Демографическое обозрение / Demographic Review
2023;10(3) 4-20 DOI: https://doi.org/10.17323/demreview.v10i3.17967

The results of the 2021 All-Russian Population Census in the light of civil registration statistics and censuses of previous years

Evgeny Andreev
(e.andreev@hse.ru), HSE University, Russia.
Elena Churilova
(evchurilova@hse.ru), HSE University, Russia.

Abstract: *The population census of the 2020 round was held in Russia in October-November 2021 and had a number of differences from the 2002 and 2010 censuses: (1) the 2021 Census was conducted during the COVID-19 pandemic; (2) for the first time ever, Russians could fill out electronic census forms on the Internet; (3) the critical moment of the census was not the first day of the census; (4) the census period was one month. In addition, public opinion polls showed a high proportion of the population that did not participate in the census. Using the published results of the 2021 Census, we assess the impact of the 2021 Census features on the accuracy of its results, as well as answer the question of whether it is possible and necessary to adjust demographic indicators for 2011-2021. Our analysis shows that information about at least one in six residents of Russia was taken from administrative sources, leading to large discrepancies in the population in all sex and age groups based on the 2021 census and current population estimates. This discrepancy is most pronounced among children (ages 0-14 years) and the elderly (80 years and older), which indicates that there are problems in administrative data for these ages. In general, we believe that the accuracy of the 2021 Census is the same as for the 2002 and 2010 censuses. However, the results of the 2021 Census should be adjusted.*

Keywords: *Russia, population statistics, population census, civil registration, data quality, data comparability.*

Funding: *This article was prepared within the framework of the HSE University Basic Research Program.*

For citation: *Andreev E., & Churilova E. (2023). The results of the 2021 All-Russian Population Census in the light of civil registration statistics and censuses of previous years. Demographic Review, 10(3), 4-20. https://doi.org/10.17323/demreview.v10i3.17967*

Introduction

Russian population statistics are based on a system of population censuses and current records of demographic events such as births, deaths and migrations. Censuses are conducted periodically, usually at approximately 10-year intervals, and between censuses, population data is calculated based on data from the most recent census adjusted by the components of population change produced since the last census. Such a scheme exists in most countries with reliable demographic statistics, but different countries interpret the concept of "census" differently. Only a few countries have population statistics based on population registers. The data obtained from the population register is more accurate, but its creation and maintenance are complex.

For the census-current recording system to work, it is necessary that censuses be conducted using comparable methods. The Soviet population censuses of 1959, 1970, 1979 and 1989 were conducted using a similar methodology. The methodology of the All-Russian population censuses of 2002 and 2010, however, contained a number of significant differences from the previous ones, and the 2021 census also has a number of distinguishing features.

Censuses record the population size by sex and age at a given time. The more time passes after a census, the more population estimates based on adjustment by the components of population change tend to diverge from the values given by the following census for both total and age-specific numbers of men and women. Some countries tolerate inconsistencies, and officially published time series contain sudden jumps in population values. Other countries recalculate data for the intercensal period, but the previous census itself and the indicators before it are not recalculated.

The Russian population census held in 2021 differs significantly from all others previously conducted. Firstly, it was initially planned for the fall of 2020.[1] However, in February 2020 the COVID-19 pandemic began, and subsequent restrictive measures, in particular lockdown and mandatory self-isolation of sick people and those in contact with them, complicated the census preparation within the planned period. As a result, the Russian population census took place in 2021, despite the ongoing COVID pandemic. Unfortunately, this year was marked by a significant drop in life expectancy because of high mortality from coronavirus infection.

Secondly, for the first time three ways to participate in the census became available to Russians: 1) a traditional interview with a census taker at home; 2) an interview with a census taker at one of the Multifunctional Centers for the Provision of Public Services (MFC); 3) self-enumeration, in which a household member fills out the electronic census forms for himself and each household member on the Public Services Portal. In the last case, the household member who filled out the electronic form in Internet received a unique QR code, which he then had to present to the census taker conducting a door-to-door survey to confirm participation in the census. Self-enumeration via the Internet is a method of collecting census forms that was used in the 2000 and 2010 census rounds in a number of European and Anglo-Saxon countries. The experience of these countries has shown that the level of online participation in the census varies greatly both across and within countries (Pyankova 2013). The decision to conduct a census using the Internet had been brewing since the 2010 census. According to ISSEK data from the

[1] Please note that on the official website of Rosstat, the last census, despite the fact that it was actually conducted as of October 1, 2021, is dated 2020 in accordance with the adopted legislative and regulatory documents. See: https://rosstat.gov.ru/vpn/2020

HSE University, in 2021, 84% of households in Russia had access to the Internet. However, the proportion of adults who never or rarely use it still varies greatly depending on age, level of education and type of settlement (Kuzina 2023). As a result, according to the Levada Center[2], among those who took part in the census, 63% were interviewed at home by a census taker, 7% came to the MFC, and 29% filled out census forms on the Public Services website. Those who used the Internet to participate in the census most often were Moscow residents and young people aged 18 to 39 (Levada Center 2021).

The information about gender and date of birth was obtained from administrative sources for persons who refused to participate or did not fill out the census forms using Internet. The collection of information about gender and age (date of birth) on the basis of administrative data became possible as a result of amendments made on November 28, 2009 to the Federal Law "On the All-Russian Population Census" dated January 25, 2002 No. 8-FZ. It was feared that during the pandemic many people would shy away from contacting census staff and would be unwilling or unable to complete the census online, which could lead to a significant undercount of the population. The use of administrative sources largely prevents this danger.

Thirdly, the All-Russian Population Census took place from October 15 to November 14, 2021. Having expected the critical census moment to occur at midnight on the night of October 14 to 15, 2021, we were quite surprised to find in the "Methodological Explanations" to the census that it was fixed at 0:00 am on October 1, 2021.

Finally, the very long census period (one month) is another feature of the 2021 census. The 2002 census lasted 8 days, the 2010 census lasted 12 days. Note that everyone who died from October 1 to November 14 should be counted in the census. According to our calculations, 367 thousand deaths should be included in the census sheets, and all those born during this period (174 thousand people), on the contrary, should not have been included.

Taking into account the above features of the 2021 All-Russian Population Census, in this article we will try to answer two questions. First: to what extent did the noted features affect the accuracy of the census results? Second: how realistic is it to revise the dynamics of indicators for 2011-2021 so that they lead smoothly to the 2021 census?

Data used

This article analyzes the published results of the population censuses of 2002, 2010 and 2021 (Rosstat 2004; 2012; 2023). We used the tables in Volume 2, which contains the distribution by sex and age and the distribution by sex, age, and marital status, and Volume 3, which includes tables by sex, age, and educational level.

The article also uses data provided by Rosstat based on the results of the 2010 and 2021 censuses on the distribution of the population of the federal subjects by gender and one-year age groups. A comparison of these two series of data showed that from the official publication of the results of the 2021 census, persons whose age was not established in the 2021 census were excluded. There are, it is true, very few of them: 0.05% of all those counted by the census.

[2] ANO "Levada-Center" is included in the register of non-profit organizations performing the functions of a foreign agent.

But in Russia such a decision was made for the first time, so it is strange that it was not documented or commented on in published materials.

We also used annual data provided by Rosstat on the age and sex composition of the population of the constituent entities of the federation as of January 1 for the period from 2010 to 2022 according to current estimates, as well as the following data from vital statistics for 2010-2021:

- distribution of those born alive in the subjects of the federation by gender and month of birth;
- distribution of deaths in federal subjects by gender and year of birth.

Comparison of the 2002, 2010 and 2021 censuses

All three censuses conducted in Russia after the collapse of the USSR gave a larger total population than was shown by calculations based on population change. The 2002 census recorded 1,266,000 more people than the current population estimate. This value was calculated without taking into account data for the Chechen Republic, about the population of which before the census there were only rough estimates, since data on the population movement of the republic in 1993-2002 were not collected.

The population according to the 2010 census exceeded the current estimate at the time of the census by 940,000 people, and according to the 2021 census - by 1,470,000. This comparison alone makes us think that the doubts expressed in the media about the completeness of the population count[3] by the 2021 census are not well founded.

Figure 1 shows the difference in population size according to the 2021 Census and current population estimates in the corresponding age-sex groups.

It should be noted that population censuses often undercount newborns (Andreev 2012). For children under 1 year of age, current estimates are believed to be more accurate than census data. To some extent, this is also true for children 2-4 years old. In the 2021 census, we see not only a fairly large undercount of newborns, but also an undercount of children under 15 years of age. The following can be said about other age groups:

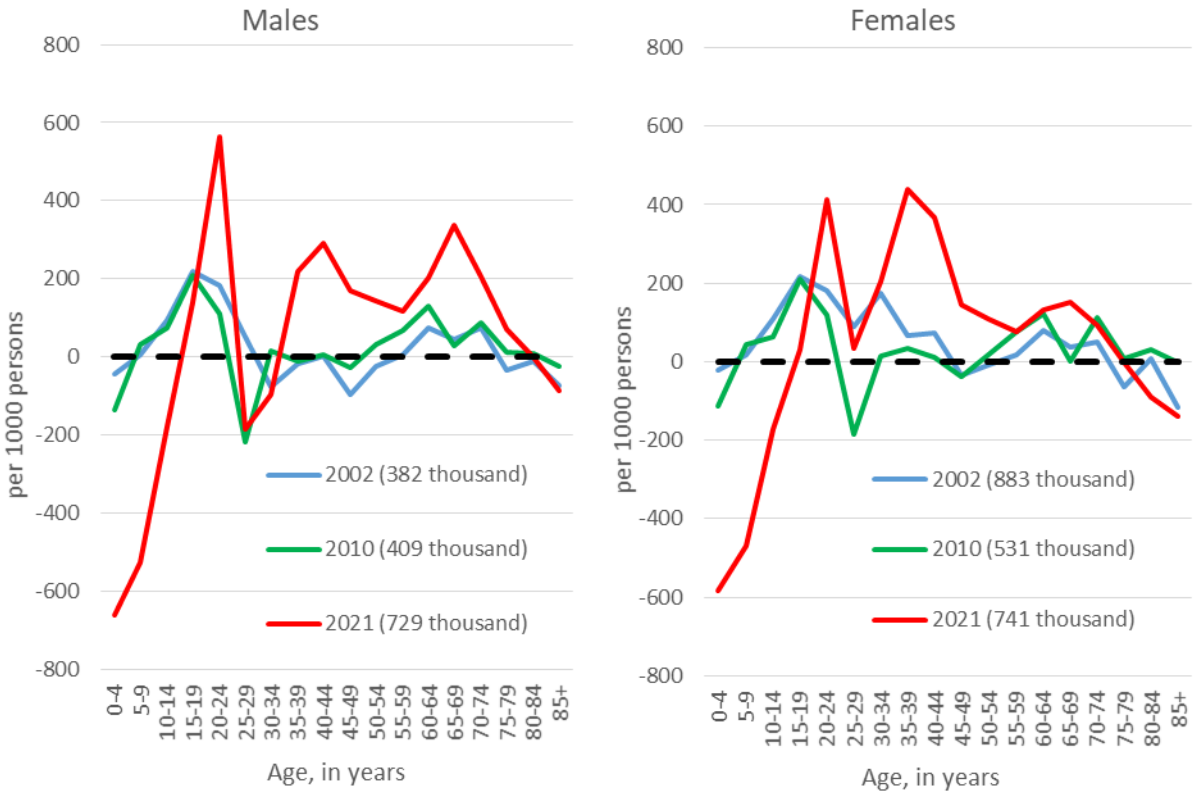
- the number of both men and women aged 20-24 years, according to the 2021 census, is significantly higher than the estimate from the current census;
- in the age group of 25-29 years, the difference between estimates according to the census and current records decreases sharply, for men it becomes negative and less than in 2002 and 2010;
- there is then a new rise in the difference with a maximum in the age group of 35-39 years for both men and women. From 35 to 79 years for men and up to 69 years for women, the difference is greater than in the previous two censuses;

[3] For example: «Census quality may be the lowest in the history of the country» (2021). *Kommersant*, 05.11.2021. «https://www.kommersant.ru/doc/5063173; «Demographer Raksha denies census data» (2022). *Public News Service*, 30.05.2022. https://www.osnmedia.ru/obshhestvo/demograf-raksha-oproverg-dannye-perepisi-naseleniya/

- at ages over 70 the difference in population size decreases, and at the age of 85 years and older it becomes negative and smaller than in previous censuses.

The discrepancies between the census and population estimates for 2002 and 2010 were hard to explain. However, the discrepancies between population estimates from the 2021 census and the population estimates based on vital and migration records are even harder to explain.

Figure 1. Difference between the size of the age group according to the census results and the population estimates at the census date, 1000 people



Note: 2002 without data for the Chechen Republic.

Source: Calculated according to Rosstat data.

We believe that such increasing discrepancies may be partly explained by the increasing prevalence of the practice of recording the population using administrative sources. The problem of under-coverage of the population by the census began to manifest itself in 2002 and worsened in 2010, when 2.5% of the total population was counted based on administrative records (Pyankova 2012). An increase in the incompleteness of population coverage by the census was also shown by data from the Levada Center (2021), according to which 42% of respondents either did not take part in the population census or, at least, did not know that one of their relatives had enumerated them. In light of these data, the increase in the proportion of the population enumerated according to administrative sources is not surprising.

Note that the law on the census, which allowed the population to be counted according to administrative sources, was adopted in 2009. However, this practice arose during the 2002 census, according to the testimonies of its participants (Population Census through the Eyes... 2003). At the same time, census takers did not limit themselves to information about gender and

date of birth, but tried to restore marital status, level of education, nationality and other characteristics.

The increasingly frequent use of administrative data is evidenced by the increased proportion of persons with unknown educational levels and marital status. In the 2010 Census, the percentage of persons with unknown education or marital status increased significantly compared to 2002 (Table 1), and census staff received a statutory right to use administrative sources. In the 2021 census, the proportion of the population with unknown educational level and marital status is more than 5 times higher than in the 2010 census, coming to 16.9 and 15.4%, respectively.

Table 1. Proportion of population with unknown educational level and marital status, %

Census year	Educational level	Marital status
	Age group	
	10 years and more	16 years and more
2002	1.1	2.2
2010	2.9	3.1
2021	16.9	15.4

Source: Calculated based on (Rosstat 2004; 2012; 2023).

We analyzed data for Russian regions in 2021 using the aggregate indicators adopted in the census and compared the proportion of the population aged 6 years and older with an unknown level of education. We selected 5 territories with the highest proportion of population with unknown educational level (Table 2). It turned out that these same territories have the highest proportion of the population aged 16 years and older with the highest proportion of those whose marital status is unknown.

Table 2. Five areas with the highest proportion of population aged 6 years and older with unknown educational level and aged 16 years and older with unknown marital status, %

	Education level unknown	Marital status unknown
Sevastopol	37.7	29.6
Moscow	34.2	32.8
Khanty-Mansiysk Autonomous Okrug	30.5	26.5
Primorskiy Krai	30.3	26.4
Saint-Petersburg	29.0	26.3

Source: Calculated based on (Rosstat 2004; 2012; 2023).

The calculation showed that the Kendall rank correlation coefficient of the proportion of the population with an unknown level of education and with an unknown marital status in 2021 (Appendix Table A) is slightly higher than in 2010 and is equal to 0.88 for 83 territories (the coefficient is significant at the 0.01 level). In real life, such values of this indicator are extremely rare, which suggests that education and marital status are in most cases unknown for the same people. A link was also found between the mortality rate from COVID-19, as measured by the standardized mortality ratio[4], and the proportion of people with unknown education and

[4] The standardized mortality rates for 2021 are presented in table A of the Appendix and were calculated on the basis of the mortality rates presented in the Russian database on fertility and mortality of the Centre for Demographic Research at the New Economic School, Moscow (Russia). The database is available at http://demogr.nes.ru/index.php/ru/demogr_indicat/data

marital status. The Kendall rank correlation coefficients are 0.23 and 0.26, respectively, and are significant at the 0.01 level. For this indicator, this value indicates a fairly strong connection.

Finally, we compared the distribution of the 83 territories that were part of the country in 2010 according to the proportion of persons with unknown education and marital status in 2010 and 2021. We calculated four Kendall rank correlation coefficients. They all lie between 0.33 and 0.37 (significant at the 0.01 level). Assuming that there is such a property of regions as "the willingness of the population to take part in a census", we can expect that in regions with a high willingness of the population to participate in the census there will be a low proportion of people with unknown education and marital status, and vice versa. The rather high rank correlation we identified for the two periods indicates the stability of this feature. In 2021, this feature was superimposed on the COVID-19 pandemic. We see a combination of two factors at work.

In 2010, there were five territories with the highest proportion of those who did not simultaneously indicate their level of education and marital status: the city of St. Petersburg and the oblasts of Astrakhan, Murmansk, Kaluga, and Tver[5].

The only intersection with Table 2 is St. Petersburg, where it is listed last.

The five territories with the highest mortality rate from COVID-19, in descending order of the standardized mortality rate, were the oblasts of Orenburg, Omsk, Sverdlovsk and Kursk, and the Republic of Khakassia. There are no intersections with table 2.

Also of interest are cases of a sharp discrepancy between the proportion of the population with unknown education and the mortality rate from COVID-19. Primorsky Krai is 4th from the top in terms of the share of the population with unknown education and only 79th in mortality, the Kostroma oblast is 19th and 73rd, and the Tomsk oblast is 9th and 60th, respectively. At the same time, the Orenburg oblast is 74th and 1st, the Republic of Kalmykia is 80th and 13th, and the Voronezh oblast is 69th and 7th.

Our comparison of the three censuses does not suggest that the 2021 census did not take into account a significant part of the population. However, for a significant part of the population, the census provided information only on the date of birth and gender of the living.

Consistency of 2021 Census results with current population statistics

To analyze the possibility of recalculation of the total size and age composition of the population for 2011-2021 taking into account the latest census, we limit ourselves to the territories where the census was conducted in 2010. Including the population of the Republic of Crimea and the city of Sevastopol in the analysis of the census would significantly complicate our task, while the main difficulty of the recount, as we will show below, is related to the discrepancy between the 2010 and 2021 censuses.

We recalculated the 2010 Census results, moving the population distributions by sex and age from October 14 to October 1. We did not attempt to estimate population change for the 13 days of October because the migration data contains only the date of registration but not the date of change of residence. Since the size and age-sex composition of the population at the beginning and end of 2010 have already been determined with the greatest possible accuracy,

[5] By decreasing percentage of those not indicating education

we took the weighted average of them with weights proportional to the distance of October 1 from January 1, 2010 and 2011: 0.748 and 0.252. Therefore, age 0 on October 1, 2010 corresponds to age 10 on October 1, 2021.

For the population size of those aged 0-9 years, we took the number of people born between October 1, 2020 and September 30, 2021, between October 1, 2019 and September 30, 2020, and so on, up to the number of births between October 1, 2010 and September 30, 2011. The numbers of births are easy to calculate based on the annual birth records (Table 3). We call this construct the augmented 2010 Census series.

Table 3. Number of births over 12 months, starting October 1 of each year between 2010 and 2021, thousand people

Period		Men	Women
from	through		
01.10.2010	30.09.2011	917.2	867.4
01.10.2011	30.09.2012	968.3	911.9
01.10.2012	30.09.2013	976.1	924.3
01.10.2013	30.09.2014	985.9	930.6
01.10.2014	30.09.2015	979.9	924.8
01.10.2015	30.09.2016	974.1	920.2
01.10.2016	30.09.2017	874.3	827.0
01.10.2017	30.09.2018	826.5	776.3
01.10.2018	30.09.2019	764.6	720.3
01.10.2019	30.09.2020	727.8	686.9
01.10.2020	30.09.2021	714.2	672.7

Source: Calculated according to Rosstat data.

The current estimate of the population composition as of October 1, 2021 is calculated in the same way as for October 1, 2010. In Table 4, we compared the difference between this estimate and the updated 2010 series with the difference between the 2021 census results and the same series by five-year age groups as of October 1, 2021. These differences represent two estimates of change in the size of the five-year cohort.

Table 4 shows some of the features of the censuses that we have already mentioned. Thus, all Russian censuses did not fully take into account children under 1 year of age, which mainly determines the discrepancy in the first row of the table. But we were unable to explain the differences by gender. The line suggests that girls were counted better than boys in the 2021 census.

The annual population estimate is calculated based on births (in this case up to and including age 10), deaths and migration records. The completeness of birth and death records is incomparably greater than migration statistics. The Law “On the right of citizens of the Russian Federation to freedom of movement, choice of place of stay and residence within the Russian Federation” dated June 25, 1993 No. 5242-1 contains very lenient rules for registration at the place of stay and does not provide for registration of temporary departure from the place of permanent residence, early departure from the place of residence and other similar situations. So the births and deaths records are considered accurate. All the differences between population based on census records and annual population estimates are usually explained by the peculiarities of migration records.

Table 4. Change in the number of generations between October 1, 2010 and October 1, 2021 according to annual population estimations and taking into account the 2021 population census, thousand people

Age as of October 1, 2021.	Change in cohort size					
	men			women		
	According to current estimate	Taking into account census	Difference	According to current estimate	Taking into account census	Difference
0-4	0.8	-651.6	-652.4	5.2	-568.9	-574.1
5-9	-26.4	-546.9	-520.4	-15.3	-474.0	-458.7
10-14	10.7	-164.1	-174.8	14.0	-152.8	-166.7
15-19	21.5	161.4	139.9	39.5	72.2	32.7
20-24	29.6	587.7	558.1	72.7	479.3	406.5
25-29	162.6	-16.6	-179.2	99.8	135.4	35.6
30-34	64.8	-30.5	-95.3	98.7	303.6	204.9
35-39	-98.8	118.4	217.2	39.1	477.2	438.0
40-44	-253.1	32.4	285.5	-29.6	335.7	365.4
45-49	-342.2	-176.3	165.9	-79.6	64.6	144.2
50-54	-412.6	-274.7	137.9	-126.6	-17.8	108.8
55-59	-668.8	-555.3	113.5	-229.0	-154.4	74.6
60-64	-1076.0	-880.0	196.0	-435.1	-301.8	133.3
65-69	-1296.7	-965.8	330.9	-639.2	-487.1	152.1
70-74	-1327.0	-1126.3	200.8	-841.3	-745.2	96.1
75-79	-725.5	-655.7	69.8	-643.7	-645.0	-1.3
80-84	-1377.3	-1377.7	-0.4	-1795.8	-1880.7	-84.9
85+	-1853.6	-1940.3	-86.7	-4798.6	-4933.6	-134.9

Source: Calculated according to Rosstat data.

Note: Calculation for the territory of the Russian Federation covered by the 2010 census.

This allows us to estimate the net migration of the population (in other words, the difference between the number of arrivals and departures) in two versions: the net migration used in the current population calculation, and the net migration corresponding to the 2021 census. Since we had already counted the births to calculate Table 4, we needed to count the deaths (Table 5).

Analyzing Table 5, we proceed from the fact that migration statistics may underestimate arrivals or departures, but cannot count the same event twice. The same applies to the statistics of births and deaths, but we do not correct these series.

The net migration estimates based on the census results vary by age and gender. For example, for men 20-24 years old on October 1, 2021, migration based on the census is 10 times greater than according to migration statistics, and for women it is 6 times. Once again, similar discrepancies are observed in men and women 65-69 years old. Two- to four-fold differences occur constantly. But for men aged 25-29 and 30-34 years, the census showed migration growth 4.3 and 1.6 times lower, respectively.

Table 5. Number of deaths and two versions of net migration by sex and age groups in the period from October 1, 2010 to September 30, 2021, thousand people

Age as of October 1, 2021.	Men			Women		
	Numbers of deaths	Net migration		Numbers of deaths	Net migration	
		according to migration statistics	according to census data		according to migration statistics	according to census data
0-4	18.1	18.9	-633.5	13.7	18.9	-555.2
5-9	40.8	14.4	-506.1	30.9	15.7	-443.0
10-14	22.6	33.3	-141.5	16.4	30.4	-136.3
15-19	16.3	37.8	177.7	9.4	48.8	81.5
20-24	31.3	60.9	619.0	13.4	86.2	492.7
25-29	71.6	234.2	55.0	23.7	123.5	159.1
30-34	182.8	247.6	152.3	57.4	156.1	361.0
35-39	306.8	208.0	425.2	101.9	141.1	579.1
40-44	411.5	158.4	443.9	141.6	111.9	477.3
45-49	460.0	117.8	283.7	168.0	88.4	232.6
50-54	502.8	90.2	228.1	196.0	69.4	178.2
55-59	739.7	70.9	184.4	301.0	71.9	146.6
60-64	1132.8	56.9	252.8	508.8	73.8	207.0
65-69	1331.3	34.6	365.5	693.9	54.7	206.7
70-74	1345.4	18.4	219.2	880.1	38.8	134.9
75-79	732.8	7.3	77.1	662.1	18.4	17.1
80-84	1382.7	5.4	5.0	1817.0	21.2	-63.7
85+	1865.7	12.1	-74.6	4816.4	17.8	-117.1

Source: Calculated according to Rosstat data.

Note: Calculation based on 2010 Census area.

Analyzing Table 5, we proceed from the fact that migration statistics may underestimate arrivals or departures, but cannot count the same event twice. The same applies to the statistics of births and deaths, but we do not correct these series.

The net migration estimates based on the census results vary by age and gender. For example, for men 20-24 years old on October 1, 2021, migration based on the census is 10 times greater than according to migration statistics, and for women it is 6 times. Once again, similar discrepancies are observed in men and women 65-69 years old. Two- to four-fold differences occur constantly. But for men aged 25-29 and 30-34 years, the census showed migration growth 4.3 and 1.6 times lower, respectively.

Net migration estimated based on the 2021 census data among those under 15 years of age or over 80 at the time of the 2021 census shows that in these age groups departures from Russia, or more precisely from the territories where the population census took place in 2010, exceeded arrivals. Elderly people change their place of residence very rarely. But from Table 5 it follows that among men who turned 85 on October 1, 2021, 74,600 more people left the territory covered by the 2010 census than entered. Similarly, 180,800 more women in the generations that turned 80 years old on October 1, 2021 moved outside the territory covered by the 2010 census than entered this territory, while in all younger ages older than 15 years, net migration is positive.

Even more puzzling is the negative net migration of children. The numbers in the first line could be explained by the undercounting of children under 1 year of age in the census. But how

can we explain what happened at older ages? The children probably left with their parents, but the departure of the parents was invisible, was hidden by the arrival of adults without children. In our opinion, such explanations look implausible, given the positive statistical data on the net migration of children and the elderly to Russia. Hence the assumption that both phenomena are artifacts, consequences of incomplete comparability of censuses.

It turned out that negative net migration under the age of 15 is higher where the share of those enumerated according to administrative data is higher. As a measure of intensity, we took the ratio of net migration to the average number of children, called the migration growth coefficient, from two sources: the census results and the current estimate at the time of the census.

Negative net migration for people under 15 years of age is observed in 76 of the 83 regions of Russia where the 2010 census took place. It turned out that the Kendall rank correlation between the migration growth rate and the proportion of the population with unknown marital status is equal to 0.21 and is significant at the 0.01 level. This is a fairly high value for this indicator. The relationship with the share of the population with an unknown level of education is somewhat weaker. The Kendall coefficient is 0.19 and significant at the 0.05 level, which is also quite high for this indicator.

In our opinion, the explanation is the following. Children under 15 years of age are registered less reliably than adults in administrative sources, because they do not have passports. In addition, there is probably an undercount of the departure of children, since removal from migration registration is carried out by the Ministry of Internal Affairs, which carries out registration at the new place of residence. This may be why in regions where the proportion of enumerated persons is higher based on administrative data, the estimated number of departures of children based on census data is greater. But most likely, they were simply undercounted in the 2021 census.

The situation with the elderly population is more complicated. Doubts about the correctness of counting the elderly in the 2010 census have already been expressed (Andreev 2012; Papanova et al. 2017). It seems that data from administrative sources in the 1990s were not always adequately corrected when emigrating from Russia, when moving to relatives in other regions, and so on. In the second case, the departure could not be taken into account in full accordance with the law “On the right of citizens of the Russian Federation to freedom of movement, choice of place of stay and residence within the Russian Federation” dated June 25, 1993 No. 5242-1. The above-mentioned authors admitted that, as a result, lists of residents could include “immortals”, persons about whose death information may not have been received, since at the time of death they were actually living in another region or country. In the 2010 census this resulted in an overestimation of the population. In those places where in 2021 the proportion of those enumerated according to administrative data was smaller, these “immortals” dropped out of the population. Where it was greater, they remained.

Negative net migration for people over 60 years of age is observed in 69 of the 83 regions of Russia where the 2010 census took place. The Kendall rank correlation coefficients between the net loss rate for people aged 80 years and over and the proportion of the population with an unknown level of education and unknown marital status are -0.26 and -0.23, respectively (both significant at the .01 level).

In our opinion, the obtained result means the following. During the 2010 population census, recourse to administrative data led to an overestimation of the number of elderly people in many regions of the country, since administrative data were likely not updated and were not cleared of those who had previously died or left the country. During the 2021 census, the smaller the number of persons enumerated in a region according to administrative data, the greater the decrease in such cases.

Let us note two more things. First, there is no statistical connection between the migration growth rate at ages under 15 and the migration growth rate at ages 80 and older. Second, by analogy with the migration growth rates, we can calculate the migration growth rate at the ages of 15-79 years. An increase is observed in 60 of the 83 regions where the population census took place in 2010. No relationship was found between the share of the population enumerated according to administrative data and the growth rate.

Let's return to the topic of recalculating the population for 2011-2021. We conclude that the discrepancy between the 2021 Census and current record estimates for children and older adults is largely due to census inaccuracy, with the 2021 census being responsible for inaccuracies in the recording of children, and the 2010 census for those of older people. Of course, this conclusion requires a more thorough verification using microdata from both censuses. As for children, we have no doubt: it would be more correct to adjust the 2021 census rather than revise the current estimates obtained in the intercensal period.

In our opinion, the differences in the magnitude of discrepancies we noted look very strange and cause distrust in the census data. This must be taken into account in the process of correcting current estimates of age-specific population sizes and, possibly, selectively smoothing out jumps.

With older people the situation is more complicated. Correction of the 2010 census is unlikely to be understood by the executive and legislative authorities and, above all, by the leadership of the constituent entities of the federation. In addition, if smoothness of series is required, then it becomes necessary to revise existing population estimates by sex and age for 2003-2009. Therefore, it seems possible to recalculate the dynamics of the number of older people up to 2011 without requiring a smooth transition of age numbers between 2010 and 2011.

Conclusion

In this article we have analyzed the published results of the 2021 All-Russian Population Census. It was found that the proportion of persons with an unknown level of education and marital status according to the census results was 16.9 and 15.4%, respectively, and the high correlation between these indicators allows us to assert that marital status and education are unknown for the same individuals. This means that for at least one in six residents of Russia data on gender and date of birth were obtained from administrative sources. Thus, the share of Russians who did not personally participate in the 2021 population census is approximately two times lower than according to public opinion polls conducted after the end of the population census. This discrepancy could be explained by the fact that some respondents participating in surveys may not know that they were registered by other household members. However, the incomplete coverage of the population by the census varies by region, reaching a third of the population in the federal cities of Moscow, St. Petersburg, and Sevastopol, as well as in the Khanty-Mansi Autonomous Okrug and Primorsky Krai.

It should be remembered that the population censuses of the Russian Federation after the collapse of the USSR differ significantly from those of the Soviet Union. Population mobility, including international migration, has increased significantly. Another change is the attitude towards the census. It seems that in the USSR people were afraid of not completing the census. Already in the 2002 census, census employees "illegally" (in violation of officially accepted methodology) resorted to information from administrative sources, and in subsequent censuses this was done legally. Not everything in the censuses has been ideal, as demographers have pointed out (Bogoyavlensky 2008; Mkrtchyan 2011; Andreev 2012). Demographers have drawn attention to the possibility for a person to be registered in one locality as a permanent resident, and in another as a temporary resident, which creates the threat of double counting. It is obvious that the problem of completeness of population coverage by the census in 2021 has worsened, and the reasons for this should be the subject of a special study. The decision to use administrative data to fill minimal gaps in information about the population is legal and logical and allows us to "count everyone." As the analysis showed, the use of administrative data does not make the 2021 census less reliable than the 2002 and 2010 censuses in terms of the gender and age structure of the population. However, the use of administrative data does not help to fill the gaps in other information about the population. In addition, an increasing proportion of the population which does not personally participate in the census for one reason or another leads to increased distrust in the census results and raises questions about both the effectiveness of informing the public about the census dates and about obligatory participation in the census.

The population according to the results of the 2021 census exceeds by 1,470,000 people the annual population estimate based on population change. However, the widespread use of administrative data has led not only to a severe undercount of children under 1 year of age – a problem that was also characteristic of the 2002 and 2010 censuses - but also to an undercount of children under 15 years of age. In addition, the problem of great discrepancies in population sizes in other age groups in the adult population has worsened. Shortly before the census, researchers were already drawing attention to the fact that the population size according to administrative records differs greatly from the annual population estimates of Rosstat (Chudinovskikh 2021). We do not know whether the quality of administrative data was assessed before its use in the 2021 census, as experts had quickly called for. We claim that great discrepancies in population by sex and age groups according to census data and population estimates complicate the task facing statistical authorities of recalculating population estimates for the intercensal period to ensure a smooth change in all indicators. Our analysis shows that it is impossible to do this without adjusting the results of the 2010 and 2021 censuses.

Finally, it would be useful if Rosstat commented on its decisions such as its refusal to publish the number of persons of unknown age or the discrepancy between the critical moment of the census and the beginning of the actual census period. Although such decisions, in our opinion, could not significantly affect the results of the census, this information is important for the expert community, and its disclosure would increase confidence in the census among demographers and other specialists. We believe that critical reflection on the mistakes made during the 2021 Census will improve the quality of the next census. We can only wish statistics workers success on this path.

References

Andreev E.M. (2012). On the accuracy of the results of the Russian population censuses and the degree of confidence in various sources of information. *Statistical issues*, 11, 21-35.

Bogyavlensky D. (2008). Were all Russian peoples counted correctly? *Demoscope Weekly*, 319-320. http://www.demoscope.ru/weekly/2008/0319/tema01.php

Kuzina L. (2023). Who in Russia doesn't use Internet and why? *ISSEK of the NRU of the HSE*. https://issek.hse.ru/news/810217750.html

Levada Center (2021). Participation of Russians in the census. https://www.levada.ru/2021/12/21/uchastie-rossiyan-v-perepisi/

Mkrtchyan N.V. (2011). Dynamics of the population of the regions of Russia and the role of migration: a critical assessment based on the censuses of 2002 and 2010. *Izvestia RAS. Geographical series*, 5, 28-41.

Papanova E.K., Shkolnikov V.M., Andreev E.M., Timonin S.A. (2017). The high life expectancy of Muscovites after 80 years - reality or statistical artifact? *Successes of gerontology*, 30(6), 826-835.

The population census through the eyes of enumerators (2003). *Demoscope Weekly*, 97-98. http://demoscope.ru/weekly/2003/097/perepis02.php

Pyankova A.I. (2012). Should participation in the census be mandatory? *Statistical Issues*, 10, 22-34.

Pyankova A.I. (2013). Foreign experience of conducting population censuses via the Internet. *Statistical Issues*, 5, 46-53.

Rosstat (2004). 2002 All-Russian population census. http://www.perepis2002.ru/

Rosstat (2023). The All-Russian census of 2020. https://gks.ru/free_doc/new_site/perepis2010/croc/perepis_itogi1612.htm

Chudinovsky O.S. (2021). On the issue of the establishment of a population register and the use of administrative data for the needs of state statistics. *Statistical issues*, 28 (1), 5-17. https://doi.org/10.34023/2313-6383-2021-28-1-5-17

Appendix

Table A. Proportion of persons with unknown marital status among the population 16 years and older, with unknown educational level among the population 6 years and older (%) according to the published results of the 2021 Census and standardized mortality rates from COVID-19 in 2021, both sexes together, by regions of Russia

	Region	Proportion of persons with unknown marital status in the population 16 years and over, %	Percentage of the population aged 6 years and over with unknown educational level	SMR from COVID-19 in 2021, both sexes together
1	Belgorod oblast	13.4	14.5	229.6
2	Bryansk oblast	11.6	12.3	170.3
3	Vladimir oblast	13.4	13.0	219.0
4	Voronezh oblast	7.8	7.4	294.6
5	Ivanovo Oblast	11.6	11.3	271.8
6	Kaluga Oblast	12.1	11.8	236.1
7	Kostroma oblast	15.5	19.7	169.7
8	Kursk oblast	14.8	15.9	305.5
9	Lipetsk Oblast	10.1	10.6	176.7
10	Moscow Oblast	17.8	18.3	270.8
11	Oryol Oblast	10.4	11.5	290.7
12	Ryazan oblast	20.4	22.7	242.2
13	Smolensk Oblast	15.7	15.9	223.2
14	Tambov oblast	9.5	9.5	220.8
15	Tver Oblast	16.5	19.1	216.3
16	Tula oblast	12.8	13.1	231.5
17	Yaroslavl oblast	19.6	21.8	206.6
18	Moscow	32.8	34.2	225.5
19	Republic of Karelia	12.9	12.3	251.2
20	Republic of Komi	23.2	22.7	253.7
21	Nenets Autonomous Okrug	15.0	16.8	263.8
22	Arkhangelsk region without its autonomous okrug	15.9	18.3	276.0
23	Vologda Oblast	15.7	23.9	201.0
24	Kaliningrad oblast	18.0	23.4	219.4
25	Leningrad Oblast	19.4	21.9	223.1
26	Murmansk oblast	19.5	18.4	293.5
27	Novgorod oblast	18.4	19.8	234.5
28	Pskov Oblast	7.3	5.4	188.9
29	Saint-Petersburg	26.3	29.0	275.3
30	Republic of Adygea	11.3	13.3	196.2
31	Republic of Kalmykia	4.7	4.3	275.1
32	Republic of Crimea	11.9	12.5	177.2
33	Krasnodarsky Krai	8.3	8.2	188.4
34	Astrakhan oblast	15.7	17.2	214.9
35	Volgograd oblast	18.9	25.2	264.3
36	Rostov Oblast	9.3	11.4	243.5
37	Sevastopol	29.6	37.7	235.3
38	Republic of Daghestan	7.3	12.0	144.4
39	Republic of Ingushetia	8.8	10.0	154.6
40	Republic of Kabardino-Balkaria	1.5	1.1	148.8
41	Republic of Karachay-Cherkessia	6.3	4.5	154.1

	Region	Proportion of persons with unknown marital status in the population 16 years and over, %	Percentage of the population aged 6 years and over with unknown educational level	SMR from COVID-19 in 2021, both sexes together
42	Republic of North Ossetia-Alania	11.5	11.3	199.3
43	Chechen Republic	1.5	0.7	190.1
44	Stavropol Krai	3.5	2.8	151.5
45	Republic of Bashkortostan	1.9	1.3	115.6
46	Republic of Mari El	10.4	12.7	121.4
47	Republic of Mordovia	7.3	6.4	199.0
48	Republic of Tatarstan	6.6	6.5	215.5
49	Udmurt Republic	15.9	15.5	217.4
50	Chuvash Republic	11.1	10.7	210.3
51	Permskiy Krai	12.1	12.3	246.9
52	Kirov Oblast	10.3	10.7	49.2
53	Nizhny Novgorod Oblast	17.9	19.5	260.9
54	Orenburg Oblast	7.2	7.0	350.5
55	Penza Oblast	10.1	10.5	245.4
56	Samara Oblast	9.2	8.3	249.8
57	Saratov oblast	13.0	14.3	255.8
58	Ulyanovsk Oblast	14.2	19.1	268.9
59	Kurgan oblast	12.2	14.5	282.0
60	Sverdlovsk oblast	13.1	14.1	322.6
61	Khanty-Mansiysky Autonomous Okrug - Ugra	26.5	30.5	229.7
62	Yamalo-Nenets Autonomous Okrug	23.3	24.5	268.8
63	Tyumen Oblast without Autonomous Districts	16.4	18.9	274.5
64	Chelyabinsk oblast	16.4	19.3	266.5
65	Republic of Altai	7.2	7.0	264.4
66	Republic of Tyva	5.8	5.2	173.9
67	Republic of Khakassia	18.7	20.3	301.0
68	Altayskiy kray	11.7	13.0	228.4
69	Krasnoyarsky Krai	14.9	17.9	261.5
70	Irkutsk Oblast	16.5	16.7	298.4
71	Kemerovo Oblast - Kuzbass	8.1	9.2	88.2
72	Novosibirsk oblast	22.3	26.3	210.1
73	Omsk oblast	13.3	15.3	333.7
74	Tomsk Oblast	22.4	24.7	202.3
75	Republic of Buryatia	8.5	7.6	214.8
76	The Republic of Sakha (Yakutia)	16.9	16.4	267.6
77	Zabaykalsky Krai	15.7	14.5	233.7
78	Kamchatsky krai	14.6	15.4	236.7
79	Primorsky Krai	26.4	30.3	142.7
80	Khabarovsky Krai	23.2	27.5	247.8
81	Amurskaya Oblast	6.8	7.0	205.1
82	Magadan Oblast	9.0	7.1	197.7
83	Sakhalin Oblast	9.6	7.3	90.4
84	Jewish Autonomous Oblast	11.2	11.3	266.3
85	Chukotka Autonomous Okrug	2.1	0.9	84.9

Source: (Rosstat 2023), authors' calculations based on the data of RosBRiS of the Centre for Demographic Research at the New Economic School.

Note: SMR - Standardized Mortality Rate.