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The "Epidemic" of Male Premature Mortality in Eastern Europe: A Spatial Perspective

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ABSTRACT

Male premature mortality remains one of the most critical components of the persisting health disadvantage of Eastern Europe. This study aims at assessing the spatial distribution of male premature mortality and its changes over time up until the onset of the COVID-19 pandemic. A special focus is put on cross-border regions. Our analyses are based on official regional mortality data obtained for 3550 spatial units in 12 countries of Central and Eastern Europe (CEE) and the former Soviet Union (FSU). These data include death counts by year, sex, five-year age group, medical cause, and district over the period 2003-2019. We focus on all-cause, cardiovascular, and external cause mortality. Our results show a clear geographical divide between the CEE and FSU country blocks. The observed discontinuities of spatial patterns at national borders have become more apparent in recent years. Within the FSU block, hot-spots of male premature mortality are predominately located in the northwestern and western parts of European Russia. Within the CEE block, the majority of hot-spots are located in Hungary, eastern Romania, and the central and eastern parts of Poland.

Key words: male premature mortality, spatial patterns, Eastern Europe

BACKGROUND AND AIM

The persisting East-West life expectancy divide still remains one of the key public health challenges for achieving more sustainable and equitable health in Europe. Despite some significant improvements during the most recent decades, progress in reducing excess mortality in the countries of Central and Eastern Europe (CEE) and the former Soviet Union (FSU) remains highly uneven over space and time. Notable disparities in life expectancy improvements can be observed in the group of CEE countries benefiting from the EU membership since 2004 or 2007 (Jasilionis et al., 2023). Between the mid-2000s and 2019, similar (albeit also varying) health progress occurred in the initially worst-performing FSU countries such as Russia, Belarus, Ukraine, and Moldova (HMD, 2024; Timonin et al., 2017; Grigoriev and Bobrova, 2020; Levchuk, 2022; Penina, 2022). Furthermore, the COVID-19 pandemic hit the region massively and interrupted positive trends (Islam et al., 2021). Except few positive examples, including Czechia, Poland, and Estonia, the majority of CEE countries still do not show any systematic convergence towards Western life expectancy levels (Jasilionis et al., 2023). The striking scale of mortality divergence across Central and Eastern Europe becomes even more evident when exploring patterns at the subnational level (Grigoriev et al., 2020; Timonin et al., 2020; Hrzic et al., 2020).

One of the most critical components of the persisting health crisis in the CEE-FSU region remains male premature mortality at working ages. This specific mortality pattern, originating from the era of communist rule or even from a more distant past, is often associated with prevailing harmful alcohol consumption cultures and alcohol-related violent deaths (Andreev et al., 2013; Grigoriev et al., 2020). By tracing spatial disparities of excess premature mortality across small territorial units in 12 CEE and FSU countries, this study aims to provide new and more detailed perspectives on common and country-specific determinants of this persisting public health challenge in Europe. Considering the unique historical contexts characterized by numerous shifts of political borders and the legacies from the period of communist rule, we assess spatial disparities of male premature mortality and its changes over time in pre-pandemic Central and Eastern Europe with a special focus on cross-border regions.

DATA AND METHODS

Our analyses are based on official regional mortality data routinely collected by the national statistical agencies in the selected FSU (Belarus, Ukraine, Russia (European part), Moldova, Latvia, Lithuania, Estonia), and CEE countries (Poland, Slovakia, Czechia, Hungary, Romania). These data include death counts by year, sex, five-year age group, medical cause, and district over the period 2003-2019. We harmonized these data to conform to the most recent territorial division. The shape files were modified accordingly. Our final dataset consists of 3550 spatial units (districts and cities), of which 2953 are located in the FSU and 597 in the CEE countries. We focus on all-cause, cardiovascular (items I00-I99, G45 in the ICD-10), and external (V01-Y98) mortality. To ensure better data comparability, we applied the proportional redistribution of ill-defined causes of death (R00-R53, R55-R94, R96-R99) for each spatial unit, period, and 5-year age group.

In this study we define male premature mortality as mortality occurring at ages between 20 and 64 years. This definition is consistent with numerous previous studies, which identified this age group as the main driver of overall male mortality trends in Eastern Europe. We focus on spatial mortality patterns in CEE and FSU countries, and their changes between 2003-2005 and 2017-2019. Before computing mortality rates, death and population counts were pooled over these three-year periods to ensure more robust estimates. The choice of these time periods was driven by several considerations: i) data availability ii) proximity to the population censuses in the countries for which reliable population estimates were not available (Moldova and Russia) iii) 2003-2005 as a turning point in mortality dynamics in many FSU countries iv) 2017-2019 as the last years before the COVID-19 pandemic.

Despite our substantial efforts to harmonize the data, it was not possible to achieve perfect comparability between the countries in terms of the size of spatial units, the level of detail of the cause-specific mortality data, and the years covered. More specifically, regional cause-specific mortality data were not available for Latvia. For Russia, we had to compute mortality rates for the period 2001-2003 with the population census 2002 as the denominator and the mid-point. Likewise, mortality rates for Moldova, which are centered around the 2004 and 2014 population censuses, refer to the five-year periods 2002-2006 and 2012-2016. Finally, the initial point of the analysis for Ukraine refers to the period 2006-2008. Keeping these data comparability issues in mind, we believe that these slightly deviating periods still can be used as a reasonable approximation for the initial and the last points of our analyses. Thus, we refer to them as such (2003-2005 and 2017-2019) thereafter. The pandemic years are not covered by our analyses because of data availability constrains for the major FSU countries (Belarus, Russia, and Ukraine) associated with the aggression of the Russian Federation against Ukraine and the ongoing war in the region.

To compute age-cause-specific mortality rates, we either relied on official data for the mid-year population or estimated population exposures (denominator) as the mean value of the population size observed at the beginning and the end of a calendar year. For Russia and Moldova, we used the data from the population censuses. For Lithuania, both the death and the population exposures come from a census-linked dataset compiled from individual records. As a mortality indicator, we rely on the age-standardized mortality rate (SDR) calculated using the direct method of standardization and the European population standard (1976). As measures of dispersion and inequalities, we employ standard deviation (both weighted and unweighted by population size) and the Theil Index (Theil 1967). These allow us to assess the degree of heterogeneity across all spatial units and within each country block, as well as measuring trends in spatial inequalities, and decomposing them into *within*- and *between-country* components. The maps of male premature mortality are categorized using *quantile* classification. To identify statistically significant *hot*- and *cold* spots of premature mortality, we rely on the *Getis-Ord Gi* statistic* (Ord and Getis 1995) and *first-order queen* conceptualization of spatial relationships. The latter implies that spatial units which share at least one common border point are considered neighbors. All spatial data operations, as well as all spatial analyses, were performed using *ArcGIS* software.

SELECTED RESULTS

Figure 1 depicts the spatial distribution of male premature all-cause mortality in 12 CEE and FSU countries in 2003-2005 and 2017-2019. In 2003-2005, we observe a clear geographical divide in terms of mortality levels between the CEE and FSU country blocks. Premature mortality in the FSU countries was substantially higher. Clear discontinuities of spatial patterns could be observed along the Polish-Belarussian and Polish-Ukrainian national borders. On the other hand, similar mortality levels could be observed in border regions at the Hungarian-Ukrainian border, at the western part of the border between Ukraine and Romania, as well as at the Romanian-Moldovan border. By 2017-2019, all countries and spatial units had experienced substantial reductions of male premature mortality levels. At the same time, the discontinuities of mortality patterns between the CEE and FSU country blocks at the national borders became more pronounced. Although spatial patterns in 2017-2019 are more scattered compared to 2003-2005, large clusters of elevated and low male premature mortality can still be identified. Given the significant differences in mortality levels between the CEE and FSU countries, our subsequent analyses are stratified by these two groups. Figure 2 shows that the geographical disparities in premature mortality exist within each block of the countries (the spatial patterns for 2003-2005 not shown here reveal larger clusters of elevated and low mortality). Within the FSU block (Panel A of Figure 2), the hot-spots of male premature mortality are predominately located in the northwestern and western parts of European Russia. Hot-spots can also be observed in northern Ukraine in the areas surrounding the capital, as well as the areas contaminated due to the Chernobyl accident in 1986. The clusters of lowest mortality (cold-spots) are located in the Baltic States, the southern part of European Russia, and to a lesser extent in southwestern Ukraine and Belarus. The spatial patterns of hot- and cold-spots for cardiovascular mortality and mortality from external causes look similar to those of all-cause mortality.

Within the CEE block of countries, the majority of hot-spots are located in Hungary (except of the western part), eastern Romania, and the central and eastern parts of Poland. A few hot-spots can also be identified in the northwestern regions of Romania at the border to Hungary, as well as in the regions of western Poland bordering eastern Germany. Unlike in FSU countries, the spatial patterns of the leading causes of death (CVD and external) do not mirror those of all-cause mortality. The only exception is Czechia, which exhibits low mortality from both CVD and external causes of death. In Romania and Hungary, the vast majority of regions exhibits elevated CVD mortality, which is not the case as far as external causes of deaths are concerned. On the opposite, large cold-spot clusters of mortality from external causes are located in these two countries. By contrast, almost all hot-spots of mortality from this cause of death are located in the central part of Poland as well as the Polish regions along the borders with Belarus (east), Ukraine (southeast), and Russia (northeast).

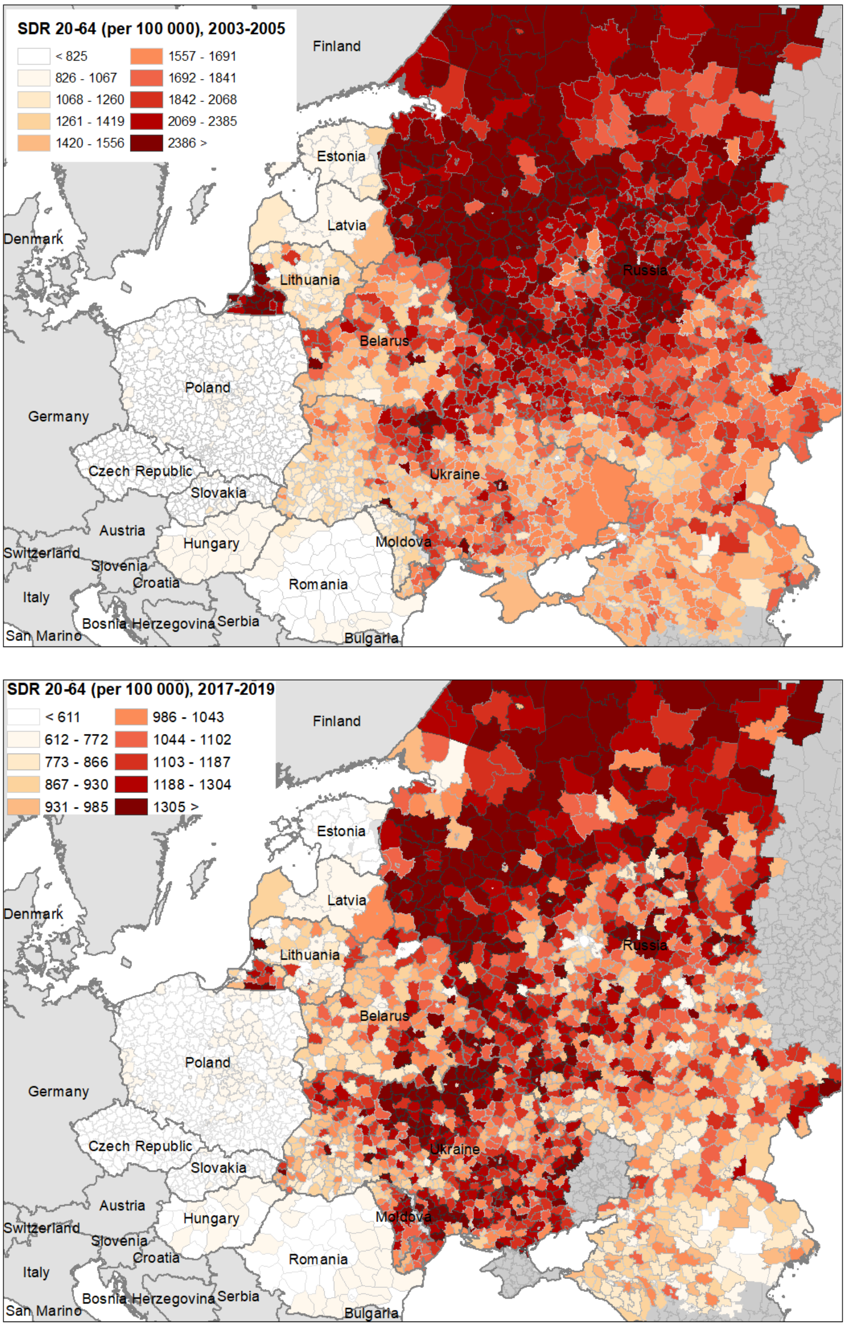

Figure 1. Spatial distribution of male premature mortality in 12 CEE and FSU countries; all causes combined, 2003-2005 and 2017-2019

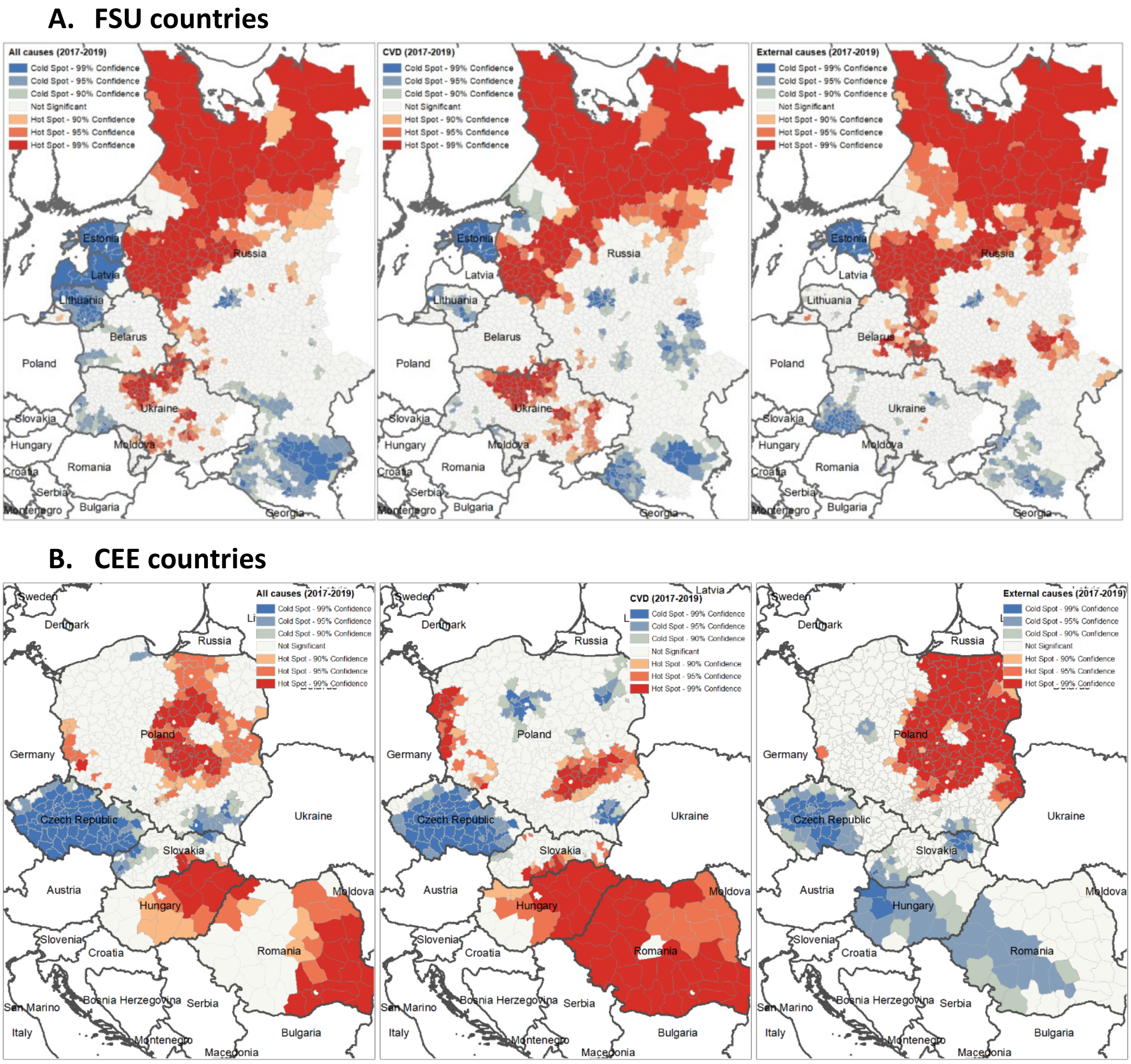

Figure 2. Hot-spots of male premature mortality in 12 FSU and CEE countries by major causes of death, 2017-2019

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