

REGIONAL DIFFERENCES AND THE IMPACT OF THE COVID-19 PANDEMIC ON MORTALITY TRENDS IN MOLDOVA IN 2014-2023

Olga PENINA, Habilitated doctor in medicine,
Nicolae Testemitanu State University of Medicine and Pharmacy, Moldova,

E-mail: olga.penina@usmf.md.

ORCID: <https://orcid.org/0000-0002-3884-2751>

DOI: <https://doi.org/10.36004/nier.cdr.18.2024.02>

Abstract. *Previous studies have demonstrated a statistically significant difference in mortality between the capital, Chisinau, and the leading northern region, compared to the lagging central and southern regions in Moldova. Aim of the study: To examine the evolution of overall and cause-specific mortality by sex and major geographical regions in Moldova from 2014 to 2023, with particular emphasis on the COVID-19 pandemic period. Material and methods: Life tables with 95% confidence intervals were computed by sex and geographical region. Changes in life expectancy were decomposed by cause of death. The analysis was based on a depersonalised database of individual death records and the usual resident population for 2014-2023. Results: Between 2014 and 2023, life expectancy at birth for both sexes increased by 2.4 years, with equal or greater gains observed in the lagging central (2.3 years) and southern (3.2 years) regions compared to the leading northern region (1.6 years) and the capital (2.3 years). The impact of the COVID-19 pandemic on life expectancy losses between 2019 and 2021 was most severe in the capital (3.8 years) and northern region (2.7 years), while the lagging regions were much less affected. Post-crisis recovery was more evident in the hardest-hit leading regions, though notable improvements were also observed in other regions. Conclusions: Overall improvements in life expectancy in Moldova after 2014 were significantly disrupted by the COVID-19 pandemic, particularly in the best-performing regions. Conversely, the lesser impact of the pandemic on the worst-performing regions contributed to more pronounced overall life expectancy gains in those areas.*

Keywords: mortality, regional differences, COVID-19, Moldova

JEL: I14, J19

UDC: 314.14(478)

Introduction. Regional disparities in mortality within countries or regions are well-documented in the literature. For example, in France, a distinct mortality gradient exists between the south and north (Barbieri, 2013). In Italy, infant mortality tends to increase from north to south, whereas adult mortality decreases (Caselli & Vallin, 2002). In Germany, mortality rates rise from south to north and from west to east (Kibebe et al., 2015). In Ukraine, the southeastern regions display the lowest life expectancy at birth (Levchuk & Luschik, 2019).

Previous studies on regional mortality disparities in the Republic of Moldova (hereafter referred to as Moldova) have revealed a mortality gradient between the capital, Chisinau, and the northern region, in contrast to the central and southern regions (Gagauz et al., 2021). This differentiation was more pronounced among females than males. Furthermore, over time, the northern population, particularly men, gradually lost this advantage (Penina, 2022). The lack of reliable annual population data previously limited the analysis of the geographical mortality profile in Moldova to census data and surrounding vital statistics. However, the National Bureau of Statistics has recently provided accurate population estimates based on the 2014 census, vital statistics, and migration data, in line with the usual residence definition.

This paper aims to analyse the evolution of life expectancy trends and major causes of death by geographical regions in Moldova from 2014 to 2022. The research questions addressed are as follows:

1. Have the disparities in mortality between the leading and lagging regions remained consistent over time?
2. What was the impact of the COVID-19 pandemic on regional mortality differences?
3. Which causes of death had the most significant effect on changes in life expectancy across different regions before, during, and after the COVID-19 pandemic?

Research methodology. A depersonalised database of death records, classified by detailed ICD-10 codes for the 2014-2023 period, was provided by the National Agency for Public Health (NAPH). Population counts based on usual residence, retrieved from the official website of the National Bureau of Statistics (NBS), were available by sex, 5-year age groups, and district for 2014-2024.

Firstly, we computed age-specific death rates for the main geographical regions: North (24 districts), Centre (26 districts), South (18 districts), and the municipality of Chisinau (the capital). Data for Transnistria were not available (*Figure 1*). Subsequently, abridged life tables with 95% confidence intervals (CI) were computed by sex and region for the 2014-2023 period. Age-specific death rates were also calculated for the following causes of death: infectious diseases (A00-B94, U04, U07), neoplasms (C00-D48), cardiovascular diseases (I00-I99), respiratory diseases (J00-J98), digestive diseases (K00-K93), external causes of death (V01-Y98), and other causes (remaining ICD-10 codes). Changes in life expectancy across different periods were decomposed by age and cause.

The data were analysed using R, employing the packages “PHEindicatorMethods” (Anderson et al., 2022), “DemoDecomp” (version 1.0.1) (Riffe, 2018) and a custom R function written by C.G. Camarda for abridged life tables with 95% CI (Camarda, n.d.).



Figure 1. **Geographical regions of Moldova: North, Centre, South, Transnistria and the municipality of Chisinau**

Source: author's elaboration based on (GADM, 2018)

Main results. *Table 1* presents life expectancy at birth with 95% CI by sex and geographical region for four key years: 2014 (the start of the observation period), 2019 (the year prior to the COVID-19 pandemic), 2021 (the year when the lowest values were recorded), and 2023 (the most recent year of observation). Changes in life expectancy were analysed for the following three periods:

- The pre-pandemic period (2014 to 2019);
- The COVID-19 pandemic (2019 to 2021);
- The post-pandemic period (2021 to 2023).

The pre-pandemic period was characterised by overall improvements in life expectancy at the national level for both males and females (1.4 years). Among males, life expectancy increased most significantly in the North (2.3 years) and least in the Centre (0.3 years), whereas among females, the largest gains were observed in the South compared to other regions. Overall, health improvements were evident across all regions before 2019, with the municipality of Chisinau maintaining its leading position (70.8 years for males and 77.8 years for females in 2019), followed by the North. The Centre (64 years for males and 72.6 years for females in 2019) and the South remained lagging.

Table 1. Life expectancy at birth with 95% CI by sex and region in Moldova and its changes between 2014 and 2023 (years)

Regions	Life expectancy at birth (years), 95% CI				Changes (years)			
	2014	2019	2021	2023	2014-2019	2019-2021	2021-2023	2014-2023
<i>Males</i>								
North	65.1 (64.6,65.5)	67.4 (67,67.9)	64.8 (64.4,65.3)	66.8 (66.3,67.3)	2.3	-2.6	2.0	1.7
Centre	63.7 (63.3,64.1)	64 (63.5,64.4)	63.5 (63.1,64)	65.1 (64.6,65.6)	0.3	-0.5	1.6	1.4
South	64.3 (63.8,64.8)	65.3 (64.7,65.9)	65.2 (64.7,65.8)	67 (66.5,67.6)	1.1	-0.1	1.9	2.8
Chisinau	68.8 (68.3,69.3)	70.8 (70.3,71.2)	66.7 (66.3,67.1)	70.9 (70.4,71.5)	1.9	-4.1	4.2	2.1
<i>Moldova</i>	65.2 (65,65.5)	66.6 (66.4,66.9)	65 (64.8,65.2)	67.4 (67.1,67.7)	1.4	-1.6	2.4	2.2
<i>Females</i>								
North	74.3 (73.9,74.7)	75.3 (74.9,75.8)	72.6 (72.2,73.1)	75.7 (75.2,76.2)	1.0	-2.7	3.1	1.4
Centre	71.4 (71,71.8)	72.6 (72.2,73)	71.5 (71,71.9)	74.6 (74.2,75)	1.2	-1.2	3.1	3.2
South	72.5 (72,73)	74.9 (74.4,75.3)	72.6 (72.1,73.2)	75.8 (75.1,76.4)	2.4	-2.2	3.2	3.3
Chisinau	76.8 (76.4,77.2)	77.8 (77.4,78.2)	74.5 (74.1,74.9)	78.9 (78.5,79.3)	1.0	-3.3	4.4	2.1
<i>Moldova</i>	73.6 (73.4,73.8)	75 (74.7,75.2)	72.8 (72.6,73)	76.2 (76,76.4)	1.4	-2.2	3.4	2.6

Source: author's calculations based on NBS and NAPH data

The COVID-19 pandemic in 2020-2021 had a varied impact on the Moldovan population. In both the capital and the northern region, life expectancy saw the most significant decline for both sexes. In the municipality of Chisinau, males lost 4.1 years of life expectancy between 2019 and 2021, while females lost 3.3 years. In contrast, the changes in male life expectancy over the same period were minimal in the South (-0.1 years) and Centre (-0.5 years). The female population in these regions experienced a noticeable deterioration in health but to a much lesser extent than in the capital or the North.

The recovery period (2021-2023) saw the most significant improvement in life expectancy in the capital, with males gaining 4.2 years and females 4.4 years. In other regions, which had been less affected by the COVID-19 pandemic, the situation also improved, with gains of more than 1.5 years for males and almost 3.0 years for females. As a result, the overall gains in life expectancy at birth between 2014 and 2023 were the most pronounced in the southern and central regions, while in the capital and the northern region, the overall improvement was substantially limited by the shock of the COVID-19 pandemic.

Table 2. illustrates the decomposition of changes in life expectancy by the main groups of causes of death for both sexes across geographical regions over the three analysed periods. During the pre-pandemic period (2014-2019), the overall increase in life expectancy was primarily driven by a decline in mortality from cardiovascular diseases and external causes of death. The impact of reduced cardiovascular disease mortality was particularly significant in the municipality of Chisinau, contributing 0.74 years to the total increase of 1.56 years (47%). The effect of the decline in external causes of death was less pronounced in the capital but was notable in the other three regions.

Table 2. Decomposition of the difference in life expectancy at birth by cause of death and geographical region between 2014 and 2023 in Moldova, both sexes (years)

Region	Infections	Neoplasms	Cardiovascular	Respiratory	Digestive	External	Other	Total
2014-2019								
North	0.20	0.03	0.40	0.11	0.09	0.56	0.32	1.71
Centre	0.03	-0.08	0.33	0.01	0.12	0.28	0.01	0.70
South	-0.04	0.26	0.62	0.03	0.16	0.51	0.11	1.65
Chisinau	0.06	0.25	0.74	0.06	0.21	0.29	-0.05	1.56
Moldova	0.08	0.08	0.50	0.06	0.16	0.42	0.10	1.40
2019-2021								
North	-1.75	0.12	-0.75	-0.11	-0.10	0.00	-0.15	-2.74
Centre	-1.43	0.22	-0.08	0.05	0.27	0.24	-0.06	-0.79
South	-1.57	0.18	-0.13	0.06	0.26	0.21	-0.07	-1.06
Chisinau	-2.83	0.18	-0.76	-0.25	-0.03	0.02	-0.10	-3.77
Moldova	-1.80	0.18	-0.39	-0.05	0.12	0.12	-0.09	-1.91
2021-2023								
North	1.62	-0.03	0.75	0.14	0.12	0.19	-0.22	2.57
Centre	1.49	0.02	0.81	0.03	-0.09	0.21	-0.06	2.41
South	1.67	0.08	0.84	0.01	-0.11	0.27	-0.18	2.58
Chisinau	2.87	0.02	1.28	0.07	0.15	0.00	0.08	4.47
Moldova	1.83	0.03	0.90	0.08	0.03	0.18	-0.08	2.97
2014-2023								
North	0.06	0.12	0.41	0.15	0.12	0.76	-0.06	1.56
Centre	0.00	0.16	1.11	0.09	0.33	0.75	-0.13	2.31
South	-0.02	0.54	1.38	0.09	0.34	1.01	-0.14	3.20
Chisinau	0.03	0.45	1.37	-0.16	0.34	0.32	-0.09	2.26
Moldova	0.03	0.30	1.04	0.09	0.32	0.73	-0.07	2.44

Source: author's calculations based on NBS and NAPH data

During the COVID-19 pandemic, the contribution of infectious diseases to the overall decrease in life expectancy was most pronounced in the municipality of Chisinau, accounting for 75% or 2.8 years out of a total decline of 3.8 years. The negative impact of cardiovascular diseases was also significant in both the capital and the northern region (0.75 years), though less so in other regions. In contrast, in the Centre and South, the spike in COVID-19 mortality was partly offset by decreases in mortality from external causes, digestive diseases. Moreover, neoplasms

made positive contributions to life expectancy in all regions during the COVID-19 pandemic.

The growth in life expectancy during the post-pandemic period was largely attributed to the decline in mortality from infectious diseases and circulatory system diseases. In all the analysed regions, these two groups of causes of death contributed more than 60% and 30%, respectively, to the positive change. The impact of other causes of death during this period was minimal.

The overall changes in life expectancy at birth between 2014 and 2023 were predominantly driven by shifts in mortality from cardiovascular diseases and external causes. The positive contribution of reduced cardiovascular mortality was least significant in the North (0.41 years) but was much more substantial in the capital (1.37 years) and the South (1.38 years). The effect of external causes on life expectancy growth was much less pronounced in the capital than in other parts of the country. Additionally, the positive impact of neoplasms became more significant across all regions, particularly in the South (0.54 years) and the capital (0.45 years).

Discussion and conclusions. This paper aimed to analyse the changes in life expectancy at birth across the main geographical regions of Moldova: North, Centre, South, and the municipality of Chisinau.

Mortality levels consistently remained lower in the capital, even during the COVID-19 pandemic, when the gap in life expectancy between regions became minimal. Before the pandemic, life expectancy was significantly below the national level in the Centre, whereas in the South and North, it was closer to the national average. The pre-pandemic period saw notable improvements in population health across all regions, largely due to better control of cardiovascular diseases and external causes of death. In Chisinau, these health gains were primarily attributed to a reduction in cardiovascular mortality. In contrast, across the rest of the country, improvements in life expectancy were either equally driven by reductions in cardiovascular and external causes of death or, in some cases, more so by the latter.

The epidemiological crisis triggered by the COVID-19 pandemic in Moldova mirrored trends observed in other Eastern European countries (Kozlov et al., 2024). At the regional level, the COVID-19 pandemic had the most significant impact on the population of the municipality of Chisinau and the North, driven by a sharp increase in infectious mortality, along with notable rises in cardiovascular and respiratory deaths. While population losses due to COVID-19 were also substantial in the Centre and South, they were less pronounced. In these regions, the deterioration in cardiovascular mortality was negligible, and ongoing improvements in mortality from external causes and digestive diseases helped mitigate the overall negative decline in life expectancy. Notably, neoplasm mortality remained largely unaffected by the pandemic and even made positive contributions to overall changes in life expectancy. The post-pandemic period, characterised by a swift recovery in life expectancy, can be viewed as a post-crisis rebound.

The recent improvements in life expectancy recorded across all geographical regions of Moldova should be interpreted with caution, as they primarily reflect a recovery period following the COVID-19 pandemic. A similar situation occurred in

the late 1980s after the end of the anti-alcohol campaign and in the late 1990s following the acute phase of the economic crisis. The more pronounced improvements in life expectancy between 2014 and 2023 in the South and Centre can be attributed to the fact that these regions were less severely affected by the COVID-19 pandemic compared to the municipality of Chisinau and the North.

REFERENCES

- Anderson, G., Fox, S., Francis, M., Fryers, P., Clegg, E., Westermann, A., Woolner, J., & Fellows, C. (2024). Common Public Health Statistics and their Confidence Intervals. Version 2.0.2. In: *Package 'PHEindicatormethods'*. <https://cran.r-project.org/web/packages/PHEindicatormethods/PHEindicatormethods.pdf>
- Barbieri, M. (2013). Mortality in France by département. *Population*, 68(3), 375-417. https://www.ined.fr/fichier/s_rubrique/22051/2013_3_france_mortality_by_departement.en.pdf
- Camarda, C. G. (n.d.). *Life Expectancy Confidence Interval* [Computer software]. <https://sites.google.com/site/carlogiovannicamarda/r-stuff/life-expectancy-confidence-interval>
- Caselli, G., & Vallin, J. (2002). Les variations géographiques de la mortalité. In: *Démographie: Analyse et synthèse. III. Les déterminants de la mortalité* (pp. 373-416). INED. <https://u.demog.berkeley.edu/~jrw/Biblio/Eprints/%20A-C/caselli.vallin.2005.chap55.fm.pdf>
- Gagauz, O., Buciuceanu-Vrabie, M., Pahomii, I., Știrba, V., Tabac, T., & Grigoraș, E. (2021). *Populația Republicii Moldova la 30 de ani de independență: provocări principale și politici necesare*. Institutul Național de Cercetări Economice, Centrul de Cercetări Demografice. Chișinău: INCE. <https://rses.ince.md/items/17beee2b-312c-438d-94a0-170fef9433af>
- Global Aviation Data Management (GADM). (2018). *GADM maps and data*. <https://gadm.org/index.html>
- Kibele, E. U. B., Klüsener, S., & Scholz, R. D. (2015). Regional Mortality Disparities in Germany. *Kolner Zeitschrift Fur Soziologie Und Sozialpsychologie*, 67, 241-270. <https://doi.org/10.1007/s11577-015-0329-2>
- Kozlov, V., Pahomii, I., Gagauz, O., & Šmit, J. (2024). Covid-19 Mortality Shock: Demographic and Economic Losses in Moldova. *Comparative Southeast European Studies*, 72(1), 135-148. <https://doi.org/10.1515/soeu-2023-0063>
- Levchuk, N. M., & Luschik, L. V. (2019). Interregional Differences in Life Expectancy within Ukraine: Main Trends and Changes. *Demography and Social Economy*, 1, 26-40. <https://doi.org/10.15407/dse2019.01.026>
- Penina, O. (2022). *Regional mortality disparities in the Republic of Moldova*. Chișinău: Medicina. <https://library.usmf.md/ro/library/medicina-sociala-si-management/penina-o-regional-mortality-disparities-republic-moldova>
- Riffe, T. (2018). DemoDecomp: Decompose Demographic Functions. Version 1.0.1. In: *Package 'DemoDecomp'*. <http://download.nust.na/pub3/cran/web/packages/DemoDecomp/DemoDecomp.pdf>