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The Russian-Ukrainian War: the Possibility of Assessment of Demographic Losses

Determining demographic losses in wars is an important and complicated problem for demographers and statisticians and a vital one for the society. To have the result produced, specialists need to assess not only immediate direct death toll among military and civilians due to warfare, but the war-entailed migration of the population beyond the country borders and the decreased birth rate.

Regrettably, the full-scale Russian invasion in the Ukrainian territory has already demonstrated an incredibly high death toll. Because the official statistics provided by the State Statistics Service of Ukraine has abstained, since the beginning of 2022, from publishing estimates pertaining to natural and mechanic movement of the population due to security considerations in time of war, researchers have to use information from various analytical websites, produced on the basis of available sources.

Another challenge is the prolonged absence of a population census that was performed in independent Ukraine only once, in 2001. Hence, prior to the full-scale invasion the information on the population number (together with the temporarily occupied Crimea and the territories in the East) was based on estimated data.

The article presents an attempt to analyze, on the basis of available information, the relative death toll due to the Russian-Ukrainian war over nine years, and to compare it with the analogous data for selected Balkan countries in the wars of late 20th – early 21st centuries. It is demonstrated that the annual relative death toll due to warfare (per 100,000 population) in Ukraine in 2022, although estimated by the available incomplete data, exceed all the analogous figures for Balkan countries.

The article's objective is to explore a feasibility of assessing demographic losses, relative death toll in particular, in time of the Russian-Ukrainian war and Balkan wars.

The analysis led to the conclusion that the demographic losses in Ukraine could not be feasibly assessed not only due to missing data on excess casualties caused by the war, but also due to the unknown number of temporary migrants (war refugees) and impossibility to estimate the number of children probably unborn due to the war.

Key words: *demographic losses, Russian-Ukrainian war, Balkan wars, demographic processes, death toll, mortality, migration.*

Introduction. The war in Ukraine has been on for ten years now. It is a long period filled with many human casualties, devastated houses, infrastructures and industrial facilities, polluted environment. This war, like any other one, obviously has adverse effects for demographic processes in the society. As argued in some research works (see, for example, [1–3]), the factors with the strongest impact on demographic processes in time of the war and after it are as follows: excess mortality; worsened life standards due to inappropriate financial support (to widows, invalids or minor children) caused by death or injuries of breadwinners; deportation of children and adults; fallen birth and marriage rates; decreased average life

expectancy; increased external migration; increased numbers of internally displaced persons that died due to the war on new settlement locations; increased death toll on the liberated territories due to explosive items, massive missile and drone attacks, artillery shelling, appalling life conditions, etc.

As emphasized by experts, demographic losses include the deaths resulting from warfare and terror attacks of an aggressor (excess mortality) and the war-related migration (which is the cumulative direct losses), and indirect losses due to the decreasing birth rate caused by postponement of births, falling probability of fertilization and reduced numbers of women due to direct losses [4]. Hence, assessing the

death toll of military and civilians over the period of the warfare and a certain span after its end constitute an objective to be achieved in order to grasp the demographic situation in a country.

The article's objective is to explore feasibilities for assessing demographic losses, in particular the relative death toll, in time of the Russian-Ukrainian war and Balkan wars.

Materials and methods. The main theses and conclusions of the article are substantiated by relevant analytical methods, including synthesis and analysis of available information sources, the logical framework analysis of problems and their potential solutions, the method of comparisons and analogies for scientific generalization in order to determine information about Ukrainian population over a certain period and the data on military casualties in the Russian-Ukrainian war and Balkan wars. The graphic analysis allowed for estimating the collected and processed information about the death toll in times of warfare by selected countries.

Results and discussion. A crucial step in grasping any kind of demographic processes in a country is determining a reasonably accurate number of the population. It is hard to speak about the number of Ukrainian population today for several reasons: first, a population census has not been conducted over longer than ten years (the only one took place in 2001), affecting population estimates provided by the State Statistics Service of Ukraine and international organizations even in prewar times; second, the lack of access to population data on the territories occupied in time of the Russian-Ukrainian war; third, the lack of credible data on migrants who left Ukraine due to the full-scale invasion; fourth, the lack of accurate information about Ukrainian citizens deported to the Russian territory; fifth, the lack of accurate information about the death toll caused by the war.

So, the major part of information being unavailable now, drawing a complete picture of demographic losses seems hardly feasible. Open sources supply various data. As reported by "The Times" [5], American military sources estimate the death toll in Ukraine as of the end of January 2024 as 70,000 to 100,000 (it refers to the losses after the full-scale invasion).

The national police have recorded the following war-related losses among civilians over the two latest years: 9,700 Ukrainians dead, 11,000 wounded, nearly 7,000 missing, 14,000 children deported by the occupants to Russia and Belarus [6]. The latest two years saw 1,758 affected children, of whom 528 died. These statistics was provided, as of 23.02.2024, by the General Prosecutor Office with reference to juvenile prosecutors, with emphasizing that the figures were not final one. The counting still continues on warfare zones, temporarily occupied and de-occupied territories [7].

The annual report of Sidney-based Institute for Economics & Peace for 2022 contains brand-new estimations of Global Peace Index (GPI), with information on death toll due to the Russian-Ukrainian war given along with other indicators [8]. GPI measures the level of the so called negative peace in a country using three domains of peacefulness, each one consisting of a certain set of indicators. The first domain is based on six statistical indicators measuring degrees and durations of counties' involvement in internal and external conflicts. Eleven indicators in the second domain assess what can be described as social safety and protection inside a country (e.g. low level of crime and terrorism, harmonious relations with neighboring countries, stable political situation and small share of internally displaced population or refugees). Six indicators of the third domain pertain to the country's militarization (access to arms, share of military spending in GDP, number of military officers per capita, financial contributions in peacekeeping missions of UN, etc.) [3]. It should be noted that the unpleasantly surprising fact is inviting a Russian female researcher to the preparation of this report as one of the five independent experts. We believe that estimates for GPI cannot be provided by experts from a country waging war with its neighbors. According to this report, the year of 2022 saw the death of 82,000 military and civilians in Ukraine [8, p. 3].

Mr. V. Zelensky, Ukrainian President, says that in time of the full-scale Russian invasion the death toll of Ukrainian military made 31,000 [9]. According to the UN International Organization for Migration, nearly 6.5 million Ukrainian citizens are refugees across the world [10], but an accurate figure of migrants can be determined by nobody now.

Statistics on Russian military losses in Ukraine are also published. According to a report from the Chief Intelligence Department of Ukraine, in the beginning of 2024 more than 406,000 persons are recorded as having been killed and wounded since the full-scale invasion was launched, and the aggressor country is capable to draft another 30,000 troops each month [11]. Another source says that 180,000 Russian troops have been killed in Ukraine [9].

So, the analysis of the military losses, deaths in particular, allows for the two preliminary conclusions: first, reliable sources of information are not enough now for a meaningful research, and this gap cannot be bridged earlier than some time after the end of the war; second, it is worthwhile to consider the reasons for obtaining inaccurate data (presently and in future periods) or missing data, set out in [12]:

a) affected persons are not always asked who has died around them due to the military conflict;

b) parties of the conflict may understate death toll data to affirm success, or overstate them in seeking a meddling of third parties;

c) independent observers may face difficulties in reaching all the locations and recording conflict casualties.

Besides that, some information sources include only direct losses of military and civilians, and another add the deaths from starvation and deceases. Other sources count the losses with inclusion of the deserters [12], which makes counting much more complicated.

Research into recent wars (Balkan ones in particular) can benefit from a lot of collected data on death toll which can be extracted from an array of sources:

- Uppsala Conflict Data Program (UCDP) [13];
- Bonn International Center for Conversion [14];
- PRIO Battle deaths Dataset [15];
- Conflict Catalog by Peter Brecke [16];
- Nation Master [17];
- Project Mars by Jason Lyall [18];
- Steven V. Miller Research [19];
- Correlates of War (CoW) [20];
- Our World in Data [21].

Unfortunately, neither of these sources can be useful now when it comes to two latest years of the Russian-Ukrainian war.

Some of the above sources cover only selected categories of war conflicts, others do not cover the whole period required by us for analysis: the data contained in PRIO Battle deaths Dataset and Conflict Catalog by Peter Brecke is limited by 2008 and 2000, respectively. UCDP provides up-to-date data, because they are updated annually. But it should be immediately emphasized that we do not fully rely on UCDP data mainly because information on Ukraine is supplied in a biased manner. The UCDP website displays the Russian-Ukrainian war in 2014–2021 as a series of intra-national clashes: Ukraine with Donetsk (“Donetsk People’s Republic”), Ukraine with Luhansk (“Luhansk People’s Republic”), Ukraine with Malorussia (details for on Ukraine – Donetsk conflict see, for example, in [22]). It is obvious that the death toll was counted using unreliable sources, with part of the data is likely to have been extracted from communications of the so called republics, not to mention the absolutely wrong approach to the classification of the war as such.

Other sources (Project Mars by Jason Lyall, Steven V. Miller Research and Correlates of War [18–20]) are updated less often, resulting in the approx. decade-long lag in their most recent data. Some researchers supplement these sources with available surveys of affected populations or official death statistics. The main information sources used by the above given analytical websites can be partially overlapping.

Our review of the information sources leads us to say that the most appropriate source for analysis of data on recent Balkan wars and the Russian-Ukrainian

war is Our World in Data. It is one of the few websites where more detailed data on both Balkan wars and the Russian-Ukrainian war over 2014–2022 can be found today. In making up tables, graphs or animation diagrams, the website analysts partially rely on data from the abovementioned experts and organizations, but they say that they use a very careful approach to data analysis with seeking to verify the data by parallel addressing several sources. Also, according to experts [23], they publish the data that cannot be found on the abovementioned websites, i. e. the data on military and civil death tolls in wars without counting the deaths caused by decease or starvation, which is often published by these sites in total.

The information from the abovementioned websites is, therefore, not fit as input data in exploring human losses in Balkan wars, whereas the death toll can be estimated using the website Our World in Data that provides the most suitable and refined information.

We believe that a comparison of information on military losses in Balkan wars of late 20 – early 21 centuries, aimed at exploring the impact of the Russian-Ukrainian war on the demographic profile in Ukraine (especially the increasing death toll among military and civilians) would be the most useful and interesting. This approach is meaningful for several reasons: these wars were waged on the European territory quite recently, they caused the largest death toll for the continent population, the parties involved in the conflict belonged to various nationalities and confessions.

Below are given the data on the death toll per 100,000 persons (Table 1, compiled by the author on the basis of [21]) for all the countries that were former republics of Yugoslavia, with separate counting for Montenegro and Serbia (that were part of the Union Republic of Yugoslavia before 2003, and part of the State Union of Serbia and Montenegro in 2003–2006) made by the website experts.

Using the information of Table 1 and the data on death toll in 2022 in Ukraine published by Our World in Data website, some comparisons of direct human losses in Ukraine and Balkan countries can be made. They should account for the two below given comments concerning Ukrainian data: about the population number and the impossibility to estimate an accurate death toll of the military on the front and of the population on the liberated and temporary occupied territories.

The number of Ukrainian population can be estimated using the following sources: State Statistics Service of Ukraine (SSSU), Eurostat, Worldometer i Our World in Data (Figure 1, built on the basis of data [21; 26–28]), bearing in mind that the latter two sources publish the same data, but of the four mentioned sources, estimated population data for 2022–2023 are provided only by Worldometer. It

The death toll due to conflicts and terrorism in Balkan countries

| Country involved | Year | | | | | | | | | | |
|------------------------|-------|--------|--------|-------|--------|------|------|-------|--------|------|------|
| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| Bosnia and Herzegovina | 11.43 | 175.86 | 139.49 | 79.34 | 261.15 | 0.05 | 0.13 | 0.05 | 0.02 | 0.02 | 0.0 |
| Croatia | 62.82 | 38.87 | 15.82 | 4.75 | 20.51 | 3.34 | 0.88 | 0.61 | 0.33 | 0.2 | 0.09 |
| Montenegro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.16 | 0.16 |
| North Macedonia | 1.33 | 0.05 | 0.05 | 0.0 | 0.15 | 0.0 | 0.0 | 0.0 | 0.29 | 0.3 | 5.34 |
| Serbia | 31.88 | 1.52 | 0.02 | 0.0 | 0.02 | 0.1 | 0.19 | 16.52 | 101.14 | 5.59 | 1.36 |
| Slovenia | 1.3 | 0.05 | 0.0 | 0.05 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Country involved | Year | | | | | | | | | | |
| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
| Bosnia and Herzegovina | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.02 | 0.05 | 0.0 | 0.03 | 0.0 | 0.0 |
| Croatia | 0.04 | 0.09 | 0.25 | 0.11 | 0.02 | 0.07 | 0.07 | 0.09 | 0.09 | 0.05 | 0.09 |
| Montenegro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| North Macedonia | 1.12 | 0.73 | 0.0 | 0.0 | 0.29 | 0.58 | 0.15 | 0.0 | 0.0 | 0.0 | 0.24 |
| Serbia | 0.76 | 0.31 | 0.55 | 0.17 | 0.02 | 0.1 | 0.06 | 0.0 | 0.02 | 0.02 | 0.07 |
| Slovenia | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Note: Death toll per 100,000 persons. Included are the deaths caused by conflicts inside and between the countries.

is obvious that following the resolution on the enclosure of official data since the beginning of the full-scale invasion, this information has not been released by the State Statistics Service of Ukraine and Eurostat. An analysis of these data can be made e.g. with reference to estimates given by professional Ukrainian demographers. These

estimates reveal that approx. 31,000,000 persons lived on the territories under Ukrainian control in the middle of 2023 [24]; 42,000,000 persons lived in Ukraine at the beginning of 2002 with counting Crimea and the occupied territories of Donetsk and Luhansk regions; approx. 35,000,000 persons lived at the beginning of 2024 [25].

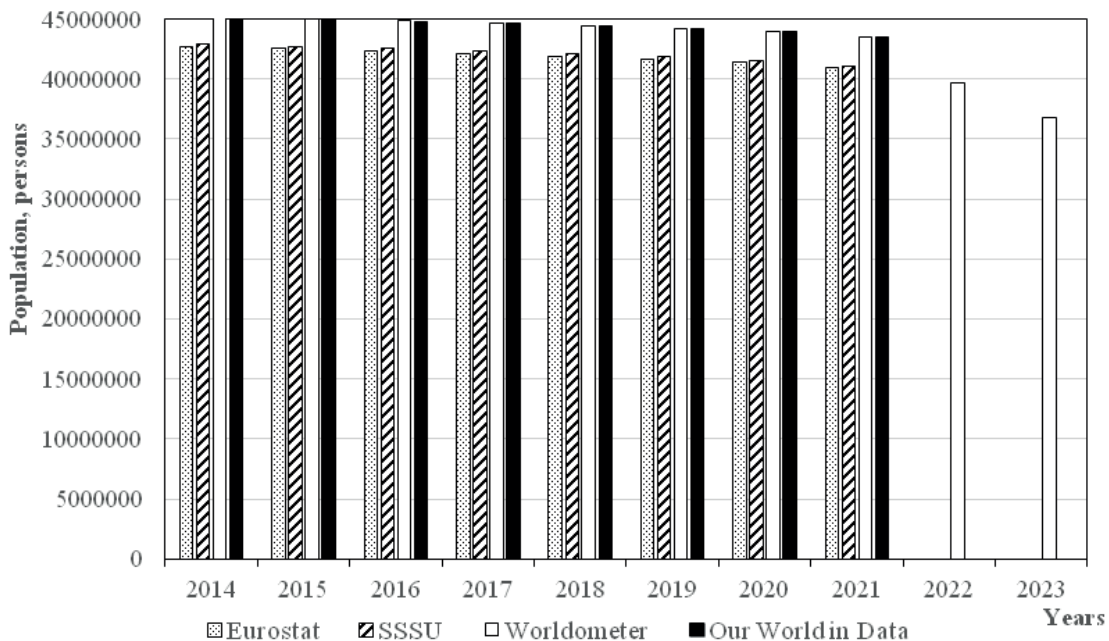


Figure 1. The Ukrainian population estimated by various sources, 2014–2023

It should be noted that the estimates given by experts of Worldometer and Our World in Data websites are somewhat higher than the estimates of two other sources over the completely analyzed period.

To compare the death toll in Ukraine with the one in military actions in time of Balkan conflicts, Table 2 (estimated by the author on the basis of data from [21; 27; 28]) shows a recount of the available mortality estimates in the Russian-Ukrainian war per 100,000 of population. This recount is made using the death toll data by year published by experts of Our World

in Data. It resulted in 82,588 military and civilians in 2022. These data do not differ much from the ones published by Uppsala University (81,943 persons), although, as observed on Our World in Data website, its analysts refine the data provided by this university using supplementary sources. Unfortunately, we realize that the data are provisional, and the final data to be released later will reveal a higher death toll. As can be seen in Table 2, the death toll caused by military actions over nine years of the war in Ukraine, if recounted per 100,000 of population, does not differ essentially across the aforementioned sources.

Table 2

Death tolls due to military actions, Ukraine, per 100,000 of population

| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|-------------------------------------|-------|------|------|------|------|------|------|------|--------|
| Source of population data | | | | | | | | | |
| State Statistics Service of Ukraine | 11.47 | 4.18 | 0.60 | 0.98 | 0.58 | 0.74 | 0.47 | 0.51 | |
| Worldometer | 10.90 | 3.97 | 0.57 | 0.93 | 0.55 | 0.70 | 0.45 | 0.48 | 208.02 |

Hence, bearing in mind that although military conflicts have been sparked in some Balkan countries until today, the hottest phases fell upon the time of establishing the states and subsequent wars for their independence, it would be logical to take the period of 1991–2000 for a comparison of the death toll by year in Bosnia and Herzegovina, Croatia and Serbia

with the military losses in the Russian-Ukrainian war. This information is illustrated in Table 2 (built by the author using the data from Table 1 and 2), with the serial number of the year referring to the period of 2014–2022 for Ukraine and 1991–2000 for Balkan countries.

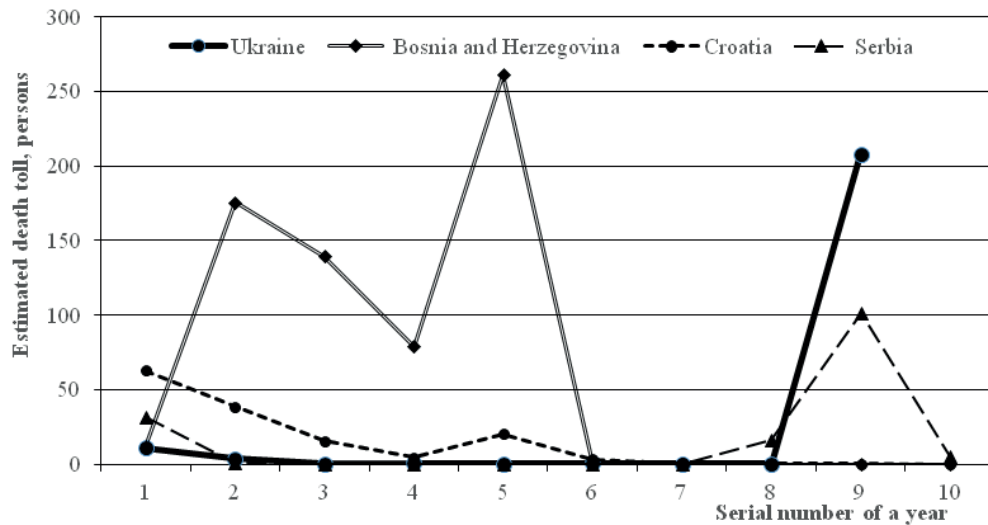


Figure 2. The death toll in times of wars, Ukraine and Balkan countries, per 100,000 population, by year

As the population in Balkan countries is essentially smaller than in Ukraine, the absolute death toll is not so high there; but once the data are recounted, Bosnia and Herzegovina lost a large share of the population in 1992 and 1995 (see the second and the fifth line on the graph, respectively). The war lasting in this country throughout 1992–1995, first between Bosnian Muslims and Bosnian Croats, joined later by Bosnian Serbs (with military actions persisting till

the signing of Dayton Peace Accords on December 14, 1995), was the bloodiest phase of Balkan wars in the ten-year period of the study. Also, many lives were taken by the war waged on Croatian territory, especially in the first year (1991), when the country's independence was declared in June, with the secession of Croatia and Slovenia from the Socialist Federative Republic of Yugoslavia announced in October. Croatia had to live through the so called civil war

between the central power and the self-proclaimed Republic of Serbian Krajina, coming to the end in 1995 when the Croatian government pursued the military operation “Storm” against the Republic of Serbian Krajina. Hence, ethnic Serbs were involved in the majority of military conflicts across Balkans, with the Serbian population (according to Our World in Data experts’ estimates) bearing significant losses in 1991–1992 and 1998–1999. But these losses were not so heavy as Bosnian ones.

The death toll in the earliest two years of the Russian-Ukrainian war (2014–2015) fell in the six following years after the signing of the so-called the second Minsk agreements. But the full-scale invasion was launched, and the death toll, if even estimated by hardly accessible statistics, increased tenfold. The death toll in 2022 recounted per 100,000 of population has already approached the highest relative annual death toll for military and civilians in all the Balkan wars at late 20th – early 21st centuries. If the estimated Ukrainian population without temporary occupied territories is considered (a meaningful approach on account of missing data on these territories), the available number of annual losses per 100,000 population already exceeds the maximum value of a similar indicator for Bosnia and Herzegovina in 1995.

As any kind of death toll statistics for Ukrainian military and civilians in 2023 are inaccessible now, we can expect its rising trend, unfortunately.

Conclusions and recommendations:

1) The death toll caused by the war in Ukraine cannot be estimated now. Even the information released on websites of some sources is incapable of providing a comprehensive picture of the death toll in 2022.

2) The Ukrainian population has not been counted in an accurate manner due to the lack of census that had to be held in 2010–2011 according to UN methodology. An access to information on demographic change on the temporary occupied territories was closed with the beginning of the Russian-Ukrainian war, and this problem was aggravated after the full-scale invasion due to the massive migration of population across the Western country borders, migration to Russia, forced removals of adults and children from occupied territories by Russians.

3) The demographic losses of Ukraine cannot be assessed due to not only missing data on excess deaths caused by the war, but also due to inaccuracy of data on migrants (war-related refugees), uncertainties with the number of those from among them coming back to Ukraine temporarily, and the lack of accurate statistics for estimating the number of children probably unborn due to the war.

4) The comparison of annual death toll in Ukraine and Bosnia and Herzegovina, Croatia and Serbia in times of Balkan wars of late 20th – early 21st centuries allows for the conclusion that the death toll in Ukraine is likely to be much higher if even assessed by incomplete statistics, unfortunately.

Analysis of the death toll data in the Russian-Ukrainian war, going to be released in open sources, is worth to be continued, although it should be born in mind that the most accurate data will be released by the official statistical offices after the end of the war. The official statistical data on demographic processes in Ukraine will allow for a more accurate assessment of demographic losses caused by the Russian-Ukrainian war, especially after the full-scale invasion.

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**Російсько-українська війна:
можливість оцінювання демографічних втрат**

Визначення демографічних втрат у війнах є важливим складним завданням для демографів і статистиків та актуальним для суспільства. На шляху до отримання результату фахівці мають оцінювати не тільки безпосередньо прямі втрати серед військових і цивільних через воєнні дії, а й спричинену війною міграцію населення за межі країн та зниження народжуваності.

Широкомасштабне російське вторгнення на територію України вже зараз демонструє, на жаль, неімовірну кількість спричинених ним жертв. Офіційна статистика, яку надає Держстат України, з початку 2022 року припинила публікацію даних за показниками, що стосуються природного і механічного руху населення, через необхідність дотримання безпеки під час війни, тому наразі дослідникам доводиться користуватись інформацією окремих аналітичних сайтів, які створюють її на базі доступних джерел.

Ще однією проблемою є багаторічна відсутність перепису населення, який у незалежній Україні проводився тільки одного разу – у 2001 році. Отже, перед повномасштабним вторгненням інформація щодо чисельності населення (разом із тимчасово окупованими Кримом і територіями на Сході) ґрунтувалася на оціночних даних.

У статті представлена спроба проаналізувати на основі доступної інформації відносну кількість загиблих через російсько-українську війну протягом 9 років та порівняти її з даними щодо відносних втрат окремих балканських країн у війнах кінця ХХ – початку ХХІ століття. Продемонстровано, що річна відносна кількість загиблих через воєнні дії (на 100 тис. населення) в Україні у 2022 році вже за доступною неповною інформацією перевищує майже усі значення цього показника для балканських країн.

Мета статті – дослідження можливості оцінити демографічні втрати, зокрема відносну кількість смертей під час російсько-української війни і балканських воєн.

На підставі проведеного аналізу зроблено висновок, що демографічні втрати в Україні неможливо оцінити не тільки через відсутність даних про кількість надлишкових смертей, спричинених війною, а й через невідому кількість тимчасових мігрантів (біженців від війни) і неможливість розрахувати кількість імовірно ненароджених через війну дітей.

Ключові слова: демографічні втрати, російсько-українська війна, балканські війни, демографічні процеси, смертність, міграція.

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