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To cite this article: Elena Bogdanova, Sergei Andronov, Andrey Lobanov, Ruslan Kochkin, Andrei Popov, Ildiko Asztalos Morell & JonØyvind Odland (2021) Indigenous women's reproductive health in the Arctic zone of Western Siberia: challenges and solutions, International Journal of Circumpolar Health, 80:1, 1855913, DOI: [10.1080/22423982.2020.1855913](https://doi.org/10.1080/22423982.2020.1855913)

To link to this article: <https://doi.org/10.1080/22423982.2020.1855913>



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Published online: 07 Dec 2020.



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Indigenous women's reproductive health in the Arctic zone of Western Siberia: challenges and solutions

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ABSTRACT

In the Russian Arctic, alarming trends (shortage of nomadic Indigenous women, high reproductive loss, child mortality rates) indicate long-term changes towards demographic decline. This study aimed at comparing some indicators of the reproductive health (childbirth rates, number of pregnancies, pregnancy loss) of Indigenous and non-Indigenous women in the exploration of cultural and social factors influencing reproductive behaviour. A multidisciplinary approach draws on methods of medicine, sociology and health economics. It includes data of the women's reproductive health collected from surveys of 879 women (of whom 627 were Indigenous) during expeditions to the settlements and the tundra of the Yamal-Nenets Autonomous Okrug in 2013–2019. In the tundra, 66.7% of registered Indigenous women's pregnancies resulted in childbirth, 7.8% in induced abortions, 25.5% in spontaneous miscarriage. More than three children were delivered by 59.1% of Indigenous women. Most Indigenous families suffered from high pregnancy loss. Marriage between close relatives was 27.0%. Child mortality equalled 24.4%, three times higher than in the population of the settlements and eight times higher than in families immigrating from other regions. The survival of Indigenous peoples significantly depends on women's reproductive health and sufficient medical service that requires targeted policy.

ARTICLE HISTORY

Received 16 September 2020
Revised 19 November 2020
Accepted 20 November 2020

KEYWORDS

Women's health; reproductive health; reproductive loss; child mortality; pregnancy; indigenous peoples; the Arctic; western Siberia; yamal-nenets Autonomous Okrug

Introduction

Demographic policy of the region: retrospective overview




The demographic policy of the Russian Federation for the period until 2025 (approved by the Decree of the President No. 1351 of 9 October 2007) identified the strengthening of reproductive health and the institution of a family as priority areas of governmental policy. These have a strong impact on both childbirth rates and the viability of future generations [1].

In the 1990s, depopulation processes became a trend in Russia (total population), closely related to decreasing rates of childbirth [2]. In contrast, until 2010, the Indigenous population living in the Yamal-Nenets Autonomous Okrug (YNAO), in the Arctic zone of Western Siberia in Russia, has been increasing. During 50 years between 1959 and 2010, its Indigenous population almost doubled: the number of

the Nenets from 13,977 to 29,772, the Khanty from 5,519 to 9,489, the Selkups from 1,245 to 1,988, and the Komi-Zyryans from 4,866 to 5,141 [3]. Nonetheless, an important change came after 2010, since, according to the official statistics, the population growth of these minorities almost stopped and the population stagnated between 2010 and 2016 (increasing by only 3.7%). Parallel to this, the number of Indigenous communities shows a slow and fluctuating decline. There were 65 communities in 2016, 64 in 2017, 59 in 2018, 61 in 2019 [4]. This may also reflect a radical change in the trend of high fertility among Indigenous peoples.

Reproductive health of the Indigenous population in the YNAO: fertility and morbidity rates in 19th–21st centuries

The reproduction of the population necessary for sustaining vital functions of the Indigenous population is

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interrelated with the maintenance of a traditional lifestyle (associated with traditional occupations: reindeer herding, hunting, fishery, etc.) by the Indigenous peoples living in YNAO. The survival of the Indigenous peoples living in small groups in the isolated territories significantly depends on women's reproductive health and reproductive behaviour. According to the Constitution of the Russian Federation (Article 19), women and men have equal rights [5]. This underlies women's right to maintain their lifestyle and make reproductive choices.

Fluctuation in the population is partly related to figures for fertility and morbidity. Some research stressed the halving in childbirth rates among the total Indigenous population in the Russian Arctic: during the last century the child index was halved (from 1,318 children per 1,000 women aged 20–49 years in 1897 to 776 in 2010 [6]). In 1998–2002, the childbirth rate of the Indigenous peoples in the North was still noticeably higher than that of the total population in Russia. However, mostly these Indigenous peoples were at the level of simple reproduction (2.2 children per 1 woman); only among the Nenets was the total fertility rate significantly higher – 3.1 children per 1 woman [6]. In YNAO, statistical data on childbirth and child mortality among the Indigenous population (especially the nomadic population) are very poor. The Nenets fertility levels in the 20th century were analysed by E.A. Volzhanina [7–10] and N.A. Mikhalev [11], and more recent data on these developments in general in the Russian Federation by Baranov et al. [12]. During the last decade, these statistics have improved. In the 21st century, trends that contribute to population decline indicated that the age of the Nenets women at first birth was increasing while the rate of childbirth was decreasing. In contrast, other trends pointed towards population increase, since infant and child mortality rates have significantly reduced among the nomadic population due to the improved health-care system in YNAO [9]. In comparison, perinatal and infant mortality rates were worsening between 1996 and 2010 among the Inuit population in Canada [13]. It was one of the sensitive policy outcomes in the global North in the 1970s when Canada's Arctic also became “a proving ground” for implementation of population control and decreasing of reproduction in Indigenous women [14] (p. 484).

Other factors contributing to population changes have to do with mobility. Alarming trends have been observed in the gender composition of the population, which indicates long-term changes towards demographic decline. A deficit of women can be related to gender-differential outmigration. The proportion of

women and men in Indigenous communities is almost 1:2. For example, the number of Nenets women living in YNAO is 15,827 [15]; women aged 16–44 years living in rural areas and inter-settlement territories number 5,736 [16]. Of the 7,381 Nenets living in the Tazovsky district, about 2,300 are of female gender. The adult Nenets tundra population in the region is 2,837, 890 of whom are women [17]. These transitions of gender relations have occurred during the last few decades, along with certain changes in lifestyle, social status (i.e., education) and the mating behaviour of Indigenous women and men [18–22]. Nowadays, women are inclined to give up a nomadic or semi-nomadic lifestyle and prefer a sedentary way of life, moving to the settlements and towns. Meanwhile, men maintain the traditional nomadic lifestyle in the tundra, occupied with reindeer herding, fishing or hunting. At the same time, men prefer to marry Indigenous women, while women have a tendency to choose Russians as mates. This leads to a “deficiency of brides” in the tundra. By leaving the tundra, women usually get higher education and are hired for qualified jobs. This can result in a decrease in the Indigenous population that undermines both traditional lifestyle and Indigenous economy if there is no governmental support.

Policy context for Indigenous women's reproductive choices in the Russian Arctic

These trends indicate that we need a conceptual framework that goes beyond a narrow perception of reproductive health in order to better understand the population trends characterising the Indigenous people of the Russian Arctic. Reproductive health, in a narrow sense, is closely related to demographic trends and is associated with the reproductive potential of the population, the reproductive potential of the individual, reproductive loss and reproductive behaviour. Beyond a strictly demographic perception of reproductive health, the World Health Organisation (WHO) promotes a holistic view according to which the concept means total well-being in all aspects of reproduction, i.e., physical, emotional, behavioural and social [23]. Therefore, the reproductive potential of the population depends not only on a healthy environment but also on socio-economic determinants and cultural patterns. Indigenous peoples' reproductive health concerns not only demographic reproduction but also reproduction within a specific Indigenous life context and its cultural patterns. This increases the importance of studying from a holistic perspective the reproductive health of the Indigenous nomadic population in comparison with the Indigenous and non-Indigenous settled population.

Within such a holistic framework the demographic fluctuations are partly associated with policy changes, partly with changes in living conditions in the Arctic.

Firstly, we should mention the overall policy context important for women's reproductive choices. In the Soviet period, the Indigenous population did not receive special governmental support or sufficient access to medical facilities. This resulted in high reproductive loss and infant mortality rates among the nomadic population in the Russian Arctic (1983–1987: 43.3 per 1,000; 1988–1992: 30.2 per 1,000 [6]). By contrast, in some other Arctic countries at that time (i.e., Canada, the USA) the medical policy regarding women's reproductive health changed to favour Indigenous community birthing and midwife services [14; 24,25]. The post-Soviet period in Russia was associated with an economic crisis and lack of resources to support Indigenous women's reproductive health, followed by an increase in infant mortality rates up to 34.3 per 1,000 (1993–1997). Since the 1990s policy initiatives focusing on Indigenous peoples implemented by the Russian Association of Indigenous Peoples of the North (RAIPON) in collaboration with regional governments (subsidising programmes for Indigenous families) have had an impact on the decline in infant mortality rates – 27.6 per 1,000 (1998–2002) [6]. Russia's current social policy encourages women to have large families with many children since they can obtain benefits for childbirth (“maternal capital”, similar to “baby bonus” programmes in Canada [26]). This is a significant input to the demographic policy in Russia. However, Arctic Indigenous women living in remote areas still have common unsolved problems which can be barriers to preserving their reproductive health: insufficient access to perinatal maternity care, lack of high-qualified medical staff in Indigenous communities, difficulties with the evacuation of childbearing women from remote areas, limited access to traditional food. This emphasises the importance of modernising the health-care system. This includes delivering pregnant women from the tundra to the municipal hospitals to give birth, and in emergency cases by air ambulances. According to Russian government officials, the Indigenous population is increasing because of the effective and progressive policies of the authorities in the region [27], including sufficient access to medical care services [28] (pp. 196–197). In YNAO, to provide sustainable development for Indigenous minority peoples, the governmental programme “Sustainable Development of the Indigenous Minority Peoples of the North in the Yamal-Nenets Autonomous Okrug for 2018–2022” [29] has been developed. Besides this, social guarantees are granted to them within 14 regional government

programmes: free medication, favourable prosthodontic aid, food for pregnant women and mothers with children under 3 years of age.

Monitoring and delivering reliable data is required for the development of social policies and health services. Therefore, the objective of our study was to describe the reproductive health of the Indigenous women in the Arctic zone of Western Siberia in comparison with the non-Indigenous population. It was also important to see whether changes to a traditional lifestyle can have a significant impact on reproductive behaviour in the future. Indigenous populations basing their subsistence on nomadic economies have been the key factor making it possible to populate the High North. The continued settlement of the High North presupposes demographic stability.

Materials and methods

Study design

In this paper we present the results of a retrospective, cross-sectional analysis of reproductive health in three groups of women living in the remote communities of the Yamal-Nenets Autonomous Okrug: 1) Indigenous women in the tundra, 2) Indigenous women in the settlements, and 3) immigrated population (from other regions of Russia and former Soviet Republics). The study takes a multidisciplinary approach that draws on methods used in the fields of medicine, sociology and health economics. This study sought to compare some indicators of reproductive health (childbirth rates, number of pregnancies, pregnancy loss) among the Indigenous and non-Indigenous women to determine cultural and social factors influencing reproductive behaviour.

Settings: The Yamal-Nenets Autonomous Okrug: geographic, population and ethnic structure

YNAO, the geographic focus of our research, is an important region for the Indigenous peoples of Russia, and is located in the circumpolar northwest of West Siberia. It has a population of 544,008 [30], living in an area of 769,250 square kilometres [31]. The population density is 0.71 people per square kilometre. The location of YNAO (more than half of its territory is beyond the Arctic Circle) significantly impacts traditional occupations in this region. It is a unique territory because almost half of the minority Indigenous population of the Russian Arctic (about 45,000 people) reside there, including the Nenets, the Khanty, the Selkups and the Komi-Zyryans [3]. A total of 14,600 people are Indigenous, living in the tundra areas as part of

a nomadic culture and community [32]. The culture, health and social well-being of Indigenous peoples are strongly linked to a traditional lifestyle.

This region has a complicated ethnic structure of Indigenous and non-Indigenous populations. Historically, three population groups were formed on its rural areas: Indigenous nomadic people, Indigenous peoples living in the settlements and non-Indigenous population arriving from other parts of Russia and former Soviet republics. Their lifestyle, family and reproduction patterns have differed. In the 11th century, some Nenets and Khanty clans migrated to the Arctic and subarctic zone of the Yamal area. Some 500 years later, the Selkups settled in this territory [33]. After the annexation of Siberia to Russia as a result of Yermak's campaigns, Russians also arrived in this territory (in the 21st century they make up about 50% of the total population in YNAO). Later, in the 19th century, the Komi-Zyryans also moved to Yamal [34]. Due to the geographic location at the Arctic Circle and the landscape features of YNAO (almost half of its territory is located in the subarctic zone, the tundra, and occupies the southern parts of the Yamal and Gydan Peninsulas) [31], the Nenets who arrived first became nomads in the tundra while reindeer herding. The Khanty, the Selkups and non-Indigenous people founded small settlements, where they mostly lived by hunting and fishing [34]. Nowadays, almost 112 ethnic groups are settled in YNAO and only about 10% of them belong to Indigenous minorities [3]. However, traditional lifestyle became the basis for meeting Indigenous peoples' vital needs and helping them to survive in the severe Arctic areas.

Measurement tools

Survey data

Information about socio-demographic characteristics, health status and reproduction was collected from the survey in the Arctic zone of Western Siberia during expeditions to the settlements and the tundra areas of the Yamal-Nenets Autonomous Okrug in the summer (August) and winter (March and November) of 2013–2019. Data collection was carried out in cooperation between the YNAO Arctic Scientific Research Centre, Health Department of the Government of the YNAO and the Northern Arctic Federal University. The inclusion criteria for the respondents were: women aged 18 and older, involved in traditional occupations (reindeer herding, hunting, fishery), residing in the tundra or in the settlements of the Arctic zone of Western Siberia for over 5 years. All participants were

divided into three groups: group 1 – Indigenous women living in the tundra; group 2 – Indigenous women living in the settlements; and group 3 – immigrated population. The participants were asked to fill in the questionnaire while undergoing the medical examination conducted by the YNAO Arctic Scientific Research Centre at health care institutions (municipal hospitals and feldsher-midwife medical stations in remote settlements) in the Tazovsky settlement, the Tazovskaya tundra, the Nakhodka tundra, the Gyda settlement, the Gydanskaya tundra, the Yavai-Salinskaya tundra. Questionnaires were developed in Russian and gave information about socio-demographic factors and women's reproduction (number of pregnancies, intervals between pregnancies, pregnancy outcomes, abortion, premature birth, childbirth, pregnancy loss). Data collection was undertaken by the medical doctors who had been trained in the study procedures, and assisted by Indigenous female nurses and researchers. A total of 879 women in YNAO participated in the survey, of whom 627 were Indigenous (Nenets, Khanty, Selkups, and Komi-Zyryans), defined by the interviewers at enrolment based on their primary Indigenous language, self-identification, nomadic or semi-nomadic lifestyle and involvement in traditional occupations (reindeer herding, hunting, fishery). Participants filled out a confidential paper questionnaire with questions about reproduction, among other things. Women's reproduction was analysed according to the questions: "How many pregnancies have you had?", "What was your age during each pregnancy?", "What were the outcomes of each pregnancy (childbirth, medical abortion, miscarriage)?", "How many your babies died under 1 year old?", "Did you have any inflammatory or non-inflammatory gynaecological pathology?" The participants received information about the programme, both verbally and in writing. They provided written informed consent. The consent form stated that participation was voluntary, and their confidentiality was assured. Participants' personal data and their answers were anonymised, numbered, and added to the de-identified databases.

Statistics

A Shapiro-Wilk test for normality of distribution was implemented. Data were presented in Me format [Q25–Q75]. To assess and compare the differences in qualitative variables between the groups, the χ^2 test was employed. Kruskal-Wallis ANOVA was used to assess the significance of differences between three or more unrelated groups.

Table 1. Socioeconomic data of the female respondents recruited for the survey, Yamal-Nenets Autonomous Okrug, 2013–2019, %.

Population	Indigenous Women in the Settlements (n = 519)	Indigenous Women in the Tundra (n = 108)	Immigrated Women (n = 252)
<i>Marital status</i>			
Registered marriage	56.3	79.0**	67.6
Single	25.2*	6.6	16.4
Widowed	12.9	9.2	12.9
Divorced	5.6	5.2	6.8
* $\chi^2 = 18.3$; $p < 0.001$; ** $\chi^2 = 18.8$; $p < 0.001$			
Closely related marriages, %	16.2	27.7	2.2
<i>Level of education</i>			
Missing data	4.8	4.6	
Absence of formal schooling	10.4	6.5	5.6
Primary school	10.0	41.7**	1.6
Incomplete secondary education	19.8	26.9***	3.9
Secondary education	6.4	5.6	2.4
Vocational school	28.3*	11.1	25.4
Technical college	8.5	1.8	13.9
Higher education	11.8	1.8	43.3
Total	100.0	100.0	100.0
* $\chi^2 = 103.0$; $p < 0.0001$; ** $\chi^2 = 27.7$; $p < 0.0001$; *** $\chi^2 = 165.0$; $p < 0.0001$			
<i>Housing</i>			
Chum	0	108	252
Wooden house	519	0	0
Total	519	108	252

Statistical analyses were performed using Microsoft Excel 2016 and SPSS Statistics 23.0. Significant differences were defined at a p-value < 0.05 .

Ethical approval

The study was approved by the Ethics Committee of the Arctic Scientific Research Centre of Yamal-Nenets Autonomous Okrug, Salekhard, Russian Federation, on 18 January 2013 (approval protocol No. 01/1-13).

Results

Three groups of participants were distributed as follows: group 1 – Indigenous women living in the tundra (n = 108); group 2 – Indigenous women living in the settlements (n = 519); and group 3 – immigrated population (Russian women) (n = 252). The age of the examined women ranged from 18 to 65 years, with the mean age in the groups as follows: 1–48.0 (95% CI 40.0–56.0), 2–45.0 (95% CI 33.0–55.0), 3–45.0 (95% CI 36.3–55.7). There were no statistically significant differences ($H_{K-W} = 5.7$, $p = 0.06$).

In Tazovsky district 45.9% of the patients were recruited for a survey and medical examination, 25.8% in the Yamalsky district and 28.3% in the Nadymy district of YNAO.

Indigenous women living in the tundra were the most likely to live in a registered marriage (79.0%). Conspicuously, the least likely to be married were Indigenous women living in the settlements (56% of them), showing a significant difference ($\chi^2 = 18.8$,

$p < 0.001$). In contrast, Indigenous women in settlements had the highest proportion of those living as singles (25.2%) compared to Indigenous women living in the tundra (6.6%), also showing a significant difference ($\chi^2 = 18.3$, $p < 0.001$) (Table 1). The marital pattern for immigrated women has been in between these two: 67.6% were married while 16.4% were single.

Closely related marriages (up to cousins) prevailed among the native tundra inhabitants (27.7%), at a rate that was 71.0% higher ($\chi^2 = 8.1$, $p < 0.01$) than among the Indigenous peoples living in the settlements (16.2%) and ten times more than in the immigrated female population (2.2%) ($\chi^2 = 54.2$, $p < 0.001$).

Indigenous women living in the tundra lag far behind the level of education of both the Indigenous women in the settlements and the immigrated women. Among the respondents, university education was four times more common in the immigrated population (43.3%) than among the Indigenous settled residents (11.8%) ($\chi^2 = 103.0$, $p < 0.0001$) and 24 times more frequent compared to the Indigenous tundra residents (1.8%) ($\chi^2 = 165.0$, $p < 0.0001$). Secondary vocational education was 2.5 times more common among the Indigenous female residents of the settlements compared to the level of education of the nomadic women ($\chi^2 = 27.7$, $p < 0.0001$). Among the tundra inhabitants, two thirds of the respondents did not have a complete secondary education and half of them had only basic skills in arithmetic and writing ($\chi^2 = 82.3$, $p < 0.001$) (Table 1).

Information about 1,650 pregnancies in the groups was collected. Fifty per cent of women of fertile age

Table 2. Distribution of pregnancy outcomes in the female respondents recruited for the survey, Yamal-Nenets Autonomous Okrug, 2013–2019, %.

Population	Indigenous Women in the Settlements (n = 519)	Indigenous Women in the Tundra (n = 108)	Immigrated Women (n = 252)
Miscarriage	12.5	25.5	8.6
Medical abortion	28.0	7.8	50.0
Childbirth	59.5	66.7	41.4
Gynaecological pathology: non-inflammatory	53.9	30.3	26.1
inflammatory	15.1	8.7	13.3
no pathology	54.6	65.2	32.8
Infant mortality	6.8	24.4	2.9

lived in the tundra, 60.9% in the settlements, and 58.5% had migrated from different regions of Russia and former Soviet Union republics. No significant differences in age were found ($H_{K-W} = 0.9$, $p = 0.6$).

Some 66.7% of pregnancies of women living in the tundra resulted in delivery while only 41.4% of pregnancies among the immigrated women had the same outcome ($\chi^2 = 29.0$, $p < 0.001$). Childbirth with congenital pathology in the inhabitants of the tundra did not show significant differences in the three groups. Abortion was almost twice as frequent in the immigrated women (50.0%) compared with the Indigenous residents of the settlements (28.0%) ($\chi^2 = 73.7$, $p < 0.001$) and five times more frequent than in the Indigenous women living in the tundra (7.8%) ($\chi^2 = 82.3$, $p < 0.001$). Spontaneous miscarriage was three times more common among the Indigenous tundra residents (25.5%) compared with the immigrated population (8.6%) ($\chi^2 = 30.8$, $p < 0.001$) and occurred twice as often among the Indigenous settlement residents (12.9%) ($\chi^2 = 17.3$, $p < 0.001$). Infant mortality was 3.5 times more frequent in the Indigenous tundra residents (24.4%) ($\chi^2 = 36.8$,

$p < 0.001$) compared with those living in the settlement (6.8%) and 8 times more common than in the immigrated female population (2.9%; $\chi^2 = 41.7$, $p < 0.001$) (Table 2).

Immigrated women mostly had one or two children (up to seven pregnancies) while Indigenous women (especially tundra inhabitants) could have nine pregnancies, giving birth at an earlier age (21 years old). However, the increase in the number of pregnancies is accompanied by increased pregnancy loss, especially among the Indigenous large families living in the tundra (2.6–20.7%). The immigrated women and the Indigenous residents of the settlements suffered from high pregnancy loss, mostly during the second and third pregnancies (19.1–21.2% and 7.9–15.8% respectively) (Table 3).

Discussion

Our study proved that negative pregnancy outcomes (spontaneous miscarriage, child mortality) were 3–8 times more common among the Indigenous tundra residents compared with the immigrated population. We see these differences as an outcome of the changing traditional lifestyle, insufficient health policy and low access to medical facilities in the Arctic zone of Western Siberia.

We indicated that Indigenous women had significantly different social status compared to the two other categories of women, which is also related to the deterioration of Indigenous peoples' health. Some researchers consider that environment and traditional lifestyle are basic factors which negatively affect the reproductive system [35–37]. The most significant factor changing reproductive behaviour and threatening the preservation of an Indigenous traditional family is assimilation processes and the destruction of the

Table 3. Distribution of childbirth and pregnancy loss in the female respondents recruited for the survey, Yamal-Nenets Autonomous Okrug, 2013–2019.

Number of the Pregnancy	Indigenous Women in the Settlements (n = 519)			Indigenous Women in the Tundra (n = 108)			Immigrated Women (n = 252)		
	Mean Age of Woman, Years	Childbirth, %	Pregnancy Loss, %	Mean Age of Woman, Years	Childbirth, %	Pregnancy Loss, %	Mean Age of Woman, Years	Childbirth, %	Pregnancy Loss, %
1st	22.0	33.0	9.2	21.0	23.6	7.9	24.3	39.3	10.9
2nd	24.0	21.9	20.7	24.5	20.9	7.9	25.2	28.9	19.1
3rd	26.0	16.0	18.1	26.0	14.6	15.8	27.1	14.9	21.2
4th	28.0	11.4	16.5	28.0	10.9	13.2	29.5	9.5	18.4
5th	31.0	8.0	14.1	30.0	11.8	18.4	32.6	4.1	15.7
6th	33.0	5.1	9.2	33.0	8.2	10.5	35.5	2.5	6.5
7th	35.0	2.5	6.3	33.0	5.5	13.2	38.0	0.8	4.8
8th	37.0	1.3	3.3	35.0	3.6	10.5	-	0	2.7
9th	38.4	0.8	2.6	36.6	0.9	2.6	-	0	0.7

traditional Indigenous family model [11]. Traditional lifestyle in the YNAO is associated with traditional occupations (reindeer herding, hunting and fishery), nomadism in the tundra or living in the settlements, consuming traditional food (raw reindeer products, local animals and birds, fish, herbs and berries) [7,38], having large families (according to our data, over 5 children in the families living in the settlements and over 9 children in the families practising nomadism in the tundra), usually extended by grandparents moving/living together with the “nuclear families” of their children and “immediate relatives” [39]. Furthermore, gender roles in an Indigenous family are also traditional. The tundra is traditionally perceived by nomads as a “men’s space”, and a woman gets used to being a wife, a sister or a daughter of a reindeer herder. There is a traditional division of gender roles in the household and ritual duties in a nomadic family: a woman keeps house, cooks food, looks after children, takes care of the fire and clothing. A man herds reindeers, catches fish, hunts and makes a sleigh [18]. These social structures help to maintain traditional values in the Indigenous communities.

However, this traditional lifestyle of the Arctic Indigenous communities is under transition, as is indicated by the findings of ethnological and sociological research [40,41]. Meanwhile, the share of those involved in the traditional occupations is also decreasing: over 40% in 2010, reduced to 23% in 2015 [42]. Indigenous peoples integrate innovations (i.e., Internet) and modern devices (electric generators, snowmobiles, mobile phones, television sets etc.) [43] into their model of the family economy. However, it has not brought a substantial enough change to the life of women in the tundra, who still have to extract fuel from under the snow, assemble and disassemble a *chum* (an Indigenous tent made of reindeer skin and wood). Carrying heavy loads, enduring hypothermia and long sleigh rides, moving to a new pasture every 3–7 days leads to more spontaneous miscarriages. Thus, a life on the tundra for women continues to be associated with hard work and high health risk. In contrast, the life of women in the remote settlements has become more comfortable, because of conveniences in the houses (central heating, running water, electricity) and modern household items (fridges, stoves, televisions, etc.). Therefore, young Indigenous women who have experienced settled life prefer to move to the settlements and get married to non-Indigenous men. The number of interethnic marriages among the Nenets women is much higher than among the Nenets men [44].

Better education among Indigenous women leads to a reduced frequency of closely related marriages since

Indigenous peoples have more opportunities to meet partners from another place when studying at boarding schools. The Indigenous women in the tundra have a lower educational level (and 75.1% of them have no formal schooling at all) than the Indigenous and non-Indigenous women residing in the settlements (40.2% and 11.1% respectively). This makes them follow a traditional nomadic or semi-nomadic lifestyle. However, the “People’s Programme of the Indigenous Minorities of the North in the Yamal-Nenets Autonomous Okrug” [45] guarantees governmental support to the Indigenous population in getting secondary, vocational and higher education. Such programmes help to increase the level of education of women, providing them with resources to change their lives. The unfolding “bride shortage” in the tundra and a prevalence of unmarried women in national settlements is already typical for other Arctic regions: the Kola Peninsula, Evenkia, Yakutia, Chukotka, and Kamchatka [21]. Well-educated women prefer to move to the settlements, adapt to the urban environment, find work easily and get married to non-Indigenous men. This can also result in modified sexual culture, accompanied by increased rates of gynaecological inflammatory diseases, medical abortions among Indigenous women living in the settlements [19]. Maintaining a nomadic household needs both a man and a woman, which strengthens the institution of the family and encourages high reproduction among Indigenous peoples. As a Northern indigenous man says: “Life in the High North is 80% dependent on women. If there is a woman in the *chum*, the owner is calm, knowing that the hostess in the *chum* will protect the fire and hearth, which creates comfort. A woman is happiness of life and life itself, the preservation of national traditions” [46]. Therefore, men nowadays share some hard traditionally “female” duties with women (i.e., carrying heavy things, assembling a *chum*) [32]. However, the life of nomadic women in the tundra is still hard and becomes less attractive for women who prefer to move to the settlements or to the cities. The “gender shift” in the tundra thus entails a high risk of depopulation processes in the Indigenous population [18].

Recent research has shown that the main factors affecting the health of the Indigenous population in the North are: low level of medical care, lack of medicines, and poor quality of food [47,48]. We identified huge maternal-newborn health disparities between Indigenous and non-Indigenous populations: high rates of spontaneous miscarriage (three times higher among the Indigenous tundra residents compared with the immigrated population and twice as high as

among the Indigenous settlement residents) and infant mortality rates (3.5 times more frequent in the Indigenous tundra residents of the settlement and 8 times more than in the immigrated female population). It is similar to the Canadian case in Quebec, where perinatal and infant mortality rates had been persistent or worsening between 1996 and 2010, particularly among Inuit people [13]. In rural and northern Quebec, there had been recent and significant increase in low birth weight among infants whose maternal tongue was an Inuit language, and the perinatal death rate increased amongst those whose maternal tongue was a First Nations language [49]. Furthermore, there was an association between very remote Quebec First Nations communities and a significantly higher risk of foetal and infant death, particularly postnatal death [50]. Limited access to medical prenatal medical service results in similar pregnancy outcomes for Indigenous women worldwide. For example, high rates of perinatal mortality, preterm birth and low birthweight are two to three times greater among the babies of Indigenous women than among those of non-Indigenous women [51]. There are many barriers for Indigenous women seeking to access antenatal care: socioeconomic constraints, educational and family factors, geographical distance from services, a lack of affordable transport, the infrequency (or absence) of local clinics, and the provision of culturally inappropriate services [52,53].

The nomadic lifestyle of Indigenous peoples in the YNAO is associated with low living standards, insufficient sanitary conditions and limited access to medical facilities [47]. In the Arctic zone of Western Siberia, Indigenous women living in remote communities or in the tundra have limited access to perinatal maternity care. This is related to the lack of medical facilities and highly qualified medical staff (in 2019, the shortage of medical doctors and nurses in YNAO was 14%) and to the traditional lifestyle, both creating incompatible circumstances for women to attend medical examinations and antenatal care later in pregnancy [53–56], as a result of which women prefer to use midwives' services [25,57]. It is also the result of a strong preference among Indigenous women's for childbirth within, or close to, their communities, because they need to take care of their large families with many children and cannot leave them for a long time (usually 1.5 months) to give birth at the regional hospital [58]. Studies on the Inuit population have revealed the same trend: community or regional birthing was preferred by 99% of the Greenlandic Inuit population [59], while virtually no Canadian Inuit women had the opportunity to choose the place of birth, as the overwhelming majority were evacuated to southern hospitals.

The risk of preterm delivery without medical assistance in the tundra is still high. Indigenous women prefer to give birth at hospital to ensure safe delivery and pregnancy outcomes. In Western Siberia, the average distance from a camp in the tundra to a settlement is more than 200 km. Complicated transportation to a municipal hospital and harsh climate conditions can be a challenge for preserving pregnancy for Indigenous women who practise nomadism in the tundra. Evacuation of pregnant women from remote areas to the hospitals is therefore one more issue for Indigenous women. In Canada, the USA (Alaska) and Russia this service is subsidised by local authorities or covered by a medical insurance policy. In 2016–2019, there were over 1,000 expeditions to evacuate pregnant women by helicopter from the tundra to municipal hospitals in YNAO (usually women are taken to the hospital 10–30 days before the expected date of delivery). However, only one way to transport pregnant women to the hospital is budgeted by the government. The air ambulance usually brings women with newborn babies back to the tundra when it has to take one more woman from a remote area to give birth. Consequently, women with newborn babies have to wait for a long time at hotels near the hospital (i.e., in Tazovsky district) until the next flight. The local government covers these costs for accommodation. However, Indigenous women face stress because they have to leave their families with little children in the tundra for more than 1.5 months. Their families cannot accompany them because men have to look after reindeer herd in the tundra. This sometimes makes nomadic women take a risk and refuse hospitalisation [27].

In Canada, transportation of pregnant women by air to give birth has been an expected intervention since the 1960s and 1970s [21, 60]. The intention is to provide universal access to safe obstetrical care for both the mother and the baby she is delivering [57]. To decrease the stress of future mothers, the Nunavut Health Department announced that Indigenous women travelling out of their communities to give birth would not have to go alone; travel escorts were funded by the territory. However, H. Bird noted that "Health Canada has followed suite, claiming similar policy change is in the works for all northern Canadian Indigenous women but is unclear as to how or when" [61]. Some researchers [25] consider that more importance should be attached to birthing supervised by nurse midwives, along with community involvement in childbirth.

Higher infant mortality rates among the Indigenous nomadic population in YNAO compared to the immigrated population (3.5 times more frequent compared to the settled Indigenous women and 8 times more

than in the immigrated female population) can be a result not only of severe climate conditions and hard life in remote territories. The trip of a mother and a newborn from a hospital to a camp in the tundra often takes more than two days. If a woman refuses to wait until the next flight of the air ambulance to be re-evacuated back “home”, she can get there by snowmobile and open sleigh. Exposure of a newborn increases the risk of pneumonia, while vibration and tremors can provoke bleeding in the parturient. These factors are important causes of high infant mortality. Thus, in the Yamalo-Nenets Autonomous Okrug in 2012, the Nenets infant mortality rate was 47.8 per 1,000 population, in the non-Indigenous population it was 7.2 times less – 6.6 per 1,000 ($p < 0.001$) [12]. In contrast, in 1997–2007, the Canadian infant mortality rate among the Indigenous population was 10.7 per 1,000, that is, 1.9 times higher than among the non-Indigenous population – 5.7 per 1,000 ($p > 0.05$). In Sweden in 2009–2013, the coefficient of infant mortality rate among the Indigenous population was only 1.3 times higher (2.8 per 1,000) than in the non-Indigenous population (2.2 per 1,000) ($p > 0.05$) [62].

Beyond social and policy factors, cultural traditions [63] may also play a role in high pregnancy loss and infant mortality. For example, in the past, the Nenets had a number of taboos: a woman had to give birth in a special *chum*, and none of the family members was allowed to enter it. As a result, if a woman lost consciousness, she often remained without any help and could die while delivering a child. Currently, Indigenous women are mostly taken to municipal or regional hospitals. If childbirth happens in the tundra, a woman stays in a main *chum*, and relatives help her, which significantly reduces pregnancy loss [64].

This study has stressed the value of supporting policy to improve reproductive health for Indigenous women in the Arctic zone of Western Siberia in conditions of transition from a traditional lifestyle. Following the UN Sustainable Development Goals, we recommend the local government to develop targeted policy responses to Indigenous women’s reproductive health, improving access to health services and increasing their social support.

The main strength of our study was using the data of quantitative research on reproductive health and childbirth in the Arctic Indigenous communities. Mostly such studies remain fragmentary, and often hard to access. Most published research is the product of anthropological research in individual communities or small groups. However, Indigenous customs vary across communities and regions. Our developed database included the data about the history of pregnancies of Indigenous

and non-Indigenous women living in the remote territories of YNAO – in the Tazovsky settlement, the Tazovskaya tundra, the Nakhodka tundra, the Gyda settlement, the Gydanskaya tundra – collected during expeditions over seven years (2013–2019).

Our study had several limitations. The studied population was recruited while undergoing medical examination at health care institutions (municipal hospitals and feldsher-midwife medical stations in remote settlements). Participation was voluntary and did not include a total population of the studied territories, which may limit the generalisability of findings. Women’s unwillingness to disclose information could lead to under-reporting. Future research could also benefit from examining the traditional patterns of reproduction in different Indigenous peoples (the Nenets, the Khanty, the Selkups, the Komi-Zyryans and others) and measuring the impact of socioeconomic and industrial risks on women’s reproductive health.

Conclusions

The findings highlight the inadequacy of existing systems in community medical facilities to provide access to routine medical examinations in the antenatal and postnatal periods. More broadly, they reflect the lack of consistency in national social policy for supporting Indigenous women’s reproductive health, which unless addressed will see the persistence of inequalities in maternity care and outcomes among Indigenous and non-Indigenous populations in YNAO, and specifically among tundra residents.

Indigenous women’s security in the High North should be strengthened. As the interviews revealed, women’s responsibilities for children and family are a common hindrance to spending a longer period in postnatal care or attending prenatal controls. Short-term family support services could strengthen women’s resources, tackling medical challenges related to pregnancy and delivery. First, strategies addressing potentially modifiable risk factors should be an important focus of antenatal care delivery to Indigenous (especially nomadic) women and may represent an opportunity to improve perinatal outcome in Indigenous communities. The improved medicalisation of childbirth in remote Indigenous communities and tundra areas should become a strategy in YNAO. There is thus a need for improved perinatal surveillance and programming with a focus on Indigenous women’s reproductive health that includes developing an economic mechanism for re-evacuation of Indigenous women with newborn babies by mobile ambulance back to the tundra after giving birth; initiating regular

examinations of Indigenous population suffering from chronic and socially significant diseases to prevent sexually transmitted infections and to determine risk groups for reproductive disorders; developing preventive programmes to support Indigenous women's reproductive health based on scientific approaches and analysis of epidemiological trends, with a focus on risk factors for reproductive health disorders. Secondly, the traditional lifestyle of nomadic residents of the tundra needs reasonable changes with the implementation of innovations (modern devices and technologies) that can make women's life both easier and safer.

Health services can be a great resource to improve the preconditions for women's reproductive health, but we need further research to explore how reproductive health could improve in relation to strengthening women's status in the communities, as well as holistically considering the factors contributing to the decline in women's willingness to stay in the tundra, social embeddedness, the relationship between settlement and nomadic or semi-nomadic life.

Acknowledgments

We thank the Indigenous communities of YNAO, Department of Health Care of YNAO and health care institutions (municipal hospitals and feldsher-midwife medical stations in remote settlements) of YNAO for their assistance and sharing data.

Author contributions

Data Curation, Sergey Andronov; Formal Analysis, Sergey Andronov; Funding Acquisition, E. N. Bogdanova; Investigation, E. N. Bogdanova and Andrey Lobanov; Methodology, E. N. Bogdanova, Andrei Popov and Andrey Lobanov; Project Administration, E. N. Bogdanova; Resources, Ruslan Kochkin; Software, Sergey Andronov; Supervision, Andrey Lobanov; Validation, Sergey Andronov and Ildiko Asztalos Morell; Writing – Original Draft, E. N. Bogdanova and Sergey Andronov; Writing – Review & Editing, Ildiko Asztalos Morell and Andrey Lobanov; Overall editing & Assessment J.Ø. Odland.

Disclosure statement

The authors declare no conflict of interest.

Funding

This study was funded by the Russian Foundation of Basic Research, grant number 18-010-00875.

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