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The European Journal of Public Health, Vol. 27, No. 5, 873–879

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doi:10.1093/eurpub/ckx093 Advance Access published on 30 June 2017

Barriers to cervical cancer screening faced by immigrants: a registry-based study of 1.4 million women in Norway

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Background: Immigrants from certain low- and middle-income countries are more prone to cancers attributed to viral infections in early life. Cervical cancer is caused by human papillomavirus but is highly preventable by regular screening. We assessed participation among immigrants in a population-based cervical screening programme and identified factors that predicted non-adherence within different immigrant groups. **Methods:** We used data from several nationwide registries. The study population consisted of 208 626 (15%) immigrants and 1 157 223 (85%) native Norwegians. Non-adherence was defined as no eligible screening test in 2008–12. We estimated prevalence ratios with 95% confidence intervals (CIs) for factors associated with non-adherence by modified Poisson regression. **Results:** In total, 52% of immigrants were not screened. All immigrants showed 1.72 times higher non-adherence rates (95% CI 1.71–1.73) compared with native Norwegian women when adjusted for age and parity. The proportion of non-adherent immigrants varied substantially by region of origin and country of origin. Being unemployed or not in the workforce, being unmarried, having low income and having a male general practitioner was associated with non-adherence regardless of region of origin. Living <10 years in Norway was an evident determinant of non-adherence among most but not all immigrant groups. **Conclusions:** An increasing proportion of immigrants and low screening participation among them pose new public health challenges in Europe. Immigrants are diverse in terms of their sociodemographic attributes and screening participation. Tailored information and service delivery may be necessary to increase cancer screening among immigrants.

Introduction

Immigrants from certain low- and middle-income countries are more prone to cancers related to infections experienced in early life.^{1,2} Cervical cancer is caused by human papillomavirus (HPV)^{3,4}

but is highly preventable by regular screening. However, immigrants tend to be less adherent to screening, and this is not only attributable to demographic or socioeconomic factors.^{5–13}

Lack of time is a barrier to screening for all women.^{12–17} In addition, immigrants face special problems related to poor proficiency in the new

language, literacy, perceived discrimination and low cultural sensitivity among health personnel. Lack of information on how to use health services, lack of knowledge or misunderstandings about screening, fear, embarrassment, shame and cultural perceptions are additional reasons why immigrants may not comply with screening.^{12,14,17–20}

Migration poses increasing public health challenges in Europe.^{19–21} Information on health resource use among immigrants is needed to adapt services. Existing evidence has mainly been derived from self-reported or community-level data, or from subsets of immigrant groups. The aim of this registry-based study was to assess screening participation among immigrants in a nationwide cervical screening programme in Norway. We also wanted to identify which sociodemographic, health care and migration-related factors within different immigrant groups predicted non-adherence.

Methods

The Norwegian Cervical Cancer Screening Programme (NCCSP) is responsible for the registration and monitoring of all cervical screening and diagnostic activity on an individual level. Organization of the screening programme is described elsewhere.²² Briefly, the NCCSP informs women about screening when they reach age 25 or immigrate to Norway after that age. The NCCSP sends a reminder when 3 years have passed since a previous screening test. Another reminder follows if no screening test is registered within 12 months. All women are reminded until they are 69-years old, unless they have personally opted-out from the screening programme. Women make appointments with their general practitioners (GPs) or gynaecologist for smear-taking. Women have to pay a co-payment which is ~30 € for the consultation at a GP. Some women opt to pay more for the consultation at a gynaecologist.

Study cohort

We identified women aged from 26 to 69 years, who were alive and resident in Norway on the 31 December 2012 from the National Registry ($n = 1\,403\,687$). Women can actively reserve themselves against having their direct identifiers registered in the NCCSP when the test result is normal. These women ($n = 2\,489$) were excluded from the cohort due to incomplete screening history. An immigrant woman was defined as someone who had immigrated to Norway or was born in Norway to two immigrant parents. A woman was native Norwegian if at least one of her parents was Norwegian. We excluded women who had opted-out ($n = 19\,697$), women with a previous diagnosis of gynaecological cancer ($n = 12\,152$) and women who were under surveillance after cervical abnormalities ($n = 3\,500$). We ended up with a study cohort of 1 365 849 women, of which 208 626 were immigrants (Supplementary figure S1).

Outcome

We categorized women in mutually exclusive groups based on each woman's individual smear history. An adherent woman had a screening test recorded in the NCCSP in 2008–12. The criterion for a screening test was a Pap smear that had not been preceded by cytological or histological changes or HPV testing within the previous 24 months. A non-adherent woman had no eligible screening test. Each woman was given a status date when she attended (the month of the primary screening test) or should have attended, screening (the month of the last reminder) during her last screening interval. If these dates were not available, the status date was set as 1 July 2010, or the date women turned 25 years old.

Explanatory variables

All residents in Norway are entitled to have a GP (<https://helsenorge.no/foreigners-in-norway/the-right-to-a-doctor>). Women choose their GP by logging in to a website connected to the regular GP registry (fastlegeregisteret). We characterized the GP for each

women from this registry as previously explained.²³ We defined the GP as foreign if the GP's country of origin was not Norway. We divided foreign GPs further into those who had the same region of origin as their patients and those who had not. We obtained women's postal codes and individual sociodemographic data at the status date from the National Registry, Statistics Norway and the Norwegian Labour and Welfare Administration as described earlier.²³ The driving distance between a woman's home and her GP's office was calculated using ArcGIS software (Esri, Redlands, CA, USA). The study was approved by the Norwegian Data Inspectorate and the South-East Committee for Medical and Health Research Ethics.

Statistical analysis

Several models of modified Poisson regression were fitted using non-adherence as a binary outcome.^{24,25} First, we assessed the prevalence ratios (PRs) of non-adherence with 95% confidence intervals (CIs) for immigrants overall and by their region of origin relative to native Norwegian women. We adjusted PRs for age and parity as these covariates differed between immigrants and native Norwegians, and because substantially higher participation rates have been observed during pregnancy when free antepartum visits are available.²⁶ To answer our second research question on predictors of non-adherence, we first conducted a backward stepwise regression for all immigrants.²⁷ Then, we included significant explanatory variables into the final regression models which we stratified by women's region of origin (Supplementary table S1). Missing or unknown data were excluded from the analyses which were done using Stata (version 14.0, StataCorp, College Station, TX, USA).

Results

Immigrants made up 15% of the total screening population. First generation immigrants constituted 97.5% of the immigrant population (Supplementary figure S1). The mean age among immigrants was 39.1 whereas it was 46.0 years among native Norwegians. Immigrants had given birth in Norway fewer times (mean parity 0.2) than native Norwegians (mean parity 1.8). Only 0.5% of native Norwegians had not enrolled in the regular GP scheme, whereas the proportion of immigrants without a regular GP was 5.8%. Women from Eastern Europe had clearly less often registered themselves with a GP (8.2%) than women from other world regions (Supplementary figure S2).

The majority of immigrants was from Eastern Europe, constituting 4.4% of the screening population (table 1). Overall, 52% of immigrants and 32% of native Norwegians were non-adherent. The proportion of non-adherent immigrants differed substantially by region and country of origin. The non-adherence among immigrants ranged from 37% among Danish immigrants up to 78% among Lithuanian immigrants (table 1).

We found lower screening participation among immigrants across all ages but the difference was greatest among women younger than 40 years. In all age groups, Nordic immigrants were the most compliant to screening. We observed different screening participation patterns by age and region of origin (figure 1).

All immigrants combined showed 1.72 times higher non-adherence rates (95% CI 1.71–1.73) compared with native Norwegian women. However, PRs of non-adherence varied substantially by region of origin. Immigrants from Eastern Europe showed the highest non-adherence rates (PR 2.04, 95% CI 2.03–2.06) compared with native Norwegians, as shown in figure 2.

Overall, 57% of immigrants had lived in Norway for <10 years. Married women constituted the majority of the immigrants. Immigrants from Western Europe and Nordic countries had the highest educational attainment, and they belonged most often to the top income quintile. Sub-Saharan African women were least likely to have a university degree or to work in white-collar

Table 1 Target population and non-adherence to the Norwegian Cervical Cancer Screening Program in 2008–12 by region of origin and major contributing countries

Region of origin	Target population (<i>n</i> = 1 365 849)		Non-adherent women	
	<i>n</i>	% of total	<i>n</i>	% of targeted
Norway	1 157 223	84.7	365 995	31.6
Nordic countries	23 243	1.7	9051	38.9
Sweden	12 022	0.9	4512	37.5
Denmark	5831	0.4	2156	37.0
Finland	2959	0.2	1201	40.6
Eastern Europe	60 219	4.4	36 990	61.4
Poland	19 206	1.4	13 372	69.6
Russia	7762	0.6	3618	46.6
Lithuania	7645	0.6	5968	78.1
Bosnia-Herzegovina	5050	0.4	2184	43.3
Kosovo	3192	0.2	1370	42.9
Romania	3012	0.2	1906	63.3
Western Europe	18 381	1.4	8857	48.2
Germany	7650	0.6	3801	49.7
UK	3254	0.2	1385	42.6
The Netherlands	2124	0.2	852	40.1
America, Oceania	12 845	1.0	5486	42.7
USA	2707	0.2	1153	42.6
Chile	2563	0.2	1060	41.4
Brazil	2142	0.2	873	40.8
Western Asia, North Africa	16 361	1.2	7381	45.1
Iraq	5932	0.4	2384	40.2
Turkey	4222	0.3	1868	44.2
Morocco	2165	0.2	1025	47.3
Sub-Saharan Africa	17 584	1.3	9399	53.5
Somalia	6414	0.5	3751	58.5
Eritrea	3344	0.2	1984	59.3
South Central Asia	26 719	2.0	13 486	50.5
Pakistan	8957	0.7	4812	53.7
Iran	5528	0.4	2297	41.6
India	3489	0.3	1859	53.3
Sri Lanka	3692	0.3	1857	50.3
Afghanistan	2528	0.2	1239	49.0
Eastern Asia	33 274	2.4	18 316	55.1
Philippines	10 565	0.8	6508	61.6
Thailand	10 465	0.8	5761	55.1
Vietnam	6485	0.5	2912	44.9
China	3257	0.2	1763	54.1

occupations. The majority of immigrants was registered with a male GP. Among Nordic immigrants, 70% had a Norwegian GP, whereas immigrants from other regions more often had a foreign GP. Study characteristics are given in Supplementary table S2a and b.

Stratified regression models indicated that non-adherence increased with increasing age at migration to Norway for all immigrants, except for South Central Asian women (data not shown). Living <10 years in Norway was associated with higher non-adherence rates in most immigrant groups (table 2). However, the length of stay had no effect among immigrants from Western Asia and North Africa and had the opposite effect for Sub-Saharan African immigrants (PR 0.93, 95% CI 0.88–0.99).

For all immigrants, the highest PRs of non-adherence were observed for being unmarried. PRs ranged from 1.21 (95% CI 1.16–1.26) among Sub-Saharan African women to 1.54 (1.46–1.63) among women from Western Asia or North Africa. Being unemployed or not in the workforce, having low income and having a male GP was associated with non-adherence across all world regions. Occupation predicted non-adherence for the majority of immigrant groups (table 2).

Distance to the screening site did not predict non-adherence for women from Western Asia and North Africa. For all other

immigrant groups, living >10 km away from the GP's office predicted non-adherence. For European women, also living <1 km away from the GP was associated with higher levels of non-adherence compared with intermediate distance.

Except for women from Western Europe, America, Oceania and Eastern Asia, a foreign GP increased the risk of non-adherence. Eastern European women with a GP of the same origin showed increased adherence (PR of non-adherence 0.96, 95% CI 0.94–0.99), whereas a GP of the same region of origin predicted non-adherence for South Central Asian women (PR 1.09, 95% CI 1.05–1.13). For all other regions, having a GP of the same origin was associated with similar non-adherence rates compared with women with a Norwegian GP (table 2). We did not observe consistent differences in non-adherence rates by GP's age and different immigrant groups (data not shown).

Discussion

We showed that 52% of immigrants were not screened for cervical cancer in the population-based programme in Norway in 2008–12. The proportion of non-adherent women varied substantially across immigrants based on their age, region of origin and country of origin. Being unemployed or not in workforce, being unmarried, having low income and having a male GP was associated with non-adherence for immigrants from all world regions but effect sizes were generally smaller. Living <10 years in Norway predicted non-adherence among some immigrant groups, whereas there was little or no effect among others.

Non-adherence was positively associated with being an immigrant. However, the risk of non-adherence was not similar across immigrant groups.^{5–13,28,29} We also observed that among immigrants sharing the same region of origin, non-adherence rates varied substantially by country of origin. Immigrants were diverse in terms of their sociodemographic attributes. Compared with the general screening population, high-income country immigrants had higher socioeconomic status whereas the opposite was true for immigrants from low- and middle-income countries.²³ Only two countries have reported higher cervical screening coverage among immigrants compared with the host population. Both studies attributed this finding to higher use of health services outside the screening programme among wealthier individuals.^{30,31}

Up to 6% of immigrants had not registered themselves with a GP, as compared with 0.5% of native Norwegians. This impedes the effectiveness of reminders from the NCCSP. Moreover, the NCCSP currently provides information on screening in Norwegian only. Language barriers undermine both the access and the quality of health services for immigrants.^{18,19,32} Providing information in several languages and adapted for different cultural backgrounds are means to tailor screening programmes at relatively low cost. Impersonal communication through printed materials may still not work, and community networks may be the most effective way to reach immigrants.^{18,20}

Many immigrant women attend screening as a result of their GP's advice.¹⁴ However, immigrants may have regular contacts with health services but still are never screened.³³ Due to communication difficulties, GP appointments can take more time and GPs have little time to raise awareness of screening. Language barriers can be overcome by using easily accessible and free professional interpreting services and training GPs to use them.¹⁹ Further, a strategy that does not use GP time, such as an option to see a nurse or midwife to discuss screening, or provision of a video could be useful.⁸

Several studies among immigrants with different backgrounds have raised the importance of a female smear-taker.^{6,10,12,14,17,32} In our study, a male GP predicted non-adherence for all immigrant groups. Interestingly, the effect of the GP's gender was greatest among Nordic immigrants who had the lowest non-adherence rates overall. This might reflect that the GP's gender comes into

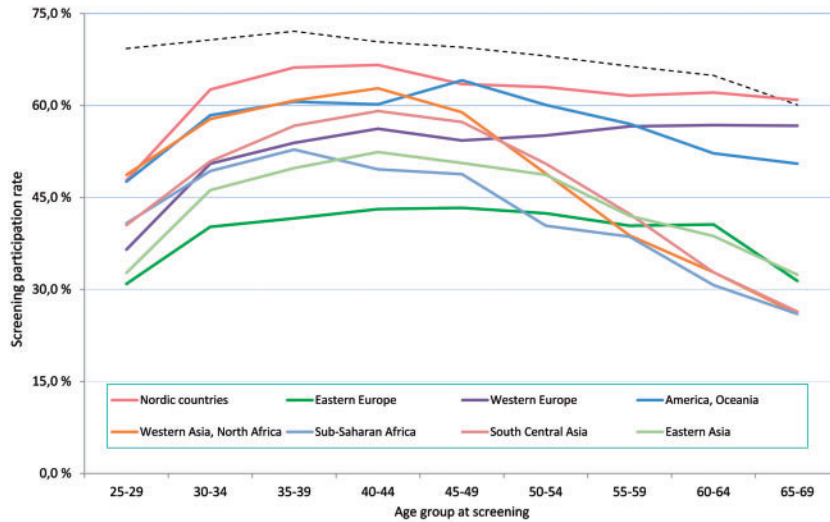


Figure 1 Screening adherence among native Norwegian (dashed line) and immigrant women (solid lines) to the Norwegian Cervical Cancer Screening Program between 2008 and 2012 by region of origin and age group at screening

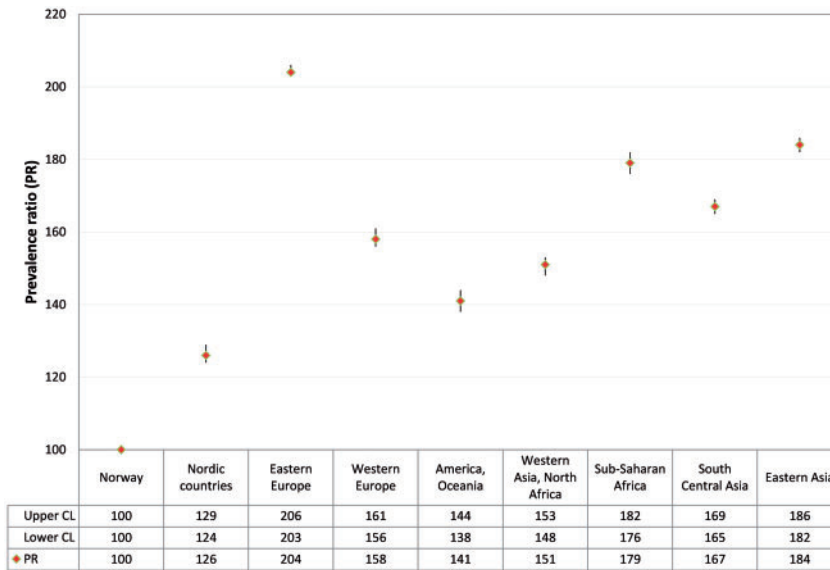


Figure 2 PR of non-adherence to the Norwegian Cervical Cancer Screening Program in 2008–12 with 95% CIs by region of origin, adjusted for age and parity

play rather late in the process when women are making informed choices for or against screening. Furthermore, Finnish and Swedish immigrants are often screened by trained female midwives in their home countries.

Some studies have demonstrated higher non-adherence rates when a physician and a patient have the same background.^{6,13} In our study, a foreign GP predicted non-adherence for the majority of immigrant groups. This indicates that the lack of effective communication may be a more important screening barrier than the nationality of the GP. Furthermore, a GP of the same origin facilitated screening among women from Eastern Europe whereas it predicted non-adherence for South Central Asian women. This was a new finding and suggests that cultural factors likely play a role. Future research is needed to study if non-adherence attributed to foreign GPs is due to differences in medical training, due to reluctance to undergo screening by a foreign GP or both.

We observed that living >10 km away from the screening site increased the risk of non-adherence for most immigrant groups. Most likely difficulties scheduling a screening appointment to fit in with daily commitments increases with increasing distance. Very short distance (<1 km) to the screening site was associated

with non-adherence only among European immigrants. This may be due to rural–urban differences in screening use, a factor we did not adjust for in this study. A study using the Norwegian Health Economics Administration Database from primary health care reported that women in rural areas had more Pap smears. Although the study material was somewhat selected and included only a small subset of smears taken within the NCCSP, authors suggested that women in rural areas tend to be better integrated in society and rural GP’s have less patients.¹⁰

We used length of stay as a proxy for acculturation.³⁴ Several studies have reported that longer time since immigration increases the likelihood of screening.^{6,32,35–37} Our study confirmed that acculturation is a determinant of non-adherence for most immigrants. A plausible explanation is that labour immigrants travel to their home countries to get health care services during the first years in Norway.¹⁰ This observation is supported by the high proportion of Eastern European women lacking a GP in our material. In our study, African and Western Asian immigrants who had stayed ≥10 years in Norway were less likely to be screened than those who had more recently arrived. Our results underlie the complexity and diversity of immigrant behaviours and

Table 2 Predictors of non-adherence to the Norwegian Cervical Cancer Screening Program in 2008–12 among immigrants by region of origin

Covariate (reference)	PR (95% CI) for non-adherence ^a							
	Nordic countries	Eastern Europe	Western Europe	America, Oceania	Western Asia, North Africa	Sub-Saharan Africa	South Central Asia	Eastern Asia
Length of stay (≥ 10 years)								
<10 years	1.18 (1.11–1.25)	1.15 (1.10–1.19)	1.23 (1.15–1.32)	1.11 (1.02–1.20)	1.00 (0.95–1.06)	0.93 (0.88–0.99)	1.13 (1.07–1.18)	1.09 (1.04–1.14)
Marital status (married)								
Unmarried	1.30 (1.24–1.36)	1.22 (1.20–1.24)	1.37 (1.31–1.43)	1.49 (1.40–1.58)	1.54 (1.46–1.63)	1.21 (1.16–1.26)	1.42 (1.36–1.47)	1.48 (1.44–1.52)
Divorced/widowed	1.18 (1.12–1.25)	1.02 (1.00–1.05)	1.17 (1.11–1.24)	1.12 (1.06–1.20)	1.15 (1.09–1.20)	1.11 (1.06–1.16)	1.10 (1.06–1.14)	1.10 (1.06–1.13)
Employment (white-collar job)								
Unemployed	1.20 (1.13–1.27)	1.18 (1.14–1.21)	1.26 (1.19–1.34)	1.21 (1.11–1.31)	1.16 (1.07–1.26)	1.24 (1.14–1.34)	1.16 (1.10–1.22)	1.12 (1.07–1.18)
Blue-collar job	1.13 (1.08–1.18)	1.17 (1.14–1.21)	1.12 (1.07–1.17)	1.04 (0.96–1.12)	1.10 (1.01–1.19)	1.05 (0.97–1.14)	1.08 (1.03–1.14)	1.07 (1.03–1.12)
Annual income (high)								
Low	1.39 (1.30–1.48)	1.32 (1.27–1.38)	1.30 (1.22–1.39)	1.32 (1.20–1.46)	1.27 (1.15–1.42)	1.23 (1.13–1.34)	1.26 (1.18–1.34)	1.19 (1.12–1.26)
Medium	1.10 (1.04–1.15)	1.07 (1.03–1.11)	1.05 (1.00–1.11)	0.99 (0.91–1.09)	1.03 (0.93–1.14)	1.04 (0.96–1.13)	1.02 (0.97–1.09)	1.02 (0.97–1.07)
Distance to GP (1–9 km)								
<1 km	1.09 (1.05–1.14)	1.05 (1.04–1.07)	1.07 (1.03–1.11)	1.06 (1.00–1.12)	1.01 (0.97–1.05)	1.02 (0.99–1.06)	0.99 (0.96–1.03)	1.01 (0.98–1.03)
>10 km	1.11 (1.06–1.17)	1.08 (1.06–1.10)	1.12 (1.07–1.17)	1.12 (1.05–1.19)	1.03 (0.98–1.09)	1.10 (1.05–1.15)	1.05 (1.01–1.08)	1.09 (1.06–1.12)
GP's gender (female)								
male	1.21 (1.16–1.26)	1.13 (1.11–1.15)	1.14 (1.09–1.18)	1.12 (1.06–1.18)	1.14 (1.10–1.18)	1.07 (1.03–1.11)	1.11 (1.08–1.14)	1.16 (1.14–1.19)
GP's origin (Norway)								
Foreign, different from woman	1.08 (1.04–1.13)	1.02 (1.01–1.04)	1.01 (0.96–1.07)	1.01 (0.96–1.07)	1.04 (1.01–1.09)	1.06 (1.03–1.10)	1.05 (1.02–1.08)	1.01 (0.98–1.03)
Foreign, same as woman	1.05 (0.99–1.12)	0.96 (0.94–0.99)	0.99 (0.88–1.12)	1.00 (0.89–1.13)	1.04 (0.98–1.12)	1.06 (0.97–1.16)	1.09 (1.05–1.13)	0.99 (0.95–1.04)

a: Adjusted for age at migration, age, parity, region of residence in Norway and GP's age at screening in addition to all covariates in the table.

acculturation. Thus, immigrants may need targeted interventions to engage them with cervical screening. A possible means to increase screening participation could be, for instance, screening at well woman clinics which may be considered more convenient than visiting a GP.¹⁷ Also, less invasive screening methods such as HPV testing on self-collected samples could remove some of the barriers associated with current screening practice.^{12,15,16,33}

We found an evident decrease in screening participation in older age groups among immigrants from low- and middle-income countries. Old age has been associated with being overdue or never screened also in other studies.^{7–9,36} In Western countries, health facilities are not easily accessible for elderly immigrants who tend to be particularly prone to poor language proficiency.^{9,38} Furthermore, a general lack of knowledge about cervical cancer can influence screening participation particularly among older immigrants.¹⁷

Consistent with the literature, unmarried immigrants had the highest levels of non-adherence in our study.^{9,19,35,36} The predictive power of marital status has often been attributed to pregnancy and childbirth which provide a gateway into the health care system. Our estimates were adjusted for parity, and the positive effect of marital status has been evident also for women and men participating in colorectal cancer screening.³⁹ Thus, marriage facilitates screening participation also by other means, such as providing social support. Some ethnic minority women may also perceive cervical screening as a sign of poor health and/or bad sexual behaviour, and thus the practice is only acceptable for married women.^{12,17,18}

Low income has been associated with non-adherence to screening among immigrants.^{6,7,36} We found that being unemployed or being outside of workforce was associated with higher levels of non-adherence across immigrants from all world regions when adjusted for the length of stay and income. This supports the notion that employment facilitates inclusion into the local culture and health care through language learning.²⁰

Lower screening participation can also result from an informed decision-making process. However, knowledge about screening for cancer in general is rather low and that applies particularly for immigrants.⁹ Many immigrants do not recognize the terms 'cervical screening' or 'smear', suggesting that clarification of what cervical screening is should be included in information for ethnic minority women.¹⁷

This was entirely a registry-based study using individual level information from comprehensive nationwide registries. We could reliably identify screening participation, and we paid close attention to include only screening visits and not surveillance due to previous abnormal smears. Studies with self-reported screening history suffer from recall bias and selection bias as 'hard-to-reach' women, who are most difficult to engage in screening activities, do not respond to surveys.^{16,40} There may also be ethnic and sociodemographic differences in reporting accuracy.⁴⁰ A retrospective design can introduce a selection bias by unmeasured factors that have an effect on screening participation and survival also in our study.

We could not confirm whether the smear was taken by the registered GP, by other GP sharing the same office or by a gynaecologist. We do not anticipate high use of gynaecologists among immigrants, and women whose own GP is male and/or foreign may prefer another smear-taker. Thus, our results probably underestimate the true effects of the GP's characteristics.

Because of their low number, we combined second generation with first generation immigrants. In future studies on health service utilization among immigrants, it would be useful to differentiate between first and second generation immigrants and between labour immigrants and refugees or asylum-seekers.³⁸

Immigrants constitute a substantial proportion of the total population. Making cancer prevention programmes more responsive to immigrants will require special attention. Immigrants

are diverse in terms of their sociodemographic attributes and screening participation. To engage immigrants with cancer screening may warrant tailored approaches to information and service delivery.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

The authors thank Ole Klungsoyr for statistical consultancy and Barbara Schwendtner from Geodata AS for her help with the article.

Funding

The study was supported by the Norwegian Cancer Society (grant 5777899) and the Cancer Registry of Norway. The work has been presented orally at 6th EUPHA Conference on Migrant and Ethnic Minority Health 2016 in Oslo, Norway (June 23–26), at ANCR & NCU Symposium 2016 in Tuusula, Finland (30 August–1 September) and at HPV 2017 Conference in Cape Town, South Africa (March 1–4).

Conflicts of interest: None declared.

Key points

- Immigrants do not comply with cervical screening but evidence has mainly been derived from self-reported or community-level data, or from subsets of immigrant groups.
- Self-reported data tend to overestimate screening utilization and underestimate disparities because people, who are the most difficult to engage with screening, do not respond to surveys.
- Screening adherence among immigrants poses new public health challenges in Europe.
- Distributions of the sociodemographic attributes and screening participation pattern is different for immigrants coming from different world regions.
- Acculturation is an evident determinant of non-adherence for some immigrants, whereas there is no effect among others. To engage all immigrants with cervical screening may warrant adaptation of information and service delivery.

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The European Journal of Public Health, Vol. 27, No. 5, 879–885

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 doi:10.1093/eurpub/ckx081 Advance Access published on 2 July 2017

How strongly related are health status and subjective well-being? Systematic review and meta-analysis

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Background: Health status is widely considered to be closely associated with subjective well-being (SWB), yet this assumption has not been tested rigorously. The aims of this first systematic review and meta-analysis are to examine the association between health status and SWB and to test whether any association is affected by key operational and methodological factors. **Methods:** A systematic search (January 1980–April 2017) using Web of Science, Medline, Embase, PsycInfo and Global health was conducted according to Cochrane and PRISMA guidelines. Meta-analyses using a random-effects model were performed. **Results:** Twenty nine studies were included and the pooled effect size of the association between health status and SWB was medium, statistically significant and positive (pooled $r=0.347$, 95% CI=0.309–0.385; $Q=691.51$, $I^2=94.99\%$, $P<0.001$). However, the association was significantly stronger: (i) when SWB was operationalised as life satisfaction ($r=0.365$) as opposed to happiness ($r=0.307$); (ii) among studies conducted in developing countries ($r=0.423$) than it was in developed countries ($r=0.336$) and (iii) when multiple items were used to assess health status and SWB ($r=0.353$) as opposed to single items ($r=0.326$). **Conclusion:** Improving people's health status may be one means by which governments can improve the SWB of their citizens. Life satisfaction might be preferred to happiness as a measure of SWB because it better captures the influence of health status.

Introduction

One of the fundamental responsibilities of governments and policy makers across the globe is to maximise subjective well-being (SWB) using finite resources.^{1,2} Identifying key factors that influence SWB is vital to informing decisions about where best to invest those resources.^{2,3} When people are asked to list the key characteristics of a good life, they include health, happiness and life satisfaction¹ and accordingly governments have tried to improve SWB by optimising public health status (e.g. by improving health care). Implicit in these endeavours is the idea that health status and SWB are closely related. Despite this assumption, it is not yet clear what is the magnitude of the association between health status and SWB; meaning that intervening to improve health status alone may

not be the optimum means by which SWB can be maximised. In addition to the lack of insight into the magnitude of the association between health status and SWB, the literature suffers a number of methodological and conceptual limitations that can be explored using meta-analysis.

The first major limitation stems from inconsistencies in the definition and measurement of SWB and health status. The terms *happiness* and *life satisfaction* have been used interchangeably to assess SWB. Happiness is most closely associated with emotions, feelings or moods and life satisfaction is concerned with people's cognitive evaluations and judgments about their life when they think about it, which might include evaluations of their work, personal relationships or perception of health status.⁴ Evidence suggests that happiness and life satisfaction need to be investigated separately in