RECENT MORTALITY IMPROVEMENT IN RUSSIA: ARE REGIONS FOLLOWING THE SAME TEMPO?

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Introduction

Since 1965 mortality in Russia has been increasing with the only exception to two three-year episodes in the mid-1980s and the mid-1990s when mortality was improving. The period after 2003 is the third period over the last 50 years in Russia when an increase in life expectancy has been recorded. But the current period differs from the two previous periods for at least two reasons: (a) it has lasted much longer (twelve years as of Jan 1, 2016); and (b) the improvements during the current period have spread to older ages (largely due to the decrease in cardiovascular mortality), whereas during the previous periods the contributions of the older age groups to increasing life expectancy were minor (Shkolnikov et al. 2013; Grigoriev et al. 2014). Researchers who have studied these trends have argued that there is some evidence that in the 2000s Russia entered the "cardiovascular revolution" (Andreev et al. 2014; Grigoriev et al. 2014).

Our aim in this study is to better understand the regional trajectories of mortality reduction under the new epidemiological conditions in Russia by conducting a systematic analysis of changes in cross-regional mortality disparities within the country. The population-weighted standard deviation of regional life expectancies is used as a measure of inter-regional disparity. We focus on the components of the recent (from 2004 onward) shift in cross-regional variation in life expectancy, applying the stepwise replacement algorithm to decompose by ages and causes of death changes in the average (with respect to regions) population-weighted life expectancy and in the standard deviation of life expectancy.

Data and methods

The initial data on death counts by age, sex, region, and cause of death and the population estimates are provided by the Russian Federal State Statistics Service (Rosstat).

The population-weighted standard deviation (wSD), counted in years, is used as a measure of the amount of the lifetime disparity across the regions. In order to gain a better understanding of the convergence/divergence process at the sub-national level between 2003 and 2014, we suggest decomposing the changes in the population-weighted life expectancy and the standard deviation measure by age and causes of death.

We employ the general stepwise replacement algorithm that allows us to decompose measures based on a set of populations (Andreev et al. 2002). Applying the stepwise replacement to the set of regional populations, the age- and cause-specific components, as well as their mortality and population-composition parts (M- and P-effects), were obtained by running a sequence of replacements of age- and cause-specific mortality rates in each region in the year t_0,$m_{x,j,i}(t_0)$, by the corresponding rates in the year *t*, and vice versa.

Results

Life expectancy increase in 2003-2014 and regional contributions

Over the period 2003-2014, the population-weighted life expectancy at birth increased from 58.9 to 65.5 years for males, and from 71.9 to 76.5 years for females. With respect to age, the increase in the overall life expectancy was attributable to the reduction in mortality at all ages, and particularly at working ages for males and at older ages for females (Fig. 1). The reduction in mortality from cardiovascular diseases and external causes of death contributed almost equally and most significantly to increasing life expectancy among males (about 40% each). Among females, the reduction in mortality was mainly attributable to the decline in cardiovascular diseases (accounting for more that 70% of the total increase in life expectancy), and secondarily to the decrease in external causes (20%).

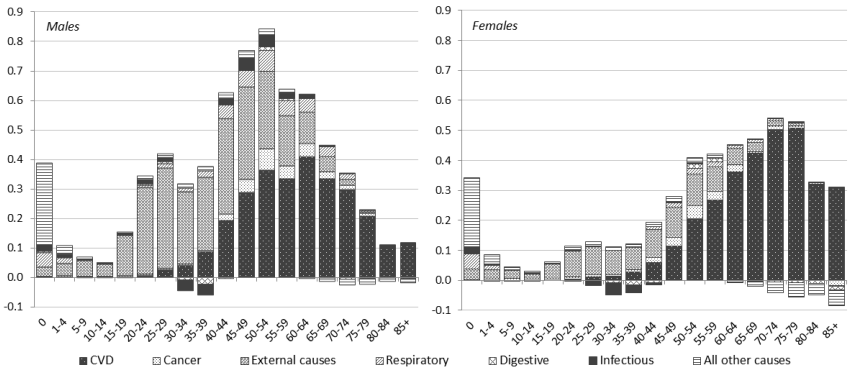

Fig. 1 Components of the changes in population-weighted life expectancy at birth, by sex, 2003-2014

Age- and cause-specific components of changes in inter-regional disparity

The total amount of disparity in life expectancy did not change much between 2003 and 2014. For males, the standard deviation (weighted by population size) remained about the same (a change from 3.27 to 3.22 years); while for females, it decreased from 2.04 to 1.75. When we eliminate the positive (divergent) effect of the population redistribution between the regions (P-effect), we find that the mortality-related change in the standard deviation (M-effect) is -0.14 years for males and is -0.32 years for females.

The decomposition of the change in the disparity measure allows us to assess the contributions of different ages and causes of death to the divergence/convergence.

Figure 2 presents the results of the decomposition of the change in the standard deviation by age and cause of death. It shows the distinct shift away from the convergent contributions at younger ages and toward the divergent contributions at older ages. In other words, mortality changes at young and middle ages forced the regions to converge, but mortality dynamics at old ages determined the divergence between the regions of Russia.

The influence of regional changes in CVD mortality on the change in the standard deviation of life expectancy across regions varies with respect to sex and age. For males, it appears that CVD mortality had almost no effect at middle ages, and the divergence process for this cause of death is observed at ages 65 and older. For females, the situation is different; we see a convergent effect of CVD mortality at ages 45-74, and then a shift toward divergence at advanced ages.

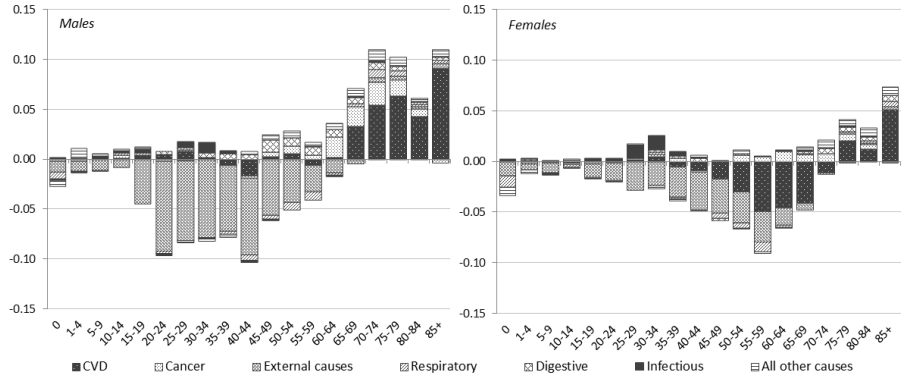

Fig. 2 Components of the mortality-related changes in standard deviation, by sex, 2003-2014 (in years)

Vanguard regions on the way to better health

The cities of Moscow and Saint Petersburg, which are included in the top-level administrative division of Russia as separate federal territorial units, contributed the most to the increase in variation in life expectancy across the country (Fig.3).

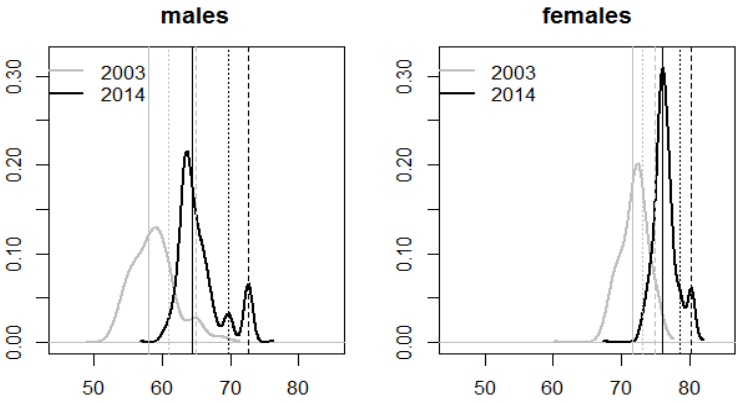

Fig. 3 Distributions of life expectancies at birth across Russian regions
Note: The vertical solid lines indicate the value of life expectancy in Russia, excluding the cities of Moscow and Saint Petersburg; dashed lines – in the city of Moscow; dotted lines - in the city of Saint Petersburg

In 2003, the favorable positions of Moscow and Saint Petersburg relative to the positions of the rest of Russia were already recognizable, especially among the male

population. But the distance between the cities of Moscow and Saint Petersburg and the other regions was less pronounced in 2003 than it was in 2014. By 2014, the advantage of being a Muscovite or a Petersburger in terms of life expectancy had increased. In 2003, males in Moscow lived 7.1 years longer and males in Saint Petersburg lived 3.0 years longer than males in Russia as a whole. By 2014, these gaps had grown to 8.3 and 5.3 years. The corresponding gaps for females were +3.5 years and +1.6 in 2003, and +4.3 years +2.6 years in 2014. The increased gap between two federal cities and the rest of the country is to a large extent explained by the fact that Moscow and Saint Petersburg have experienced faster mortality decline from circulatory diseases at older ages. Thus, the cardiovascular revolution which seems to have started in Russia, has affected the regions rather unevenly. Muscovites and Petersburgers have yet benefited more from its beginning than the residents of other Russian regions. In the examples of Moscow and Saint Petersburg, we see a possible pure effect of the advantages of being a resident of a metropolitan city in Russia. The residents of other megalopolises of Russia may also realize benefits (in terms of years of life expectancy) from living in big cities. Further investigations at a more disaggregated (district) level or at an individual level are needed to analyze the link between the place of residence and mortality in Russia.

If we take into account only the "larger" (left-hand side) parts of the distributions, we can see that the distributions have narrowed. This leads us to conclude that there has been both (1) a divergence of Moscow and Saint Petersburg on the one hand and the rest of Russia on the other, and (2) a convergence of the regions that constitute "the rest of Russia."

Conclusions

The recent period in which life expectancy has been increasing in Russia has turned out to be the most significant and stable phase of improvement after decades of mortality deterioration and huge short-term fluctuations. Within this context of health improvements in Russia, we have examined the trends in regional life expectancies.

We applied the stepwise replacement algorithm to decompose the changes in the disparity measure. Changes in mortality among males under age 60 and among females under age 70 forced the regions to converge, whereas mortality dynamics at older ages determined the divergence across the Russian regions. With respect to causes of death, mortality reduction from external causes contributed to the convergence of the regions. Among males, it appears that there was no convergent effect of the reduction in CVD mortality at middle ages, and that a process of divergence occurred at ages 65 and older. Among females, a convergent effect of CVD is observed at ages 45-75, and a divergent effect is observed at advanced ages.

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