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Educational inequalities in cervical cancer screening participation in 24 European countries

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ABSTRACT

Objectives: Cervical cancer screening (CCS) is an important public health measure for early detection of cervical cancer and prevents a large proportion of cervical cancer deaths. However, participation in CCS is relatively low and varies substantially by country and socio-economic position. This study aimed to provide up-to-date participation rates and estimates on educational inequalities in CCS participation in 24 European countries with population-based CCS programmes.
Study design: This was a cross-sectional study.
Methods: Using data from the European Health Interview Survey (EHIS) conducted in 2019, 80,479 women aged 25–64 years were included in the analyses. First, standardized participation rates and standardized participation rates by educational attainment were calculated for all 24 countries based on each country-specific screening programme organization. Second, a series of generalized logistic models was applied to assess the effect of education on CCS participation.
Results: Screening participation rates ranged from 34.1% among low-educated women in Romania to 97.1% among high-educated women in Finland. We observed that lower-educated women were less likely to attend CCS than their higher-educated counterparts. Largest educational gaps were found in Sweden (odds ratio [OR] = 6.36, 95% confidence interval [CI] = 3.89–10.35) and Poland (odds ratio = 5.80, 95% CI = 4.34–7.75).
Conclusion: Population-based screening initiatives have successfully reduced participation differences between women with medium and high educational attainment in some countries; however, persistent disparities still exist between women with low and high levels of education. There is an urgent need to increase participation rates of CCS, especially among lower-educated women.

Introduction

Cervical cancer screening (CCS) is an essential public health measure for early detection of cervical cancer. Cancer screening can be opportunistic or population based. Opportunistic cancer screening depends on the individual's initiative or a physician's recommendation. Population-based or organized cancer screening is available to all eligible individuals (target population) who are systematically invited and screened through a policy-regulated structure.[1] While opportunistic screening is less cost-effective and less equal,[2] well-organized population-based cancer screening programmes for cervical cancer are proven to save lives and be cost-effective. Hence, a high attendance rate is crucial for individual and public health.[2,3] Regarding the effectiveness of CCS, a study from Nordic countries estimated a decrease in cervical cancer mortality between 25% and 80%.[4]

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According to a recent systematic review, cervical cancer mortality was reduced by 41%–92% for women attending organized screening vs non-attenders.[5]

The participation in the national cancer screening programmes is often insufficient.[6] Participation rate in CCS in Europe was recorded at only 34% in 2016.[7] Even in the longest running and well-funded cancer screening programmes, participation has stagnated at lower than 70% of the eligible population. One of the main reasons for the untapped full potential of cancer screening is the build-in assumption that all social groups will equally seek to avert future diseases. However, empirical evidence has documented that higher socio-economic groups are more likely to use healthcare services in general and prevention services in particular. Therefore, regardless of the type of cancer screening programme, lower overall participation is driven by lower rates of participation by disadvantaged social groups.[8]

While participation in organized CCS may differ by age group,[9,10] evidence also suggests that low participation is linked to socio-economic status.[11,12] CCS uptake rates were greater among the higher-educated women in different countries.[11,13] Education is a socio-economic determinant consistently described to be associated with CCS participation.[12,14,15] Systematic reviews and meta-analyses showed a clear association between educational attainment, measured by the highest educational attainment or the years of schooling, and participation in opportunistic and organized CCS in high-income countries.[12,14] It has been shown that women with highest educational attainment are twice as likely to adhere to cervical screening compared with lowest educated women.[14]

The knowledge of differences in CCS participation by social position is essential for policymakers to provide recommendations for preventive strategies. To our knowledge, recent comprehensive overview of educational inequalities in cervical screening is missing. The European Union (EU) comparison can only be found in studies analysing data from Eurobarometer 66.2 conducted in 2006[13] and EHIS Wave 2 conducted in 2013–2015.[16] Therefore, this study aimed to estimate recent educational inequalities in CCS in a wide range of European countries with population-based CCS programmes individually.

Methods

This study used pooled data from the European Health Interview Survey (EHIS), particularly wave 3 of the EHIS (EHIS-3) obtained from EUROSTAT. EHIS-3 is a cross-sectional country-level representative health survey. The main goal of this health questionnaire is to obtain harmonized and high-quality data on health across Europe. The survey is based on the Commission Implementing Regulation (EU) No. 2018/255. Data were collected between January 2018 and September 2020 in all EU countries, Iceland, Norway, Serbia, the United Kingdom, and Turkey. Data were collected in the prepandemic period, except for those from Germany, Spain, and Malta. EHIS-3 gathers cross-sectional data on health status, health care, health determinants, and socio-economic characteristics of individuals.

The quality report of the third wave of the EHIS—2022 edition—provides more information.[17]

The survey was conducted in 30 European countries; however, we used the data from 24 European countries with established population-based screening programmes at the time of data collection (Table 1). The countries with non-population-based (opportunistic) screening were excluded (Austria, Bulgaria, Cyprus, Greece and Luxembourg). Furthermore, the analyses did not include data for France, which did not provide individual data for scientific purposes.

Based on the question 'Last time of a cervical smear test', we computed 'up-to-date cervical cancer screening (CCS) participation' (the dependent variable). The options given to respondents were as follows: 'within the last 12 months', '1 to less than 2 years', '2 to less than 3 years', 'more than 3 years', and 'never'.

We computed the variable following each country-specific screening programme interval (Table 1). The response options did not allow us to follow the up-to-date participation of the last screening in the case of 5-year screening intervals; in such cases, we could not distinguish between lifetime participation and 5-year interval participation. We evaluate this group of countries separately (shown as 'group 2' in the results). We assume that despite these inaccuracies, the computing of up-to-date participation gives us the best information about women's ability to use offered preventive health care in each country. Countries with a 5-year interval in major parts of the screening interval are also shown as group 2. In addition, Malta was included in the analysis as a group 2 country as screening is opportunistic in the age range of 40–64 years. Thus, 'group 1' contains countries where up-to-date participation could be calculated, whereas in 'group 2', we calculated lifelong participation for the reasons mentioned earlier.

Women aged 25–64 years were included in the analyses, even if the target age group was wider in some countries. In the case of narrower age groups, only such defined age group was considered (Table 1). Educational attainment level in the EHIS survey is based on International Standard Classification of Education (ISCED)-2011 categories.[18] We merge the obtained data into three categories: low education (ISCED 0–2), medium education (ISCED 3–4), and high education (ISCED 5–8). Only women with known educational attainment and CCS participation were included in the analysis. In total, data from 80,479 women were analysed (the number of participants for each country can be found in Supplement 1).

First, age-standardized up-to-date participation rates for each country were calculated, both by educational attainment and overall. The 2013 European Standard Population was used for standardization.[19] Second, binary logistic regression was applied to estimate the chances of up-to-date non-participation in CCS by educational level for each country. All regression analyses were adjusted for age.

Results

The overall standardized up-to-date CCS participation rates in the 24 countries ranged from 65.8% (Serbia) to 95.4% (Sweden) in group 1 countries and from 54.8% (Romania) to 97.2% (Finland) in group 2 countries. The participation rate range was wider when distinguished by the women's educational attainment (Fig. 1).

Based on the participation rates by education, it is already possible to say that differences in participation differ within and between countries. In some countries, there were very small within-country differences in participation rates between high- and low-educated women—below 11 percent points (pp) in Sweden and Iceland (in group 2 also in Finland, Ireland, Italy, Norway, and Spain, and even a negative difference of −2.1 pp in the Netherlands). In other countries, differences were more substantial—over 30 pp in Poland, Serbia, and Slovakia (and Romania in group 2). The lowest attendance among low-educated women was recorded in Serbia (46.7%) and Romania (34.1%, group 2), while the highest attendance of high-educated women was in Sweden (96.3%) and Finland (97.1%, group 2). Full results can be found in Supplement 2.

The results of binary logistic regression (Fig. 2) confirmed significant differences between countries in up-to-date non-participation by educational attainment. In every country except for Malta (group 2), low-educated women had significantly higher chances of non-participation than high-educated women ($P < 0.05$). The odds

Table 1
Basic characteristics of cervical cancer screening programmes in selected EU countries around the year 2019.

Country	Group	Target age	Screening interval (years/age group)	Year of programme initiation	References
Belgium	1	25–64	3	2013	20,21
Croatia	1	20–64	3	2012	22
Czechia	1	15+	1	2008	10,21
Denmark	1	23–64	3 (23–49); 5 (50–64)	2007	21,23,24
Estonia[a]	2	30–55	5	2006	24–26
Finland	2	25–65	5	1963	21,24,27
Germany[d]	1	20+	1 (20–34); 3 (35+)	2020	28
Hungary	1	25–65	3	2003	21,29
Iceland	1	23–69	3	1964	24,30
Ireland	2	25–60	3 (25–44); 5 (45–60)	2008	21,31
Italy	1	25–65	3 (25–29); 5 (30–65)	2014	28,32
Latvia	1	25–69	3	2009	21,26
Lithuania	1	29–59	3	2004	21,26
Malta[b]	2	27–64	3	2016	33
Norway	1	25–69	3 (25–33); 5 (34–69)	1995	24,34
Poland	1	25–59	3	2006	21,35
Portugal[e]	1	20–64	3	1995	36
Romania	2	25–64	5	2012	21,37
Serbia	1	25–69	3	2012	38
Slovakia[c]	1	23–64	3	2008	21,39
Slovenia[c]	1	20–64	3	2003	40,41
Spain	2	25–64	3 (25–34); 5 (35–64)	2019	42
Sweden	1	23–64	3 (23–50); 7 (51–64)	1967	24,28,43
The Netherlands[f]	2	30–65	5 (30–40); 10 (41–65)	1970	21,43

Group = group of countries analysed; group 1 = countries where it was possible to calculate the up-to-date participation regarding their screening intervals (up to 3 years in all or majority of age groups); group 2 = countries where the screening interval is larger than 3 years and therefore the lifetime participation is calculated.

[a] In **Estonia**, since 2021, the target age was expanded to 65 years.

[b] In **Malta**, women aged 40–64 years are still screened opportunistically.

[c] In **Slovenia** and **Slovakia**, the first two screenings are in 1-year intervals, then in 3-year intervals.

[d] In **Germany**, a population-based cervical cancer screening programme was introduced in January 2020. Data for EHIS 2019 were collected in 2020 in Germany.

[e] In **Portugal**, a population-based CCS programme covers all the country's regions except for the Madeira Autonomous Region. There are also variations in the CCS programme specificities across regions in terms of primary screening test (Human papilloma virus (HPV) test, liquid-based cytology, or conventional cytology), periodicity (every 3 or every 5 years), and target age groups (women aged 25–60, 25–64 or 30–65 years old).

[f] In the **Netherlands**, women aged 45 and 55 years are invited only if they missed screening 5 years ago or were HPV positive at the last screening.

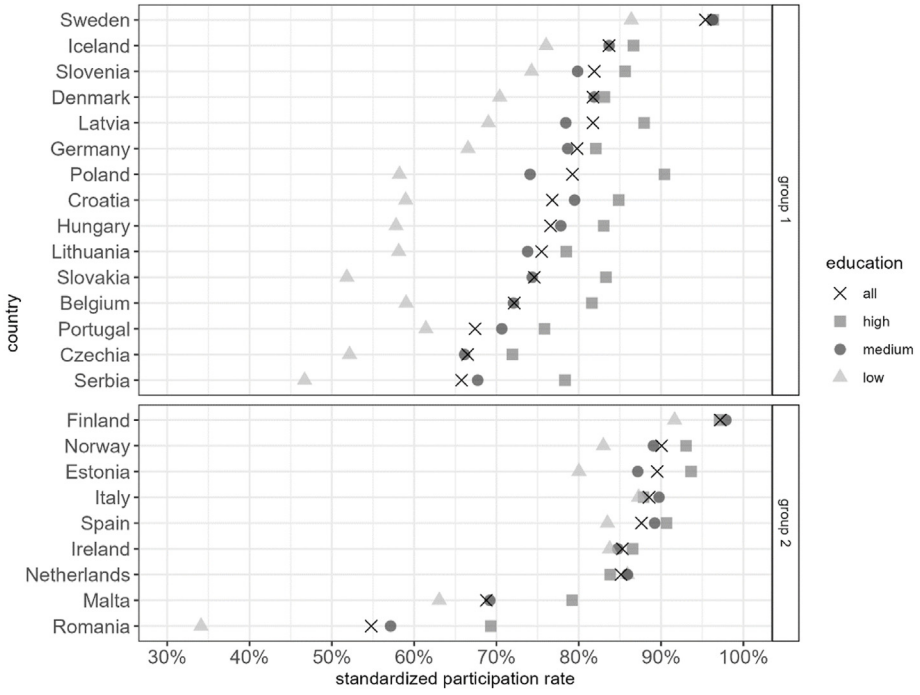

Fig. 1. Standardized up-to-date participation rates by educational attainment in selected EU countries.

ratios (ORs) for up-to-date non-participation in low- compared with high-educated women ranged from 6.36 (95% confidence interval [CI] = 3.89–10.35) in Sweden to 1.67 (95% CI = 1.24–2.26) in Slovenia (group 1) and from 4.49 (95% CI = 3.68–5.49) in Romania to 1.81 (95% CI = 1.30–2.51) in Ireland (group 2). When comparing chances for up-to-date non-participation of medium- to high-

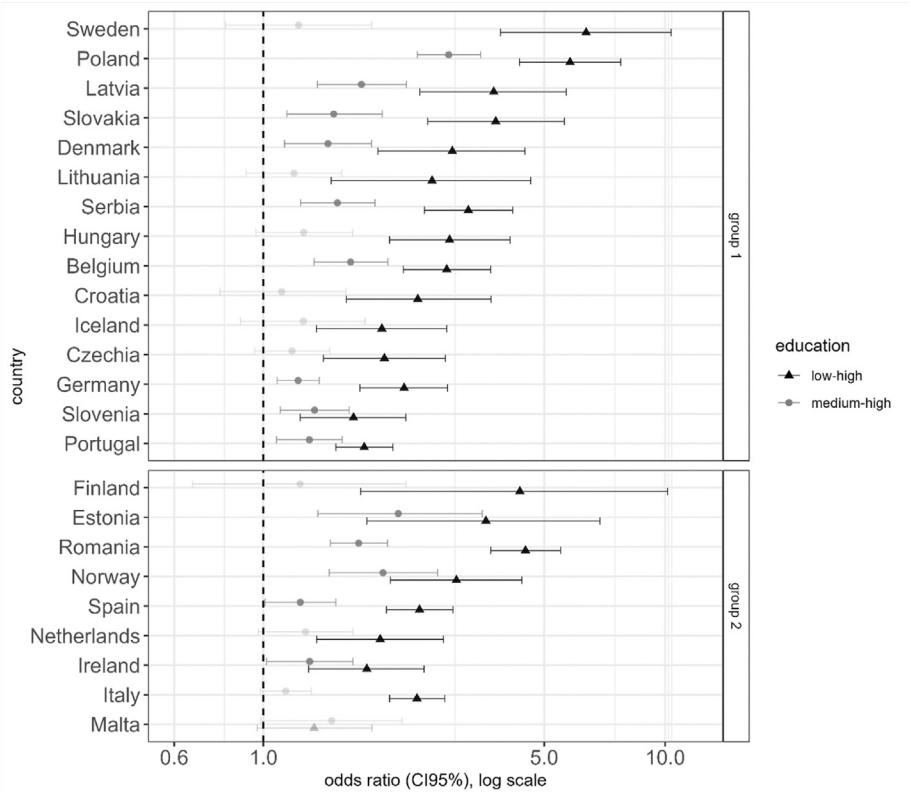

Fig. 2. Chances of up-to-date non-participation by education compared with high education, results of binary logistic regression.

educated women, they were lower in all countries, and the ORs were not significant in some. The table with the binary logistic regression results can be found in Supplement 3.

While in several countries, no discernible social disparity was noted between women with medium and high levels of education, a notable trend emerged in which women with lower educational attainment exhibited significantly higher odds of being non-participants in up-to-date screening than their highly educated counterparts across all countries. It is worth mentioning that this pattern held in all countries except for Malta, where statistical significance was not reached due to a limited number of respondents in the study.

Discussion

Discussion of estimated results

A crucial prerequisite for implementing population-based screening initiatives is the mitigation of social disparities in the utilization of preventative healthcare services.[3] Several studies that exclusively focused on population-based programmes or differences between opportunistic and population-based programmes have already reported the absence of socio-economic inequalities in participation rates.[6,44,45] However, it is worth noting that educational attainment, recognized as a key socio-economic determinant, consistently emerges as a significant factor linked to screening engagement.[12,14,15]

In line with these findings, our research underscores a clear association between educational attainment and participation in organized CCS programmes. In our analytical approach, we intentionally controlled for age alone, allowing us to examine the comprehensive impact of education on participation. The observed association was consistent across all countries included in our analysis.

It is possible that the high uptake of screening in all educational groups, with no significant social differences in low-medium comparison such as Sweden, Iceland, or Finland (group 2), is due to the very long duration of screening programmes (in both countries, screening was introduced more than 50 years before EHIS 2019) as all cohorts of women are already used to the procedure. In addition, since the participation is already very high in these countries (95.4%, 83.7%, and 97.2%), only the educational benefits of high-educated women compared with low-educated women can be observed.

Explanation of persisting social gap

Attempts to find mediating pathways between education and screening participation identified health literacy, perceived susceptibility, and cues to action (i.e. feeling symptoms) as the core mediators.[46] In recent systematic reviews and meta-analyses, adequate health literacy significantly increased the chance of attending screening, including CCS.[47] Some studies have also shown that screening participation is most strongly associated with overall healthcare utilization. Kristensson et al.[9] reported that having no contact with dental care and no contact with a general practitioner were the main predictors for non-participation in CCS. Different theories try to explain the universally observed association between educational attainment, health outcomes, and preventive behaviour. For instance, Wardle et al.[48] discussed the role of cognitive and psychosocial models in socio-economic differences in cancer screening participation. The psychosocial model suggests that factors such as higher stress and lower social support explain, in part, why people from lower socio-economic status environments are less likely to participate in screening. The

cognitive model suggests that beliefs about cancer risk and screening will be essential in differential participation. In practice, both factors may contribute to explaining socio-economic differentials.[48]

Moreover, structural factors and country-level indicators may affect educational disparities in screening attendance. For instance, countries with better access to health care (i.e. higher general practitioner (GP) density, higher public health expenditure) and higher levels of social protections (unemployment benefits, social assistance, and better healthcare provision) have lower social inequalities in CCS.[15,49]

Limitations

Our analyses come with several inherent limitations that deserve acknowledgement. First, our data on screening participation were sourced from a population-based survey reliant on self-reported information provided by women regarding their utilization of screening services. It is important to note that self-reported data have inherent limitations, including the potential for memory biases and the influence of social desirability bias. In simpler terms, women often overstate their participation in cervical screening within a given timeframe.[50]

However, it is crucial to recognize that the extent of this overestimation effect may vary among different demographic groups, particularly when considering educational differences. More highly educated women may overestimate their participation more than less educated counterparts due to their awareness of the importance of screening and the societal expectations surrounding it. Screening behaviour is often perceived as socially desirable. Conversely, certain groups, particularly those with lower levels of education, may misreport their screening utilization, for instance, because they are less aware that cervical screening is a component of routine healthcare examinations or the question wording on participation is unclear to them.[50]

On the other hand, in many countries, self-reported participation is the only way to estimate cancer screening participation in combination with other sociodemographic, health status, and healthcare usage characteristics.

The second limitation is the fact that it was not possible to assess the countries based on the system of their invitations. All countries included in the analysis had some form of population-based screening programme, which should also include systematic inviting of target population to screening. However, there are no general recommendations on the form, content, and frequency of the invitations which countries should use. This can result in inequalities between and within countries which have not been assessed. It has, for example, been shown that the opt-out invitations, where women are already given a set time of their screening appointment, are more efficient.[51] In addition, it also depends on the wording of the invitation to be understood by patients of all educational levels. However, this was not possible to tackle in this study.

The third limitation could be seen in the 'participation' outcome definition. Several outcomes can be used: non-participation within the period, lifelong non-participation, participation up-to-date, participation within the last year, and participation in EU-recommended interval. As our main goal was to estimate the ability of different women's groups to use offered preventive care and see the ability of individual health systems to include vulnerable and most at-risk groups in preventive care, we believe that comparing the participation up-to-date is the best measure for health behaviour of the populations.

Determining up-to-date participation in each studied population posed certain complexities and proved quite labour intensive. Initially, it was necessary to retrospectively gather information on screening guidelines in each country around 2019 as the EHIS data were primarily collected during that year. The literature used for this step is listed in Table 1. Furthermore, it became apparent that the proposed question regarding CCS in the EHIS study adhered to EU recommendations for that particular year (endorsing a 3-year screening interval). However, from the responses, it was impossible to distinguish between regular and lifetime participation in countries where the screening occurred within a 5-year interval. Further inaccuracies may arise in countries where health care is not uniformly structured, and individual regions have different rules for screening and so forth. Overall, it has been revealed that there is significant variability in screening practices, and cross-country comparisons can introduce various biases and challenges. However, this should not affect the assessment of the social gradient.

The examination of social inequalities in cervical screening participation has been the focus of numerous studies. However, from our perspective, this study stands out as one of the first to explore these disparities across all EU countries where population-based screening programmes operate. Another noteworthy advantage of our study is the uniform utilization of the EHIS 2019 data set across all countries, using a consistent methodology for estimating the potential screening uptake, irrespective of its health-related impacts.

Conclusion

Prevention and early detection of diseases have become increasingly prominent in population health within developed countries. This shift in focus is necessitated by chronic diseases, including cancer, comprising a significant portion of the disease burden and mortality. One valuable intervention for mitigating the incidence and mortality associated with cervical cancer in women is screening.

Despite the availability of highly effective CCS programmes, many women remain disengaged from screening activities. A notable trend emerges where women with lower educational backgrounds tend to underuse CCS services. While population-based screening initiatives have successfully narrowed the participation gap between women with medium and high educational attainment in some countries, a persistent disparity exists between women with low and high levels of education. This enduring inequality was evident in 23 of 24 countries studied and contributed to the widening health disparities. Remarkably, this pattern persists even in countries with well-established population-based CCS traditions.

There are potentially several ways to help increase the participation, such as walk-in screening or prescheduled invitations, offering days off for preventive care appointments, increasing health awareness and health education. However, for setting appropriate health policies, exploring mediating pathways between screening participation and education (or social status) is necessary. This is crucial for gaining comprehensive understanding of non-participation and addressing the unequal participation properly. Health systems should consider vulnerable groups' social and cultural context when designing prevention programmes.

Author statements

Ethical approval

All data used in this study were anonymized entirely. Therefore, ethical approval was not required.

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Competing interests

None declared.

Authors' contributions

A.A. and M.L. conceived the study. A.A., M.L., and P.N. performed the analysis. A.A., I.K., and M.L. drafted the manuscript. K.R. provided the literature review. All authors critically reviewed the manuscript for important intellectual content and approved the final version of the article.

Data availability

This article is based on data from Eurostat, EHIS 2019. The responsibility for all conclusions drawn from the data lies entirely with the authors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2024.04.036.

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