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Health inequalities among Russian-born immigrant women in Finland: Longitudinal analysis on cervical cancer incidence and participation in screening

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ABSTRACT

Research has documented both lower and higher cancer incidence among migrants. Evidence among the large Russian-born migrant population, however, is scarce. We examined cervical cancer incidence and screening participation among Russian-born immigrant women in Finland, a country with complete cancer registration and universal public health care including organized cancer screening. Our study population included all the women that resided in Finland during 1970–2017 and was formed linking individual-level data from four nationwide registries. The linked data sets on cancer and cancer screening were analysed separately using different statistical models. Russian-born immigrant women had increased (+62%) incidence of cervical cancer compared to the general Finnish female population, and they participated in cervical cancer screening slightly less than other women. Our findings showed no consistent transition pattern in cancer incidence or screening participation rate with duration of stay. Potential explanations for the observed differences include institutional and behavioural factors. Cervical cancer is one of the most preventable cancers, and cancer screening can both prevent and reduce incidence and mortality of cervical cancer. Efforts should be made to encourage migrant populations to participate in cervical screening.

Introduction

Monitoring health inequalities is essential to identify variation in health between populations, and to create policies that aim to eliminate them. Immigrants are one of the many population subgroups whose health has been shown to differ from that of the general population. Moreover, migrant women are often in a more vulnerable position than men and may become marginalized in their new home countries. They may also be at greater health risk and have more difficulty accessing the health care services than the native female population. By increasing knowledge about their health and health behaviours, it is possible to develop equity-driven health policies, programmes, and practices.

Immigrants often have better health and lower mortality rates than the native population in their host country, despite of having low levels of socioeconomic status (Markides and Coreil, 1986; Khlat and Courbage, 1996; Cunningham et al., 2008). The most prominent explanation offered for this 'healthy migrant paradox' is the 'healthy migrant effect'. It refers to the selective immigration of healthy migrants or immigrants with higher education or more healthy lifestyles, relative to the general population in their countries of origin. Not all health indicators show the same advantage, however, and migrants have also been shown to be negatively selected (Bostean, 2013) since they often report more health problems and distress in health surveys than the native populations in the destination countries or in the countries of origin. Moreover, the possible health advantage does not remain uniform (Lu et al., 2017). It is particularly evident in the early years of migration and is likely to decrease with time spent in the destination country. Stressful acculturation process, discrimination or language and structure barriers contribute to immigrants' health. Over time, the health behavior of all immigrants is also likely to change.

Little is still known of the impact of the healthy migrant effect on cancer incidence – and of how long any such impact lasts. Thus far, most

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studies on cancer outcomes among immigrants in Europe have used broad geographic categories, and variations by different female immigrant groups have remained unobserved (Arnold et al., 2010; Norredam et al., 2007; Hjerkind et al., 2017; Hjerkind et al., 2020). A recent study on cancer incidence among migrants of diverse origin in Belgium showed no consistent cancer burden transition pattern with duration of stay in the destination country (Van Hemelrijck et al., 2021).

Cervical cancer incidence is a good indicator for health inequalities. Cervical cancer is one of the most preventable cancers, traditionally through screening of precursor lesions and more recently by HPV vaccinations. In Europe, a population-based cervical cancer screening program is recommended by the European Commission, and it exists in most EU member states, either nationally or regionally (International Agency for Research on Cancer (IARC) 2017). However, significant geographical incidence rate variations exist in Europe (de Martel et al., 2020; Arbyn et al., 2020).

Several Nordic studies have used register-based and longitudinal data to examine the attendance of migrant women to cancer screening. The results show a lower participation rate among immigrant women than among the native female populations, and large variations between immigrant groups have also been reported (Azerkan et al., 2012; Moen et al., 2017; Hertzum-Larsen et al., 2019; Pankakoski et al., 2020). For the moment, registry-based health research among Russian- and Soviet-born (referred later to as Russian-born for short) migrant population is still scarce, even though Russian Federation is the fourth largest source country of international migrants (International Organization of Migration (IOM) 2020). At the turn of the millennium, the Russian emigrant population was close to 11 million, and together with the migrants from other former Soviet states the number was almost double (United Nations (UN) Department of Economic & Social Affairs Population Division 2020).

In this article, our focus is on the health of Russian-born immigrant women residing in Finland in 1970–2017. Our main objective is to investigate the incidence of cervical cancer compared to the general female population in Finland, and to evaluate cervical cancer screening participation among Russian-born immigrant women. Of particular interest are whether duration of stay in Finland and year of immigration affect the cancer incidence and screening participation. The established Finnish system of national cancer and screening registries with high completeness and individual screening histories provide a unique data source to follow and monitor cancer incidence and screening participation in female populations.

Russian women's health and the role of public health care

In the last year of the Soviet rule, in 1990, there were only 9600 Soviet-born immigrants in Finland, and two thirds of them were women (Statistics Finland, 2020). After the dissolution of the Soviet Union, immigration to Finland significantly increased. At the end of 2020, approximately eight percent of the Finnish population of 5.5 million had a foreign background. The largest immigrant group, 18%, equalling 75, 700 residents, is comprised of those born in Russia or the FSU. The majority, 60%, of the Russian-born immigrants in Finland are women (Statistics Finland, 2020). The most typical reasons for moving from Russia to Finland have been the return migration of Ingrian Finns and their families, marriage with a Finnish citizen, and working or studying in Finland (Kuusio et al., 2020; Lehtonen, 2016; Mähönen and Yijälä, 2016).

Despite the countries' shared history and geographical proximity, there are differences between the Finnish and the Russian health care institutions and practices, as well as in people's health and health behaviours. The existing Finnish welfare regime is based on the Nordic welfare-state model, which guarantees universal and equal access to high quality health care, both preventive and curative. The health care services in Finland have been rated among the best and most equal in the world (GBD 2019 Universal Health Coverage Collaborators, 2020). In the Soviet Union, health care was defined as a citizen's right, and services were free to patients and were provided by the state (Barr and Field, 1996). However, the quality of health care available to the general public varied, and big differences existed by region, ethnic background and the social status of the person (Clem, 1980). The Soviet health care system was mainly oriented toward dealing with infectious diseases and was not ready to handle chronic illnesses (Cockerham and Shkolnikov, 1999). Inequalities and access to health care appear to have improved since the Soviet era and the turbulent years of change. However, significant problems still remain, including the practice of informal payments for health care, and the Russian health care system lags far behind those considered the best in the world (GBD 2019 Universal Health Coverage Collaborators 2020; Aarva et al., 2009; Balabanova et al., 2012).

Organized screening program is a good example of preventive health care practices, as it can effectively reduce cancer burden in a population. Finland has been very successful in organizing a nationwide screening program and reducing the number of cervical cancers (Arbyn et al., 2020; Nieminen et al., 1995). According to Finnish legislation, organized cancer screening is residence based and free of charge for the screened person. In Russia, on the contrary, there is no national screening program (Barchuk et al., 2018). Furthermore, reliable and comprehensive data on non-organized cervical testing in Russia are not available. According to a recent study on cervical test coverage in Finland, Russian speaking women were the most likely (65.6%) of the foreign speaking female population to attend organized screening programs (Pankakoski et al., 2020). The attendance rate was best (68.9%) among women speaking native languages. A regional study covering a five-year period found that Russian origin women participated to cervical cancer screening similarly to the Finns (Idehen et al., 2020). Russian origin women also participate substantially in prenatal care in Finland (Malin and Gissler, 2009). However, ethnographic interviews among Russian speaking immigrants in Finland have revealed that Soviet-era practices and perceptions of health exist alongside the tradition of Russian popular healing, modern biomedicine, and preventive Finnish health care practices (Toukomaa, 2001).

Cervical cancer is more common in Russia than in Finland. In 2020, age-adjusted incidence rate was 14.1 per 100,000 in Russia (Globocan, Russian Federation, 2020). Epidemiological data on cervical cancer trends from Russia show a worrying increase in incidence and mortality in the past decades (Barchuk et al., 2018). In Finland, the incidence of cervical cancer has decreased considerably since the start of screening: in 1963 it was approximately 15 per 100,000 women, while in 1991 it was only 2.7 (Finnish Cancer Registry (FCR) 2020). This change has been greatest in the screened age groups. However, the incidence increased again after the lowest rates in the beginning of 1990s, and in 2019, incidence rate was 4.8 per 100,000.

Material and method

We used data from four nationwide registries in Finland: The Digital and Population Data Services Agency, Statistics Finland, the Finnish Cancer Registry (FCR), and the Mass Screening Registry. The individual-level data obtained from these registries were linked using a personal identity code (PIC). A unique PIC is assigned to all Finnish residents at birth or, in the case of immigrants, when they have been admitted a residence permit and have an address of residence in Finland (Finnish Act on the Population Information, 2009).

We first identified the women who were born in Russia or the FSU and registered as residents in Finland during the study period 1970–2017 ($n = 55{,}250$) These data were obtained from the Digital and Population Data Services Agency. The period was chosen according to the availability of register data and the timing of the Russian immigration. After excluding women with missing history of residence and those who had emigrated within one year after immigration, we had a total study population of 54,199 Russian-born women.

The women were followed from the date of immigration to death, emigration, age of 95, or end of the year 2017 depending on whichever came first. Date of immigration was defined as the start of the first period of residence in Finland, and date of emigration was defined as the start of the first foreign period of residence after immigration. The subsequent periods of residence after the first emigration were excluded.

For cervical cancer incidence analyses, the data were combined with cancer data and for screening participation analyses, the data were combined with screening data. The data sets had different years of onset. The cancer data from the FCR included the cervical cancer diagnoses from years 1970 to 2017. Data on residence periods were reliable enough from 1973 onwards to build follow-up. Thus, for women immigrated before 1973, the follow-up for cancer incidence analyses was started from 1973. Women with emigration or death before 1973 or with immigration date registered as the last day of 2017 were excluded, as well as women with diagnosis before the immigration date.

The first year for which we have access to full national organized cervical cancer screening data from the Mass Screening Registry is 1991. Thus, these data included invitations and participations of the target population (permanent female inhabitants aged 30–60, in some municipalities also women aged 25 and/or 65) from 1991 until 2017. Women outside screening age in that period (n = 13,937) or without follow-up (residence ended before 1991, n = 2727, or women immigrated too late in 2017 to be included in the invitation data, n = 355) were excluded. Furthermore, women not residing in Finland during the screening invitation year (when aged 25, 30, 35, …,65; n = 1766) or with missing screening data (n = 1092) were not included. Fig. 1 shows the exact flow and number of women in the study process.

The linked data sets on cancer and cancer screening were analysed separately. As individual cancer screening data were available for all women, Russian immigrant women were compared to other women resident in Finland. In the cancer analyses, Russian immigrant women were compared to the general Finnish female population due to the aggregate data available. These reference data on cancer and cancer screening were retrieved from the FCR and the Mass Screening Registry. Statistical analyses were performed using the R program version 4.0.2.

In both analyses the independent variables included duration of residence, age at immigration, mother tongue, and education level. Since ethnic background is not included in the population registries in Finland, mother tongue was used as its indicator. Mother tongue was divided into four major groups: domestic languages (Finnish, Swedish, Sami), Russian, Estonian, and other. Data on birth year, periods of residence in Finland, and mother tongue were retrieved from the Digital and Population Data Services Agency. Education was chosen as the best variable to describe the women's socioeconomic background. Education level was defined as the highest achieved education during the follow-up, and it was divided into levels of primary (0–9 years or missing data), secondary (10–12 years), and tertiary (12+ years). The data on education level were retrieved from Statistics Finland.

Cervical cancer incidence

The number of cancers and person-years at risk were calculated by 15-year calendar period, 10-year age group, duration of residence (0–9, 10–19, 20+ years), age group at immigration (0–19, 20–29, 30–39, 40+ years), mother tongue, and education level. For women diagnosed with multiple cancers, only the first cervical cancer diagnosis was included, and the time at risk ended at the date of diagnosis.

Cancer incidence in the study cohort was compared to the general Finnish female population using standardized incidence ratio (SIR). SIR was calculated as the ratio between the observed and expected number of cancers. The expected numbers of cancers were calculated by multiplying the 10-year age group and 15-year calendar period specific incidence rates in the general female population by the corresponding person-years in the study cohort. Using the Poisson model, the total SIR with 95% confidence intervals was calculated, as well as the SIR for the subgroups. SIR was adjusted for attained age and calendar period. Multivariate Poisson regression model was used to model the relative differences in incidence as incidence rate ratios (IRR) with 95% confidence intervals in the key subgroups, and it was adjusted for attained age, calendar period and mother tongue.

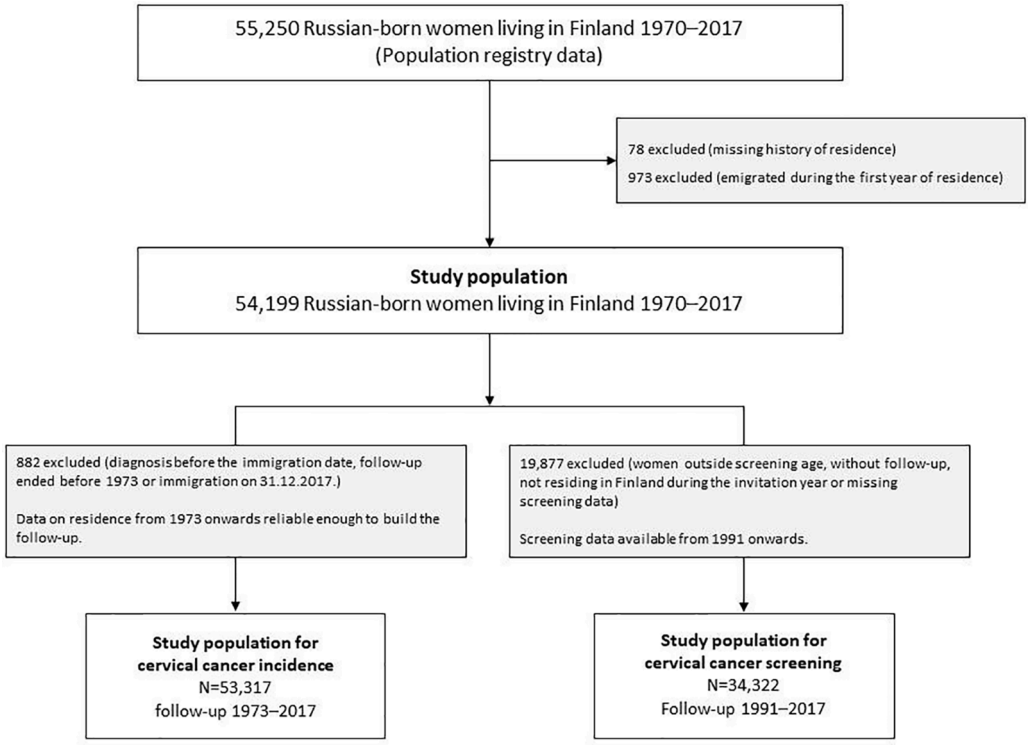

Fig. 1. Flow of the study population.

Cervical cancer screening participation

The women in the study population were followed from their first screening invitation to the invitation at the highest screening age, death, emigration, or end of the year 2017 depending on whichever came first.

The screening participation rate among the invited was calculated by year, 10-year age group, duration of residence (0–9, 10–19, 20+ years), age at immigration (0–19 years, 20+ years), mother tongue, and education level.

Screening participation in the study population was compared to the other Finnish female population by calculating a standardized participation ratio (SPR) between the observed number of participations in the study cohort and the expected number of participations. The expected numbers of participations were calculated by multiplying the 10-year age group, 5-year calendar period, and education level specific participation rates in the general female population by the corresponding numbers of invitations in the study cohort. The standardized ratio was calculated for the total participation as well as for participation in the key subgroups. Normal approximation was used to calculate 95% confidence intervals for the standardized ratios.

Multivariate binomial regression model was used to model the adjusted relative differences in participation rates (PRR, participation rate ratio) with 95% confidence intervals in the key subgroups. Since women may have multiple invitations and participations, the parameters of the model were estimated using generalized estimation equations (GEE) to consider the assumed correlation structure between the observations.

Results

Description of the study population

Most women from Russia or the FSU migrated to Finland as young adults (Fig. 2). Mean age at immigration was 34 years, and 45% of the women were 20–39 years at the time of arrival. There were 89 mother tongues registered altogether. The most common mother tongue was Russian, followed by Finnish, Estonian, and Ukrainian. One third of the women had achieved the highest education level. Yet, most women, 41%, had only primary education or their education information is missing. Due to registration changes in 1971 and deficient registration previous to this, a clear artificial peak in immigration can be seen in 1971. Immigration was highest after the collapse of the Soviet Union, from the 1990s onwards, and the mean duration of residence was 14 years. Table 1 summarizes the main characteristics of the study population.

Cancer incidence: SIR and IRR analyses

Observed and expected cervical cancer cases, person-years, SIRs, and IRRs in each subgroup are presented in Table 2. A total of 91 cervical cancers were diagnosed in the study population during the study period. Russian immigrant women had increased incidence of cervical cancer compared to the general Finnish female population. The SIR of 1.62 (95% CI 1.30–1.98) indicates that there were over 60% more cervical cancer cases among the Russian immigrant female population than would be expected based on the age- and period-specific incidence rates in the Finnish female population. The highest SIR 2.09 (95% CI 1.53–2.77) was observed among women born in the 1960s and 1970s. Cervical cancer incidence among the migrants with the domestic mother tongue was similar to that among the Finnish female population (SIR 1.07, 95% CI 0.64–1.66). There were no clear trends indicating higher or lower incidence by increasing age at migration nor by duration of residence in Finland. The later the arrival, the higher the SIR, which is supported by the findings by calendar period. Comparisons of education level differences in SIR were not possible due to the imperfection in the education level data of the general population.

Additional analyses presenting IRRs showed no significant relative differences by calendar periods, attained age groups, mother tongue, education level and migration related variables.

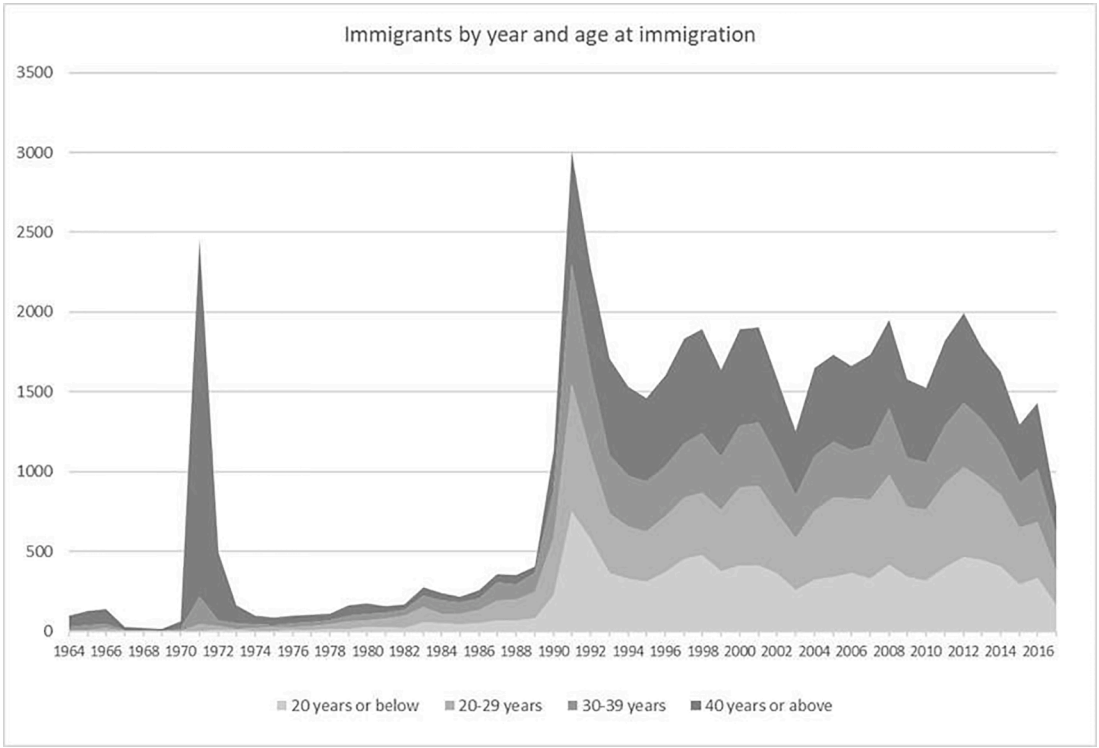

Fig. 2. Female Russian-born immigrants by year and age at immigration to Finland.

Table 1
Summary of study population characteristics.

		N	%
Birth country*	The Russian Federation	5519	10.2
	The former Soviet Union	45,762	84.4
	The Russian Empire	2918	5.4
Birth cohort	−1950	11,005	20.3
	1950–1959	7709	14.2
	1960–1969	9447	17.4
	1970–1979	9206	17.0
	1980–1989	9965	18.4
	1990-	6867	12.7
Mother tongue	Finnish, Swedish or Sami	7766	14.3
	Russian	39,858	73.5
	Estonian	4154	7.7
	Other or unknown	2421	4.5
Education level	Primary or missing	22,012	40.6
	Secondary	14,148	26.1
	Tertiary	18,039	33.3
Immigration year	−1979	4273	7.9
	1980–1989	2619	4.8
	1990–1999	18,092	33.4
	2000–2009	16,959	31.3
	2010–2017	12,256	22.6
Age at immigration	20 years or below	11,262	20.8
	20–29 years	13,388	24.7
	30–39 years	11,214	20.7
	40 years or above	18,335	33.8
Duration of residence**	10 years or below	21,025	38.8
	10–19 years	17,852	32.9
	20 years or above	15,322	28.3
Total		**54,199**	**100**

*The country of birth is determined by the combination of year of birth and birth country due to the inconsistencies in birth country registrations. Those born in the Russian Federation include everyone born in 1992 and after. The former Soviet Union also includes the years of the Soviet Russia (1917 - 1922). Those born in the Russian Empire include everyone born in 1916 and before.
** The duration of residence is calculated from the date of immigration to death, emigration, age of 95, or end of the year 2017 whichever came first.

Participation in cervical cancer screening

The participation rate for cervical cancer screening was 64,1% for the Russian-born and 70.8% for the other female population for the entire study period, 1991–2017. A difference in participation activity between the two groups existed every year (Fig. 3). Furthermore, the trends were rather similar from the late 1990s, and the annual differences from 2010 onwards.

There was some variation in the participation rate within the Russian-born population by age group and education level (Table 3). The adjusted participation rate ratio (PRR) showed that, the older the invited age group, the more active the participation. Russian-born women who were invited to a screening at the age of 60–69 years participated 21% more actively than the reference group, women invited at the age of 30–39 years. Education level was most strongly associated with participation. Participation was lowest among Russian-born women with unknown or primary level education. Attendance in the screening program was 32% higher among women with at least 10 years of education. Among Russian-born women, those who spoke Finnish or Swedish were the most active participants, whereas participation was lowest among the Estonian speaking women. Women immigrating before age 20 participated slightly less actively than women immigrating at age 20 or above. In contrast, the adjusted participation rate ratio showed no significant differences by duration of residence in Finland.

The standardised participation ratio (SPR) showed a significant difference in cervical cancer screening participation between the Russian-born immigrant women and the other female population in Finland in all subgroups. Among all Russian-born women, attendance in the program was six percent lower than in the reference population. Biggest differences were seen by age group and education level. The youngest and oldest age groups differed most from the other female population. The lower the education, the greater the difference between the Russian-born and other female population.

Discussion

Russian immigrant women have a 62% excess risk of cervical cancer, and a 6% lower participation in organised cervical cancer screening compared to Finnish women in general. Cervical cancer incidence is highest among migrants born in the 1960s and 1970s. Duration of stay in Finland and woman's age at migration does not significantly affect the cervical cancer burden nor cancer screening participation.

Study results are in line with available data indicating high cervical cancer incidence among women in Russia (Barchuk et al., 2018). Previous research conducted in other Nordic countries, on the other hand, has led to contradictory findings, that indicate both lower and higher cervical cancer incidence among the Eastern European immigrant women than in the native female populations (Hjerkind et al., 2017; Hjerkind et al., 2020; Beiki et al., 2009; Hemminki et al., 2002). However, the country groupings differ by study, and Russian-born women are not always considered Eastern European. Furthermore, cervical cancer incidence in Finland is lower than in the other Nordic countries (International Agency for Research on Cancer (IARC) 2022).

There were clear trends in screening participation regarding the invitational age and education level. Younger age and lower education level were related to lower attendance in the screening program among the Russian-born women. Similar findings have been observed in the organized screening program also among the general female Finnish population, with the differences in participation rates by age and education level increasing over time (Pankakoski et al., 2020; Virtanen et al., 2015).

Given the nature of our study, we cannot provide explanations for the observed differences, but can provide answers based on existing knowledge. Infection by human papilloma virus (HPV) causes almost all cases of cervical cancer. Overall, HPV prevalence has been estimated to be over three times as high in Russia than in Europe (de Sanjosé et al., 2007). Risk factors for HPV infection include early onset of sexual activity and multiple sexual partners. Information on the sexual behavior of the Russian-born women is not available, although the increasing trend in cervical cancer incidence among younger cohorts in Russia reflects some changes in sexual behavior (Barchuk et al., 2018). Low use of contraception increases the risk for infection. In 1989, only 15% of all women in the Soviet Union had access to contraceptives. Even in the 1990s, regardless of the availability of contraceptives and health educational schemes, only one in five women practiced safe sex (Denisova, 2010). Primary prevention of cervical cancer relies on HPV vaccination and avoidance of HPV infection. The disease is also largely preventable by effective screening. The absence of both vaccination and a national screening program in Russia and the FSU are possible explanations for the high cervical cancer incidence among our Russian-born study group.

According to Russian migration studies, the first migrants leaving the country were mostly ethnic Russians and middle-class professionals followed in later years by temporary labor migrants employed both in low qualified jobs and in positions requiring high education (Vorobyeva et al., 2018). Our results show that the immigrants in our study population might be positively selected on cancer incidence. Russian immigrant women had 62% increased incidence of cervical cancer compared

Table 2
Incidence of cervical cancer. Observed and expected cases, person-years, SIRs, and IRR by calendar periods, demographic and migration related variables.

	Observed	Expected	Person-years	SIR (95% CI)*	IRR (95% CI)**
Number of first cervical cancer cases (total)	91	56	765 331	1.62 (1.30-1.98)	
Period					
2003–2017	61	35	513 820	1.73 (1.33–2.20)	1
1988–2002	23	13	202 972	1.80 (1.16–2.64)	1.01 (0.62–1.66)
1973–1987	7	8	48 539	0.85 (0.37–1.65)	1.30 (0.54–3.12)
Attained age group					
0–29 years	6	3	193 353	1.89 (0.75–3.83)	0.21 (0.08–0.51)
30–39 years	23	14	150 642	1.64 (1.06–2.41)	1
40–49 years	27	13	148 167	2.15 (1.44–3.07)	1.20 (0.68–2.09)
50–59 years	14	8	116 966	1.73 (0.97–2.80)	0.80 (0.41–1.56)
60–69 years	6	7	72 632	0.84 (0.33–1.70)	0.58 (0.23–1.45)
70–79 years	7	7	52 660	1.00 (0.43–1.93)	0.99 (0.39–2.51)
80+ years	8	4	30 910	1.83 (0.84–3.40)	2.04 (0.81–5.16)
Birth cohort					
−1960	38	30	320 418	1.26 (0.90–1.70)	
1960–1979	44	21	272 626	2.09 (1.53–2.77)	
1980-	9	5	172 287	1.79 (0.86–3.22)	
Mother tongue					
Domestic	17	16	142 325	1.07 (0.64–1.66)	1
Russian	63	34	525 259	1.87 (1.44–2.37)	1.36 (0.66–2.81)
Estonian	10	5	73 014	2.08 (1.04–3.64)	1.48 (0.60–3.64)
Other	1	2	24 733	0.53 (0.03–2.35)	0.43 (0.06–3.38)
Education level					
Primary or missing	36		253 201		1
Secondary	27		238 257		0.84 (0.48–1.46)
Tertiary	28		273 873		0.70 (0.40–1.22)
Duration of residence					
0–9 years	50	28	428 313	1.76 (1.32–2.30)	1
10–19 years	28	20	240 491	1.42 (0.96–2.01)	0.82 (0.50–1.33)
20+ years	13	8	96 527	1.57 (0.86–2.59)	0.91 (0.46–1.78)
Age at immigration					
0–19 years	5	4	157 351	1.32 (0.47–2.83)	1
20–29 years	26	14	191 241	1.92 (1.28–2.76)	2.00 (0.65–6.17)
30–39 years	26	14	170 641	1.89 (1.25–2.71)	1.82 (0.54–6.20)
40+ years	34	25	246 098	1.35 (0.94–1.85)	1.80 (0.47–6.85)
Date of immigration					
1990 or before	22	17	166 210	1.26 (0.81–1.86)	1
1991–2000	40	24	371 130	1.65 (1.19–2.21)	0.98 (0.52–1.83)
2001 or after	29	15	227 991	1.98 (1.35–2.79)	1.33 (0.64–2.77)

*Adjusted for attained age and calendar period.
**Adjusted for attained age, calendar period and mother tongue.

to the general Finnish female population. Cervical cancer is, however, three times more prevalent in Russia than it is in Finland, and thus far more common than among our Russian study population (Globocan, Russian Federation 2020). The lack of comparable individual-level data, however, means that selection cannot be measured.

Low level of societal trust may hinder immigrants from seeking care and participating in preventive cancer screening provided by the public sector. Our findings show that Russian-born women seem to trust the Finnish screening system, as their screening participation is only slightly lower than that of the other female population. It must be noted that as Soviet health care was mainly focused on dealing with infectious diseases instead of chronic illnesses or health education, immigrants may not be familiar with non-communicable diseases such as cancer, or the associated screening processes. The role of Soviet practices and institutional differences between Russia and Finland should not, however, be exaggerated. In fact, the results of the cancer screening participation indicate that health behavior of the Russian-born women and of the women born in Finland is quite similar.

Although the existing Russian immigrant communities do not have a long history in Finland, they are close, and immigrants may find it easier to relate to them rather than to Finnish communities and society. This, in turn, may slow down the integration process and the adaptation to local health care practices. Screening participation was highest among immigrants with the domestic mother tongue. Although some health promotion material exists in Russian, the lack of Finnish language skills remains a clear barrier for the Russian speaking immigrants. The invitations for cancer screening, for example, are sent by mail, and in most municipalities in Finnish. We do not have information on the birth country or mother tongue of the women's partners who may also affect women's health behavior and screening participation.

The present results are significant in at least two major respects. First, using valid, consistent, and comprehensive Finnish registers and comparable individual-level data we were able to include all women that resided in Finland during a period of almost fifty years, from 1970 to 2017. Second, our findings provide valuable information on health and health behavior among the Russian-born migrant population which, given its large size, has so far been little studied in quantitative study context. To our knowledge, this is the first study on both European and global level exploring cancer incidence and screening behavior among Russian migrant women using longitudinal, nationwide registry data.

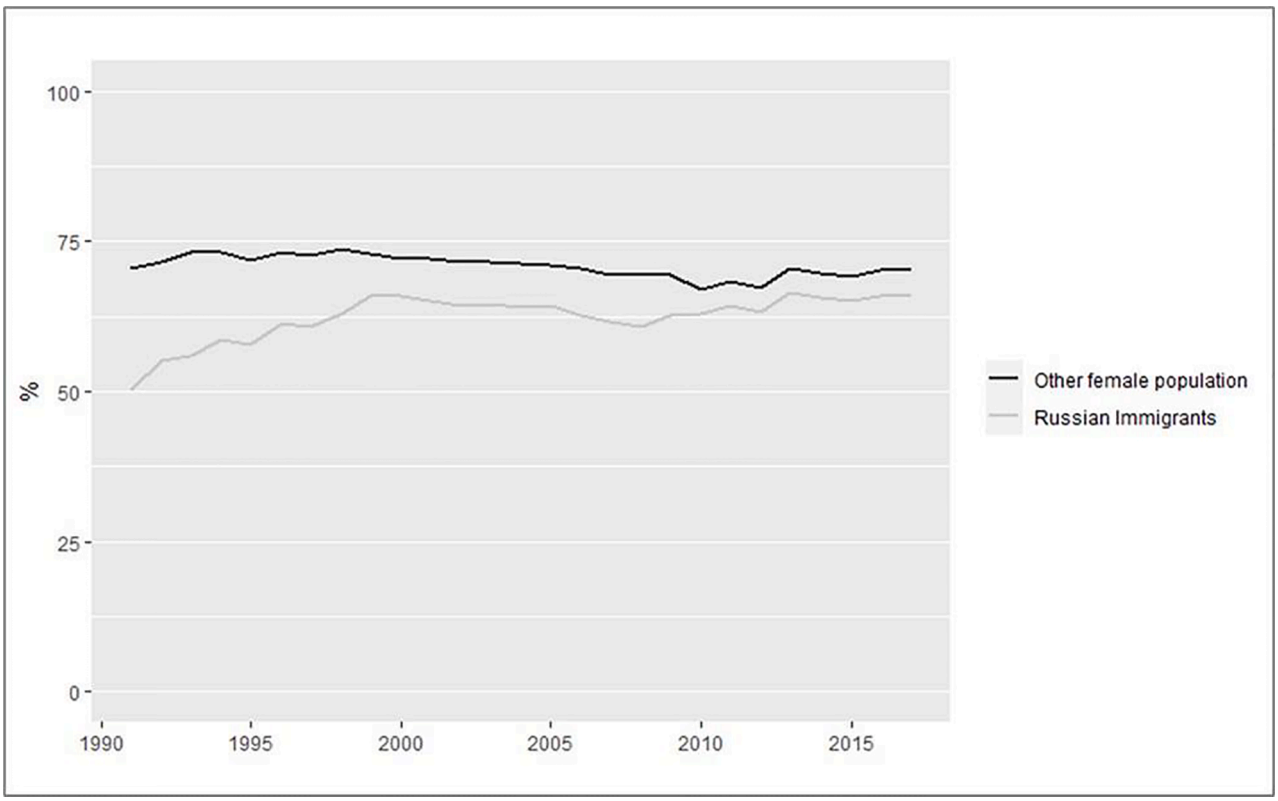

Fig. 3. Cervical cancer screening participation rate among the Russian-born and other female population by year.

Table 3
Participation in cervical cancer screening among the study population subgroups and compared to the other female population in 1991–2017.

	Invited	Participated	%	PRR (95% CI)*	SPR (95% CI)**
Age group					
25–29 years	3 387	1 542	45,5	0.80 (0.77–0.83)	0.87 (0.83–0.92)
30–39 years (ref.)	24 331	14 025	57,6	1	0.96 (0.95–0.98)
40–49 years	26 280	17 509	66,6	1.14 (1.13–1.16)	0.96 (0.94–0.97)
50–59 years	22 250	15 346	69,0	1.20 (1.18–1.21)	0.92 (0.91–0.94)
60–69 years	9 024	6 197	68,7	1.21 (1.19–1.23)	0.89 (0.87–0.92)
Mother tongue					
Domestic (ref.)	5 225	3 550	67,9	1	0.94 (0.91–0.97)
Russian	67 855	43 621	64,3	0.94 (0.92–0.97)	0.95 (0.94–0.95)
Estonian	9 235	5 637	61,0	0.90 (0.87–0.93)	0.89 (0.87–0.91)
Other	2 957	1 811	61,2	0.92 (0.88–0.96)	0.94 (0.89–0.98)
Duration of residence					
0–9 years (ref.)	41 433	25 470	61,5	1	0.92 (0.91–0.93)
10–19 years	31 620	20 907	66,1	1.02 (1.00–1.03)	0.96 (0.95–0.97)
20+ years	12 219	8 242	67,5	1.00 (0.99–1.02)	0.95 (0.93–0.97)
Age at immigration					
0–19 years (ref.)	7 795	4 177	53,6	1	0.92 (0.89–0.95)
20+ years	77 477	50 442	65,1	1.07 (1.05–1.10)	0.94 (0.93–0.95)
Education level					
Primary or missing (ref.)	17 652	9 316	52,8	1	0.88 (0.86–0.90)
Secondary	29 254	19 579	66,9	1.32 (1.29–1.34)	0.96 (0.95–0.97)
Tertiary	38 366	25 724	67,0	1.32 (1.29–1.34)	0.95 (0.94–0.96)
Total	85 272	54 619	64,1		0.94 (0.93–0.95)

*Participation rate ratio (PRR), adjusted for calendar period, age group and education level. Estimated using Generalized Estimation Equations (GEE). 95% confidence intervals.
** Standardised participation ratio (SPR), standardised for calendar period, age group and education level. 95% confidence intervals.

Despite the above strengths, our study suffered from a few limitations. Regardless of the high quality of data on cancer and cancer screening, there are some registration imperfections regarding the data on residing history. We lacked the individual level cancer data on native women, which narrowed our options for statistical models. However, the aggregate level data and an adjusted SIR model were well suitable for comparisons. We excluded women at their first emigration. We know from previous migrant studies and statistics that return migration is a common phenomenon. However, for people who move in and out of the country several times, it is difficult to correctly assess the outcome of cancer. We were not able to analyze the education level differences in cancer incidence due to the imperfection in the education level data of

the native population. Nevertheless, the above reported screening results and earlier studies on cancer incidence in Finland indicate that education level might partly explain the cancer incidence rates. The Finnish Mass Screening Registry includes only data from the organized screening program, and nonorganized cervical testing is known to be common. However, it has been shown that during a five-year period the Russian speaking women attended nonorganized tests less frequently than the Finnish speaking women (14.8% vs 17.5%) (Pankakoski et al., 2020). Therefore, nonorganized testing is unlikely to distort the findings on screening participation. It must also be noted that, although Russian-born women form the largest group of female immigrants in Finland, their number is too small for closer examination of the results in many subgroups, and only the small number of cancers were observed. Some of the findings may thus be coincidental. Furthermore, we must be cautious with all generalizations regarding Russian-born immigrants, as they are of multiple ethnicities and socioeconomic backgrounds.

Russian migration is linked to significant social change in Russia in the 1990s. The differences in living standards between Finland and the FSU were also substantial, and disparities remain. Further research is needed to understand the possible health-based selection of Russian immigrants. Moreover, the possible healthy – or unhealthy – migrant effect relating to cancer mortality and cancer incidence of different cancers should be studied. There is also a need for longitudinal studies among large Russian immigrant populations elsewhere. It is important to pay attention not only to the health inequalities caused by demographic differences between individuals, but also to the environment, society and its institutions and their effects on health.

We conclude that the observed higher cervical cancer incidence cannot be solely explained by nonadherence to cervical screening. Nevertheless, the higher cervical cancer incidence among Russian-born women in Finland means that it is crucial to promote organized screening and encourage migrant populations to participate in it.

Declaration of Competing Interest

None.

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