortality by cause of death between rural and urban areas on differences in all-cause mortality in 1991-1993 and 2017-2019. Among males, differences in cardiovascular

Table 4. Absolute differences (RD) in mortality by cause between rural and urban areas and their impact (%) on absolute differences in all-cause mortality in 1991-1993 and 2017-2019, Republic of Moldova, by sex

	1991-1993		2017-2019	
	RD	%[1]	RD	%[1]
Males				
Infectious diseases	0.59	0.16	-1.92	-0.53
Neoplasms	-115.17	-32.09	-77.53	-21.55
Circulatory system diseases	411.86	114.75	290.95	80.87
Respiratory system diseases	25.99	7.24	53.20	14.79
Digestive system diseases	39.69	11.06	44.45	12.36
External causes	22.05	6.14	47.02	13.07
Other diseases	-26.09	-7.27	3.60	1.00
All causes	358.92	100.00	359.77	100.00
Females				
Infectious diseases	0.50	0.16	-4.16	-1.78
Neoplasms	-75.67	-24.34	-58.10	-24.81
Circulatory system diseases	325.10	104.59	221.58	94.62
Respiratory system diseases	15.35	4.94	18.45	7.88
Digestive system diseases	53.41	17.18	47.38	20.23
External causes	8.03	2.58	10.23	4.37
Other diseases	-15.89	-5.11	-1.19	-0.51
All causes	310.83	100.00	234.19	100.00

RD: rate difference (rural-urban), per 100000 population.
[1]the impact of RD in mortality from a cause *i* on RD in all-cause mortality was calculated[6]:
RD for a cause i / RD for all causes x 100.
Source: author's calculations based on NBS, NAPH data.

mortality most influenced differences in all-cause mortality over the two periods (114.75% and 80.87%). The impact of respiratory diseases and external causes of death on overall mortality differences between rural and urban males nearly doubled between 1991-1993 and 2017-2019. At the same time, the impact of digestive system diseases remained unchanged. The combined effect of respiratory diseases, digestive diseases and external causes of death on rural-urban mortality disparities for all causes increased from 24% in 1991-1993 to 40% in 2017-2019. Among women, during the two periods, differences in mortality between rural and urban settings were mainly attributable to differences in mortality from diseases of the circulatory system (104.95% and 94.62%) and diseases of the digestive system (17.18% and 20.23%). For both sexes, differences in mortality from neoplasms had the smallest effect among men (-32.09% in 1991-1993 and –21.55% in 2017-2019) and women (-24.34% in 1991-1993 and –24.81% in 2017-2019).

Discussion

The study focused on inequalities in all-cause and cause-specific mortality between the rural and urban populations of the Republic of Moldova. The results were limited to global changes in rural-urban mortality differences between 1991-1993 and 2017-2019. The analysis was done after preliminary processing of the raw data with attention to redistributing the ill-defined causes of death in the 1990s when their share increased considerably. According to the international recommendations, mortality inequalities were analysed in terms of absolute and relative measures.

A rural-urban mortality gradient common to many post-communist countries was observed in Moldova. Our findings showed that differences in all-cause mortality between rural and urban Moldovan populations were more pronounced among males than females in absolute terms, while the gradient was the same in relative terms for both sexes. At the start of the 1990s, the rate ratio for overall mortality among women was even higher than among men. Excess deaths in rural areas were observed in children and the adult population, while older people were less prone to health inequalities, particularly older men. These results are consistent with a census-linked study in Lithuania which demonstrated a lower involvement of the elderly in rural-urban mortality differentiation[17].

In the early 1990s and the late 2010s, the two leading causes of death in urban and rural mortality profiles were circulatory system diseases and neoplasms, accounting for 75-80% of all deaths. The exception was rural females whose mortality rates from digestive system diseases were statistically significantly higher than those from neoplasms in 1991-1993. Cardiovascular mortality was the principal source of the rural mortality disadvantage. Over the study period, the gap in cardiovascular mortality between rural and urban populations was narrowed due to a more rapid decline in rural areas. Our research also found that the urban population was consistently at a higher risk of dying from neoplasms than in rural areas (a negative rural-urban gradient). This is partly correlated with the results for Lithuania where only women tend to have higher cancer mortality in urban areas than in rural areas, particularly from smoking-related cancers [17]. For both sexes, however, cancer mortality has increased more rapidly since independence in rural areas than in urban areas, thus lessening the gap between the two settings.

Diseases of the digestive system and external causes were the other two main causes of death that dominated mortality patterns in both areas. A relatively high proportion of digestive system diseases, especially among rural females, is a specific feature of the Moldovan mortality pattern compared to other former Soviet republics. The difference in standardised indicators for this pathology between rural women and urban men was statistically non-significant. The burden of liver cirrhosis on the health of the Moldovan population for both sexes is to be closely linked to a dangerous Mediterranean alcohol consumption dominated by homemade wine[10]. On the contrary, the influence of external causes of death is less important in Moldova than in traditional spirits-drinking countries such as Lithuania or Ukraine. Over the study period, the rural-urban gradient of mortality due to external causes increased as result of more rapid progress in urban areas. At the same time, health problems associated with the chronic consequences of alcoholism, such as liver cirrhosis, have maintained a high level among men and have decreased moderately among women without changing rural-urban inequalities. Respiratory diseases have also contributed to an increase in mortality disparities between rural and urban areas due to a more favourable evolution among the urban population.

Conclusions

A positive rural-urban mortality gradient for all-cause mortality, expressed equally in relative terms for both sexes, was found. Diseases of the circulatory system and digestive diseases among men and women and external causes and respiratory system diseases among men were the principal components accounting for the rural mortality disadvantage. A negative rural-urban gradient was determined for cancer mortality. During independence, the rural-urban gradient of all-cause mortality declined among women, but not among men. For both sexes, a more rapid reduction in mortality from diseases of the circulatory system and a more rapid growth of neoplasm mortality in rural areas than in urban areas narrowed the gap between the two settings. Different changes in mortality from diseases of the respiratory system and external causes of death by place of residence contributed to an increase in the rural-urban mortality differential. Public health programmes aimed at reducing elevated cardiovascular mortality in rural areas are a key strategy for addressing mortality disparities between rural and urban populations.

Author Contributions:

Conceptualization, O.P..; methodology, O.P.; software, O.P; validation, O.P.; formal analysis, O.P.; investigation, O.P.; resources, O.P; data curation, O.P..; writing–original draft preparation, O.P.; writing–review and editing, O.P..; visualization, O.P..; supervision, O.P.; project administration, O.P.

Compliance with Ethics Requirements:

„The authors declare no conflict of interest regarding this article"

„The author declares that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study"

Acknowledgements

The study was carried out in the framework of Project 21.00208.8007.02/PD „Socio-demographic and regional mortality disparities in the Republic of Moldova".

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