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Demographic typology of indigenous peoples of Russia: cluster analysis of age structure

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Abstract. This study analyzes the age and sex structure of indigenous peoples of the Russian Federation based on data from the 2020 All-Russian Population Census. Using statistical and cluster analysis methods, typological groups of peoples based on similar demographic characteristics are identified. Two clearly distinct demographic types are identified: Cluster I, with a predominantly young population, and Cluster II, with a predominantly older population. Quantitative indicators and distinctive features of each type are presented. Conclusions are drawn regarding the demographic resilience of some groups and the risks of depopulation in others, and areas for further research and measures to support indigenous peoples are proposed.

Keywords: demographic structure, age composition, population reproduction, depopulation, ethnic groups

Conflicts of interest. The authors declared no conflicts of interest.

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Демографическая типология коренных малочисленных народов России: кластерный анализ возрастной структуры

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Аннотация. Проанализирована возрастно-половая структура коренных малочисленных народов Российской Федерации по данным Всероссийской переписи населения 2020 г. С использованием методов статистического и кластерного анализов выявлены типологические группы народов по сходству демографических характеристик. Выделены два четко различающихся демографических типа: кластер I с преобладанием молодого населения и кластер II с преобладанием лиц старших возрастов. Приведены количественные показатели и отличительные особенности каждого типа. Сделаны выводы о демографической устойчивости одних групп и рисках депопуляции других, предложены направления дальнейших исследований и меры поддержки коренных малочисленных народов.

Ключевые слова: демографическая структура, возрастной состав, воспроизводство населения, депопуляция, этнические группы

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Introduction

Studying the demographic development of the Indigenous Small-Numbered Peoples of the North, Siberia, and the Far East (ISPN) is particularly relevant, as the dynamics of their population size and structure serve as indicators of the socio-demographic sustainability of the regions they inhabit [1. P. 138]. Since 2019, there has been an increase in researcher attention to this topic, both at the federal level and within individual regions [2. P. 165]. Analyses cover both general trends in the population size and reproduction of these peoples, and specific features of their age structure, nuptiality, migration, and other indicators [3. P. 174].

According to official data from the 2020 All-Russian Population Census, the total population of the 40 officially recognized Indigenous Small-Numbered

Peoples of the North, Siberia, and the Far East amounted to approximately 262,600 people, an increase of 5,000 compared to 2010 [4. P. 7]. However, this growth was uneven: only 14 out of the 40 ethnic groups showed an increase in numbers, mainly relatively larger groups, while most of the smaller-numbered peoples experienced a decline during the intercensal period [4. P. 8]. By 2020, the proportion of the urban population among the ISPN remained relatively low, with settlement in rural areas and places of traditional habitation prevailing for most groups [2. P. 170]. Nevertheless, significant inter-ethnic differences in the demographic situation are noted: several peoples are still characterized by relatively favorable natural increase and a young age composition, while others are experiencing population aging associated with a long-term decline in birth rates and increased assimilation of the youth [1. P. 143; 3. P. 180].

Scientific literature emphasizes that natural increase is the primary factor in the reproduction of the Indigenous Small-Numbered Peoples, as migration inflow is practically non-existent [1. P. 140]. Thus, several northern ethnic groups (e.g., the Nenets, Evenks, Dolgans) maintain relatively high birth rates and continued population growth, largely facilitated by their traditional way of life and state-level support [3. P. 178]. Simultaneously, other groups (e.g., the Veps, Izhorians, Setos), residing in the European part of Russia and being numerically very small, are experiencing natural decline and acute aging: they have an extremely low proportion of children and youth, with pension-age persons predominating, which threatens their continued existence [2. P. 175]. Synthesizing disparate demographic indicators through a typological approach holds scientific interest and practical significance for developing differentiated support measures.

The aim of this study is to identify types of age (and sex-age) structures among the Indigenous Small-Numbered Peoples of Russia based on data from the 2020 population census and to analyze the characteristics of each type from the perspective of demographic sustainability.

Materials and Methods

The analysis was conducted based on data from the 2020 All-Russian Population Census on the distribution of the population by nationality, sex, and age. The sample includes all ethnic groups officially classified as Indigenous Small-Numbered Peoples of the North, Siberia, and the Far East of the Russian Federation (In accordance with the legislative list), as well as several other small ethnic groups

similar in population size and way of life[1]. For each people, data were considered for all of Russia and for the main regions they inhabit (to account for regional differences). A total of 42 ethnic groups and over 100 territorial groups (ethnic group-region) were examined.

For each ethnic group, summary demographic indicators were calculated: the proportion of children (0–14 years), the proportion of persons above working age (60 years and older), median age, sex ratio coefficients, and others. Specifically, the population aging index was determined using formula

$$AI = \frac{P_{65+}}{P_{0-14}} \times 100\%, \quad (1)$$

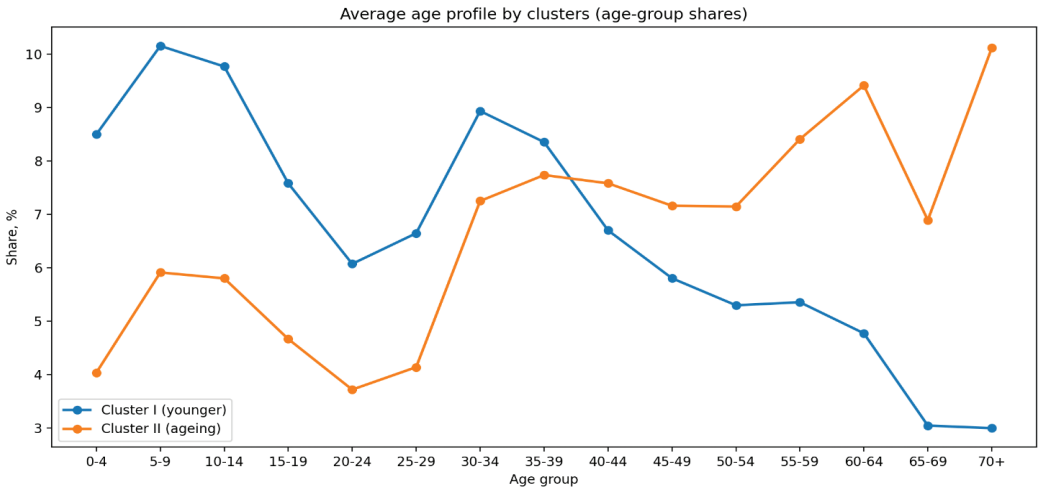
where P_{65+} — the population aged 65 years and older; P_{0-14} — is the population of children aged 0–14 years. The *AI* value shows how many elderly persons there are per 100 children; a value exceeding 100% indicates a predominance of older ages over younger ones. Additionally, the dependency ratio for the working-age population was calculated as the ratio of the sum of children and elderly to the working-age population (defined as ages 15–59) per 1,000 working-age individuals. This indicator reflects the burden on the economically active part of the population.

To identify the typology, a cluster analysis procedure was applied. In the first stage, the initial indicators of age structure (proportions of the population in five-year age groups) were standardized and reduced using principal component analysis to two integral factors reflecting the general variations in age profiles. Subsequently, using the k-means method, all observations (ethnic groups, considering regions) were grouped into clusters based on the similarity of their age structure. The optimal number of clusters was determined based on maximum inter-group differences and the interpretability of the resulting segments. As a result, two stable clusters were identified, differing in their age pyramids and related demographic parameters.

Results

Cluster analysis divided the small-numbered peoples into two distinct groups (conditionally named Cluster I and Cluster II). Their demographic profiles differ significantly (Fig.). Cluster I is characterized by a young age structure, whereas Cluster II has an aging (old) population structure. Table presents the key indicators for each cluster.

[1] In addition to the 40 official groups of the Indigenous Peoples of the North, the analysis includes, for example, the Abazins, Nagaybaks, Shapsugs, and others, who are not related to the Indigenous Peoples of the North, but have a small population and similar development problems.



Distribution of the population by main age groups in clusters I and II

Source: made by D.V. Nakisbaev, A.M. Sitkovskiy based on Rosstat[2] using Python according to the method described in the article.

Table demonstrates that, on average in Cluster I, nearly 28% of the population consists of youth aged 0–14 years, while the elderly (60 years and older) account for only about 11%. In contrast, in Cluster II, the proportion of children does not exceed 16%, and the share of the older ages reaches 26%. The median age differs by more than 15 years: approximately 30 years for Cluster I compared to ≈45 years for Cluster II. The aging index in Cluster I is low (less than 50%, i.e., the elderly are several times fewer than children), while in Cluster II it exceeds 100%, indicating a numerical predominance of the elderly over children. The dependency ratio for the working-age population in both clusters ranges between 740–830‰, reflecting a high dependency burden; however, the structure of this burden differs: in the first cluster, the majority of the burden comes from children, while in the second, it comes from the elderly.

Cluster I (young) primarily includes peoples who have maintained relatively high birth rates and natural increase. This group comprises all the largest Indigenous Small-Numbered Peoples by population size: the Nenets, Evenks, Evenks (Lamuts), Chukchi, Dolgans, Nanai (the main core in Khabarovskiy Krai), and others — mainly ethnic groups of the North of Siberia and the Far East. Common to them is that a significant part of the population lives in traditional rural settlements, where large families persist and a lower average life expectancy is compensated by a high proportion of young ages. For example, according to census data, the

[2] Table 21. Population of indigenous peoples of the Russian Federation by age groups and gender. *Results of the 2020 All-Russian Population Census. Volume 5. Ethnic composition and language proficiency: Rosstat*. 2022. URL: https://rosstat.gov.ru/storage/mediabank/Tom5_tab21_VPN-2020.xlsx (accessed: 28.12.2025). (In Russ.).

number of Evenks in Russia continued to grow, and among them, the proportion of children significantly exceeds the proportion of the elderly [3. P. 181]. The peoples of Cluster I are characterized by a median age of around 30 years and a moderate gender imbalance: the sex ratio is close to equilibrium (90–95 men per 100 women on average), which is typical for a relatively young population.

Key demographic indicators for the id entified clusters (average values)[3]

Cluster	Share 0–14 years, %	Share 15–59 years, %	Share 60+ years, %	Median age, years
I younger	28.4	60.8	10.8	30.5
II ageing	15.7	57.8	26.4	44.8

Source: made by D.V. Nakisbaev, A.M. Sitkovskiy based on Rosstat[4] using Python according to the method described in the article.

Cluster II (aging) unites groups with low birth rates, stagnation or population decline, and pronounced aging. This group includes, first and foremost, the smallest-numbered and/or most assimilated peoples: such as the Veps, Izhorians, Setos, Shapsugs, Negidals, Sami, Chulyms, Teleuts, Tubalars, Kamchadals, and some others. The common denominator is a very small total population (often hundreds or the first few thousand people) and a high proportion of elderly due to the young generation being either small in number or leaving for larger ethnic groups through inter-ethnic marriage and migration. Among the peoples of Cluster II, the median age exceeds 40 years, and the sex ratio is skewed towards a predominance of women, especially in older ages (which is characteristic of the general trend of feminization of the older population). For example, according to estimates, among the Veps and Izhorians, the proportion of persons over 60 years old is more than a quarter, while children account for less than one-tenth (according to census data and research, see [2. P. 172). These groups have proven to be demographically vulnerable: natural population decline is observed (mortality exceeds birth rate), and the small number of children being born does not ensure simple generational replacement.

Thus, the cluster approach has clearly divided the small-numbered ethnic groups into “demographically successful” and “demographically problematic”

[3] Cluster I includes 80 territorial groups (ethnicity-region), Cluster II — 25 groups. The proportion of age categories and median age are calculated based on 2020 census data.

[4] Table 21. Population of indigenous peoples of the Russian Federation by age groups and gender. *Results of the 2020 All-Russian Population Census. Volume 5. Ethnic composition and language proficiency: Rosstat*. 2022. URL: https://rosstat.gov.ru/storage/mediabank/Tom5_tab21_VPN-2020.xlsx (accessed: 28.12.2025). (In Russ.).

categories. It should be noted that the boundaries between the clusters are somewhat conditional. Variability is observed within each: for example, some peoples in Cluster I are already close to a transitional structure (e.g., the Mansi and Khanty — their average age is increasing due to the influence of urbanization), and some groups in Cluster II still retain pockets with a younger population (e.g., the Tofalars and the Nanai of Primorye have a slightly higher proportion of youth in certain settlements, despite overall aging). Nevertheless, the division into two types is generally clearly discernible.

Discussion

The results obtained align with the information available in the literature regarding the differentiation of demographic development among Indigenous Small-Numbered Peoples. It has been previously noted that among these peoples, there are groups that have shown population growth in the post-Soviet period (due to the maintenance of high birth rates and ethnic re-identification of part of the population), and there are groups whose numbers have been declining from census to census (mainly due to assimilation processes and negative natural increase) [2. P. 169; 4. P. 8]. Our analysis confirmed this, proposing a formalized division into two categories.

Cluster I includes ethnic groups which, despite socio-economic changes, have managed to largely preserve the traditional model of reproduction. They are characterized by relatively high total fertility rates (close to or above the Russian average), a lower average age of mothers at childbirth, and a larger average family size [1. P. 142]. For example, among the peoples of the Far North — the Nenets, Chukchi, Evenks — natural increase was observed in the 2010s, and the average number of children per woman remained around 2 or more (which ensures population reproduction) [3. P. 181]. Furthermore, many of them experience an influx of youth into the ethnic category due to a revived interest in their native culture and identity (cases where descendants of mixed marriages begin to identify themselves with the small-numbered people). All this contributes to the age pyramid of these peoples still being close to an expansive type (a large base of young people and a narrowing apex of older ages).

In Cluster II, on the contrary, the consequences of demographic modernization and assimilation are evident. Most of these peoples, already during the Soviet period, transitioned to a narrow type of reproduction (low birth rate, small proportion of children) against the backdrop of a mass outflow of youth to cities or into the composition of larger peoples (Russians, Yakuts, Tatars, etc.) through

marriage and identity change [2. P. 176]. As a result, by the early 2000s, they had developed a regressive age structure — a narrow base of the pyramid (few children) and a broad top (many elderly). Our 2020 data show a further intensification of this trend. In such conditions, even relatively low mortality (characteristic of an assimilated population living mainly in areas with developed infrastructure) does not prevent declining trends — simply because there is insufficient young replacement [5]. An example is the Izhorians in the Leningrad Oblast: according to the 2020 census, they number only about 200 people, of whom more than half are above working age; the birth rate in Izhorian settlements is almost zero, which means the inevitable disappearance of the Izhorians as a separate demographic category in the coming decades (In essence, only descendants with partial Izhorian ancestry, already classified under other peoples, will remain).

It is important to emphasize that the geographical factor and the degree of preservation of the traditional way of life play a significant role. The peoples of Cluster I mostly live in remote areas of the North and Siberia, where, despite challenges, traditional nature management and a semi-nomadic lifestyle (reindeer herding, fishing, hunting) are preserved. This contributes to higher reproductive behavior (more children in families) and somewhat lower urbanization. In contrast, the groups of Cluster II often live either in relatively urbanized regions (Northwest, Urals) or are settled in a mosaic pattern among larger peoples, which accelerates their demographic contraction. Nevertheless, some northern ethnic groups also face the threat of aging — for example, the Sami of the Kola Peninsula (Cluster II) experience youth outflow and low birth rates, although geographically they belong to the Far North. This indicates that not only geography, but also historical conditions (population size, contacts with the outside world, policy) determine the demographic type.

Overall, the identified types correspond to the categories of “demographically successful” and “demographically problematic” small-numbered peoples. Such a typology resonates with the findings of other studies that distinguish groups with relatively stable population growth and groups with clear depopulation [4. P. 182]. The novelty of our approach lies in the application of cluster analysis to formalize these differences and in the quantitative confirmation of the gap between the types.

Conclusion

As of the early 2020s, the Indigenous Small-Numbered Peoples of Russia are divided into two polar demographic types. The first type comprises peoples with a still-young population structure and relative natural increase (despite their

small numbers, these groups reproduce their population thanks to high birth rates and a low average life expectancy, which keeps the proportion of elderly low). The second type comprises peoples with an aging and declining population, characterized by low birth rates, a small proportion of youth, and a predominance of the elderly, leading to depopulation.

The application of cluster analysis made it possible to quantitatively confirm the existence of these types and to assign specific ethnic groups to one type or another. The obtained results have practical significance: demographically "young" peoples (Type I) need support aimed at consolidating achievements — ensuring accessibility of education, healthcare, and jobs for the young population in places of traditional habitation, to maintain positive reproduction trends. At the same time, for demographically "aging" peoples (Type II), urgent measures are required aimed at preserving the ethnic group: stimulating birth rates (e.g., support programs for young families specifically of this ethnicity), developing cultural autonomy, documenting and popularizing linguistic and cultural heritage, and drawing public attention to the problems of these peoples. Despite their small numbers, each of these ethnic groups is unique and represents a value for the country's cultural and ethnic diversity.

Prospects for further research lie in an in-depth analysis of the factors influencing demographic types. Of particular interest is the role of the level of socio-economic development of regions, accessibility of infrastructure, migration processes, and the degree of preservation of traditional culture in shaping a particular type of age structure. It is also advisable to monitor dynamics: comparison with data from previous censuses (2002, 2010) and tracking future changes, which will reveal whether the division into types persists or if a transformation occurs (e.g., the transition of some peoples from the first type to the second as they age).

Undoubtedly, the demographic well-being of the Indigenous Small-Numbered Peoples is an important component of their overall survival and development. Identifying problem areas (at-risk groups) should be accompanied by targeted state support measures, including improving medical care for the elderly in small settlements, creating conditions for increasing the birth rate, and reducing youth outflow. Preserving these small-numbered peoples is not only a matter of cultural heritage but also an indicator of the success of national policy in ensuring the sustainable development of small ethnic groups in a multinational country.

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