

# Self-reported participation in cervical cancer screening among Polish women in 2004–2019

Irmina M. Michalek<sup>1</sup> , Marta Manczuk<sup>1</sup> , Florentino Luciano Caetano dos Santos<sup>2</sup> ,  
Anna Macios<sup>3</sup> , Joanna Didkowska<sup>1</sup> , Andrzej Nowakowski<sup>3, 4</sup> 

<sup>1</sup>Department of Cancer Epidemiology and Primary Prevention, Maria Skłodowska-Curie National Research Institute of Oncology, Warsaw, Poland

<sup>2</sup>Harvard Business School, Harvard University, Boston, MA, United States

<sup>3</sup>Department of Cancer Prevention, Cervical Cancer Prevention Clinic and Central Coordination Center for Cervical Cancer Screening Program, Maria Skłodowska-Curie National Research Institute of Oncology, Warsaw, Poland

<sup>4</sup>Division of Surgical Robotics, Voivodship Specialist Hospital, Lublin, Poland

## ABSTRACT

**Objectives:** We aimed to assess self-reported participation in cervical cancer screening among Polish women between 2004 and 2019 and to identify the groups with the lowest participation rate.

**Material and methods:** Data on declared participation in cervical cancer screening were obtained from the European Health Interview Survey from 2004 to 2019.

**Results:** In 2019, 86.7% of Polish women aged  $\geq 15$  years declared that they had ever undergone a Pap test. Compared to 2004, the coverage of ever-screened women improved by 16.6 percentage points. The proxy population coverage was 72.9%. The highest proportion of women who underwent a Pap smear in the last three years was observed among those aged 35–44 years and 25–34 years (84.0% and 83.2%, respectively), and the lowest among women aged  $\geq 75$  years (20.5%). The proportion screened within the last three years also varied by education (up to lower secondary education 26.4%, up to post-secondary non-tertiary education 62.8%, and the highest level of education 83.7%), urbanization (large cities 66.7%, suburbs, and smaller cities 62.8%, and rural areas 59.0%), income (poorest households 42.5%, wealthiest households 70.6%), and declared health status (best 68.9%, worst 41.4%). The lowest participation in screening was observed in the southeastern regions and the highest in the northwestern regions of Poland

**Conclusions:** In Poland, in 2019, the approximate coverage of cervical cancer screening was high compared to other European countries and has improved over the last 15 years. A complete screening registry is required to confirm questionnaire-based self-reported data. Targeted interventions should be implemented to address low participation in the identified regions and socioeconomic groups.

**Keywords:** early detection of cancer; cervical cancer; papanicolaou test; cytology

Ginekologia Polska 2024; 95, 5: 335–342

## INTRODUCTION

Cervical cancer originates in the cells of the cervix uteri, the neck portion of the uterus, forming the canal between the lower isthmus and the vagina. It is the fourth most frequent malignancy in women worldwide, with 604 thousand new cases and 342 thousand deaths reported in 2020. The numbers correspond to 13 new cases and seven deaths per 100 thousand women. Low- and middle-income countries account for over 90% of the new cases and fatalities world-

wide [1]. In Poland, in 2020, there were 1,940 new cases of cervical cancer and 1,511 deaths due to the disease, corresponding to 6 new cases and four deaths per 100 thousand women [2]. However, it is important to exercise caution when interpreting these figures, as they were influenced by the COVID-19 pandemic and indicate a decrease of approximately 500 cases compared to the previous year.

Effective interventions at various life points can help mitigate cervical cancer's high incidence and mortality.

### Corresponding author:

Irmina M. Michalek

Department of Cancer Epidemiology and Primary Prevention, Maria Skłodowska-Curie National Research Institute of Oncology, Warsaw, Poland

e-mail: irmina.michalek@pib-nio.pl

Received: 24.07.2023 Accepted: 13.10.2023 Early publication date: 6.12.2023

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Human papillomavirus (HPV) vaccination, available on the market since 2006 [3] protects against the most prevalent HPV subtypes that cause cervical, vaginal, and vulvar malignancies. In May 2023, all EU-27 countries, except Poland, had national programs allowing girls to be vaccinated against HPV [4]. However, from June 1, 2023, the Polish Ministry of Health started financing preventive vaccinations against HPV for girls and boys aged 12 and 13 in a two-dose scheme to implement the National Oncology Strategy for 2020–2030 [5]. The mainstay of cervical cancer screening is identifying high-grade cervical intraepithelial lesions by exfoliative cytology (Pap test), validated HR HPV test, or both (co-testing). Effective treatment of these lesions in most cases prevents development of invasive disease.

Cervical cancer screening is typically recommended for women of a certain age. The recommended age range varies by country and may depend on the screening method used [6]. In Poland, cervical screening is recommended every three years for women between 25 and 59 years of age and is mainly conducted using Pap smear tests [7]. Polish women can get tested in a national, state-funded cervical cancer prevention program and opportunistic screening within both reimbursed and private services. To date, Poland has no national registry for cervical cancer screening, apart from the database of the screening program, which collects major data on screening procedures in the program. All other Pap tests and screening procedures are not registered; therefore, there is a significant gap in the knowledge regarding the participation of Polish women in cervical cancer screening. No easily accessible data or literature allow for the assessment of changes in this indicator over time and evaluation of the effectiveness of efforts to increase women's participation.

Ensuring high participation in cervical screening is critical to reducing the burden of cervical cancer. First, it can reduce the incidence of invasive disease by identifying and treating precancerous lesions before they progress to cancer. Second, screening increases the number of cervical cancer cases detected at an early stage, when the disease is most curable. Both interventions can reduce cervical cancer mortality.

This study aimed to assess self-reported participation in cervical cancer screening among Polish women between 2004 and 2019. The secondary aim of this study was to identify the socioeconomic groups and geographical regions with the lowest participation rates.

## **MATERIAL AND METHODS**

### **Study design and data sources**

This study employed an observational, descriptive design to assess self-reported participation in cervical cancer screening among Polish women. Several data sources were

employed in this research: Statistics Poland, Eurostat, and Polish National Cancer Registry.

Data on declared participation in cervical cancer screening tests were obtained from the European Health Interview Survey (EHIS), a cross-sectional analysis of the health status of the European population. Statistics Poland is responsible for the Polish data collection. The survey was carried out cyclically every five years and included questions about the entire household and its inhabitants. It was conducted in all voivodeships (the highest level of the administrative region). The survey offers representative data at both national and regional levels. Each time, it is intended to include 24 thousand households, randomly selected via a two-stage stratified scheme, with different selection probabilities in the first step. The study is carried out using the direct interview method, using questionnaires that each adult participant answers personally. Following Eurostat guidelines, proxy interviews may concern people with long-term cognitive impairment, serious illness, long-term hospitalization, and long-term absences due to study or work. A detailed description of the EHIS study can be found in [8].

In this study, we included data from EHIS 2004, EHIS 2009, EHIS 2014, and EHIS 2019, for which the survey was conducted over four months, from September to December 2004, 2009, 2014, and 2019, respectively. In 2004, 2009, 2014, and 2019, interviews were conducted with 14,564, 16,295, 12,229, and 11,024 households, respectively. These corresponded to 42,991, 41,818, 28,826, and 23,753 individuals, respectively. Refusal rates were 39%, 32%, 49% and 54%, respectively. The reasons for non-participation included refusal to participate in the survey (49%), failure to make contact despite repeated attempts (21%), and dwellings unoccupied for more than three months (16%). The statistical information obtained was generalized to the Polish population as of the 31<sup>st</sup> of December 2004, 2009, 2014, and 2019. The results obtained are representative at both the country and voivodship levels.

Our analysis included data on cervical cytology examinations obtained through the following question: When was the last time you had a cytological examination, cervical smear? [possible answers: in the last 12 months; from 1 to 2 years ago; from 2 to 3 years ago; 3 years ago, or more; never; I do not know or refuse to answer]. In addition, in the analyses, we used information on the age group, level of education, degree of urbanization of the place of residence, income, and self-reported health status. Education level was categorized according to the International Standard Classification of Education (ISCED), a statistical system introduced by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) to organize educational data. The current version of the ISCED includes nine levels (0–8), denoting: 0 — early childhood education; 1 — primary

education; 2 — lower secondary education; 3 — upper secondary education; 4 — post-secondary non-tertiary education; 5 — short-cycle tertiary education; 6 — bachelor's or equivalent; 7 — master's or equivalent; and 8 — doctorate or equivalent [9]. The level of urbanization of the residences was categorized according to the Degree of Urbanization (DEGURBA) classification, which indicates the characteristics of the local administrative unit. The DEGURBA includes three levels: 1 — cities; 2 — towns and suburbs; and 3 — rural areas [10, 11]. In this study, income is expressed as equivalized income, which is estimated by considering the net monthly income for the entire household and the size and composition of the household [12]. The self-reported health status was classified as very good, fair, bad, or very bad.

Data from the EHIS conducted in Poland were obtained from Statistics Poland and Eurostat [8, 13]. However, the presentation of data varies between sources according to the range of the years presented and the stratification of data by, among other things, age groups, the level of education attained, and the level of urbanization of the place of residence. Therefore, we obtained the data for our study in a hybrid manner. Data on overall self-reported participation in cervical cancer screening in 2004, 2009, 2014, and 2019 were obtained from Statistics Poland. The data presented by Statistics Poland differ, depending on the EHIS edition, in terms of the number of possible answers to the question of how much time has elapsed since the last cytology. Therefore, we converted the data from 2004 and 2009 to correspond to data from 2014 and 2019 and to the data presented by Eurostat. Therefore, all answers that covered the period  $\geq 3$  years from the last examination and the answers “had a Pap smear but did not remember when” were grouped into one group “ $\geq$  three years from the last examination”. In addition, for 2009, there was an additional second category of missing data, denoting that it was unknown whether the woman had ever performed the Pap smear test (3.3% of the dataset). For this EHIS edition, this category was grouped in our study with the answer “never screened”. Data for more comprehensive analyses of self-reported participation in cervical cancer in 2019, stratified by education and the level of urbanization of the place of residence, were obtained from Eurostat.

Data on cervical cancer mortality among Polish women in 2004, 2009, 2014, and 2019 were obtained from the Polish National Cancer Registry [2], a public institution operating in Poland whose primary goal is to register new cancer cases. The data collection methods used at this institution have been described elsewhere [14].

### Data analysis and reporting

The annual mortality rate was calculated as the number of new cervical cancer deaths per 100,000 person-years.

The mid-year Polish female population size on June 30<sup>th</sup> of the corresponding year was applied in the denominator. As the data are presented yearly, and the denominator is the mid-year population, we convey the metrics per 100,000 inhabitants in the Results section for clarity. Direct age standardization for the World Standard (Segi) [15] was performed to allow worldwide comparisons.

Descriptive statistics for categorical variables (number of respondents who responded to a question) are presented as percentages. We utilized R Studio (version 2019.09.0 “Ghost orchid”) for data administration and analysis.

### Compliance with ethical standards

The data evaluated in this study were a re-analysis of existing data freely available at the locations indicated in the Data sources section. Statistics were submitted according to the EQUATOR network's SAMPL criteria for statistical reporting. All analyzed data were collected anonymously.

## RESULTS

### Cervical cancer screening in Poland in 2019 and over time

In 2019, 86.7% of Polish women aged  $\geq 15$  years had ever participated in cervical cancer screening (Tab. 1). Among all women surveyed, the time since the last examination  $< 3$  years was reported by 62.6% ( $< 1$  year by 30.4%,  $\geq 1$  and  $< 2$  years by 20.7%,  $\geq 2$  and  $< 3$  years by 11.5%)  $\geq 3$  years by 24.1%, and 13.3% of women never participated in such a screening. Compared with 2004, when the ever-screened rate was 70.1%, there was an improvement of 16.6 percentage points (pp). It is worth noting that the participation rate within  $< 3$  years increased (+21.2 pp), and participation within  $\geq 3$  years decreased (−4.6 pp). The increase in the participation rate within  $< 3$  years was higher for older age groups, the highest for women  $> 60$  years of age (+30.4 pp; Tab. S1).

In the same population, the mortality rate due to cervical cancer in 2019 was 5.68 per 100,000. Compared with 2004, when the rate was 8.59 per 100,000, there was a decrease in cervical cancer mortality of 2.91 per 100,000 inhabitants, corresponding to a reduction in the rate of never-screened individuals (Fig. 1).

In 2019, the participation rate in cervical cancer screening within the last three years for women aged 20–69 years, which is the closest approximation of the definition of population coverage according to many European countries [16], was 72.9%.

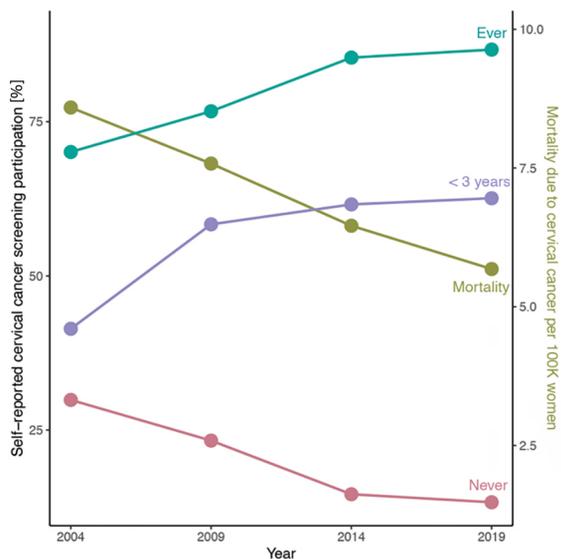
### Cervical cancer screening in Poland in 2019 by age group

The highest proportion of women who reported performing a Pap smear in the last three years was recorded

**Table 1.** Self-reported cervical screening participation and mortality due to cervical cancer per 100,000 women, by year — Polish women aged ≥ 15 years

Year	Self-reported cervical screening participation [%]							Cervical cancer mortality/100 K
	Never	Ever						
		Overall	< 1 year	≥ 1 and < 2 years	≥ 2 and < 3 years	< 3 years	≥ 3 years	
2004	29.9	70.1	20.8	10.7	10.0	41.4	28.7	8.59
2009	23.3	76.7	28.5	22.6	7.3	58.4	18.3	7.58
2014	14.6	85.4	30.1	20.7	10.8	61.6	23.7	6.46
2019	13.3	86.7	30.4	20.7	11.5	62.6	24.1	5.68
Change between 2004 and 2019	-16.6 pp	+16.6 pp	+9.6 pp	10.0 pp	+1.5 pp	+21.2 pp	-4.6 pp	-2.9

pp — percentage points; The data source for the calculations is Statistic Poland; however, it has been converted as outlined in the materials and methods section



**Figure 1.** Self-reported cervical screening participation and mortality due to cervical cancer per 100,000 women, by year — Polish women aged ≥ 15 years. Note: The data source for the calculations is Statistic Poland; however, it has been converted as outlined in the materials and methods section

among those aged 35–44 years and 25–34 years, 84.0% and 83.2%, respectively (Tab. 2; Fig. 2). The lowest proportion was recorded among women aged ≥ 75 years (20.5%). The highest proportion of never screened was recorded among women aged 15–24 (63.5%).

### Cervical cancer screening in Poland in 2019 by education level

Women with education at the ISCED 0–2 level, that is, up to lower secondary education, were characterized by the lowest share of participation in cervical cancer screening (26.4%) within the last three years. Among women with education at the ISCED 3–4 level, that is, upper second-

ary education and post-secondary non-tertiary education, this rate was 62.8%. On the other hand, among the best-educated women (ISCED 5–8), that is, those who completed a short-cycle tertiary education or obtained a bachelor’s, master’s, or doctorate degree, this rate was the highest (83.7%; Tab. 2).

Among women who, due to their age, could already achieve education at the maximum level (ISCED 5–8), that is, among women > 25 years of age, the most considerable differences in the participation rate in screening below three years were observed in women aged 55–64 years (ISCED 0–2 = 36.8% vs ISCED 5–8 = 81.9%; Fig. 3; Tab. S2).

### Cervical cancer screening in Poland in 2019 by urbanization of the place of residence

The proportion of women who participated in cervical cancer screening varied depending on the level of urbanization of the place of residence. The highest participation rate within the last three years was observed in areas with urbanization at the DEGURBA 1 level, which included large cities (66.7%), intermediate in places with urbanization at the DEGURBA 2 level, which included suburbs and smaller towns (62.8%), and the lowest in DEGURBA 3 areas, meaning rural areas (59.0%). When the above data were stratified by age group, the highest differences between large cities (DEGURBA 1) and rural areas (DEGURBA 3) were found in women aged 65–74 years (53.6% for DEGURBA 1 and 38.0% for DEGURBA 3; Fig. 3; Tab. S3).

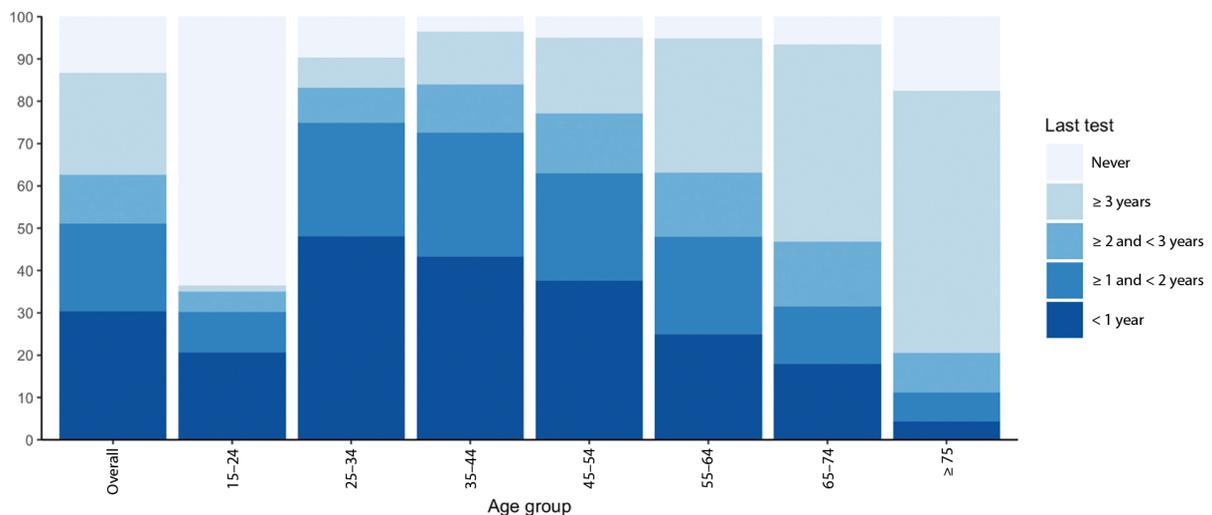
### Cervical cancer screening in Poland in 2019 by equalized income

Participation in cervical cancer screening varied across equalized income groups. This income is calculated by considering the net monthly income for the entire household and the size and composition of the household. Stratification occurs in quintiles, where

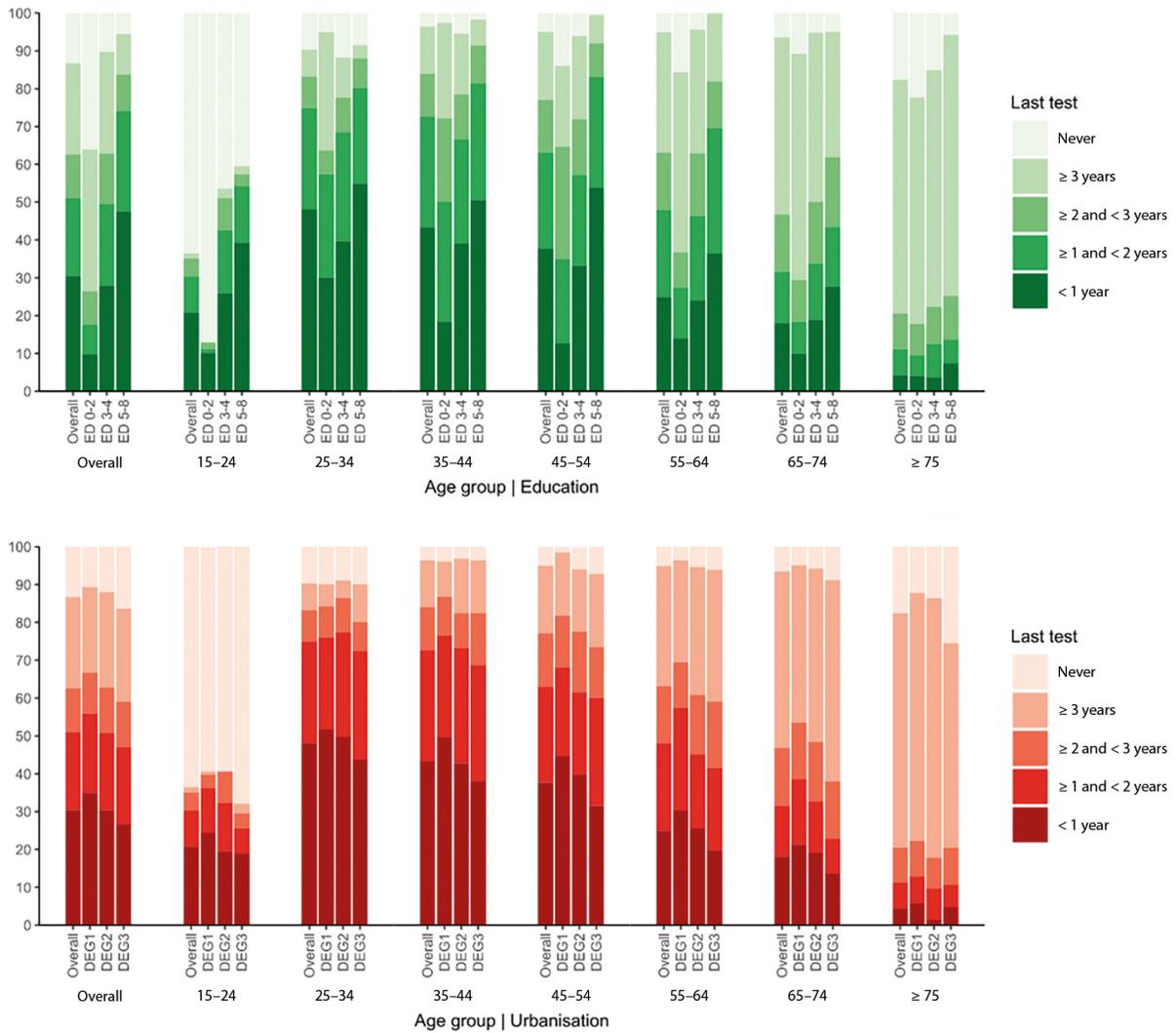
**Table 2.** Self-reported cervical screening participation, by age group, education level, urbanization of place of residence, equivalized income, and perceived health — Polish women, 2019

	Age group [years]	Self-reported cervical screening participation [%]						
		Never	Ever					
			Overall	< 1 year	≥ 1 and < 2 years	≥ 2 and < 3 years	< 3 years	≥ 3 years
	<b>Overall</b>	<b>13.3</b>	<b>86.7</b>	<b>30.4</b>	<b>20.7</b>	<b>11.5</b>	<b>62.6</b>	<b>24.1</b>
Age group [years]	15–24	63.5	36.5	20.7	9.6	4.8	35.1	1.4
	25–34	9.7	90.3	48.1	26.8	8.3	83.2	7.1
	35–44	3.6	96.4	43.3	29.3	11.4	84.0	12.4
	45–54	5.0	95.0	37.7	25.3	14.1	77.1	17.9
	55–64	5.1	94.9	24.9	23.1	15.1	63.1	31.8
	65–74	6.5	93.5	18.0	13.5	15.3	46.8	46.7
	≥ 75	17.7	82.4	4.3	6.9	9.3	20.5	61.9
Education	ISCED 0–2	36.1	63.9	9.7	8.0	8.7	26.4	37.5
	ISCED 3–4	10.3	89.7	27.9	21.6	13.3	62.8	26.9
	ISCED 5–8	5.7	94.4	47.6	26.4	9.7	83.7	10.7
Urbanization	DEGURBA 1	10.5	89.4	34.9	21.1	10.7	66.7	22.7
	DEGURBA 2	12.1	88.0	30.4	20.4	12.0	62.8	25.2
	DEGURBA 3	16.4	83.6	26.5	20.6	11.9	59.0	24.6
Equivalized income	1Q	17.5	82.5	17.0	14.6	10.9	42.5	40.0
	2Q	14.6	85.4	22.9	18.1	11.4	52.4	33.0
	3Q	12.7	87.2	29.6	21.8	10.7	62.1	25.1
	4Q	11.0	89.0	33.8	23.4	11.6	68.8	20.2
	5Q	12.6	87.4	36.6	22.3	11.7	70.6	16.8
Self-reported health status	Very good	16.2	83.8	34.6	23.0	11.3	68.9	14.9
	Fair	8.0	92.0	26.3	18.6	12.7	57.6	34.4
	Bad and very bad	12.8	87.2	18.4	14.3	8.7	41.4	45.8

International Standard Classification of Education (ISCED): 0 — early childhood education; 1 — primary education; 2 — lower secondary education; 3 — upper secondary education; 4 — post-secondary non-tertiary education; 5 — short-cycle tertiary education; 6 — bachelor’s or equivalent; 7 — master’s or equivalent, and 8 — doctorate or equivalent; DEGURBA (degree of urbanization classification): 1 — cities; 2 — towns and suburbs; 3 — rural areas; The data source for the calculations is Statistic Poland; however, it has been converted as outlined in the materials and methods section



**Figure 2.** Self-reported cervical screening participation, by age group — Polish women, 2019. Note: The data source for the calculations is Statistic Poland; however, it has been converted as outlined in the materials and methods section



**Figure 3.** Self-reported cervical screening (4) participation by age group, education level, and urbanization of place of residence — Polish women, 2019. International Standard Classification of Education (ED): 0 — early childhood education; 1 — primary education; 2 — lower secondary education; 3 — upper secondary education; 4 — post-secondary non-tertiary education; 5 — short-cycle tertiary education; 6 — bachelor’s or equivalent; 7 — master’s or equivalent, and 8 — doctorate or equivalent. degree of urbanization classification (DEG): 1 — cities; 2 — towns and suburbs; 3 — rural areas. Note: The data source for the calculations is Statistic Poland; however, it has been converted as outlined in the materials and methods section

the first and fifth quintiles are the poorest and highest-income groups, respectively. The rate of women participating in screening in the last three years has increased with equalized income. For women from the poorest households, it was 42.5%, and for those from the wealthiest households, it was 70.6%.

**Cervical cancer screening in Poland in 2019 by health status**

Women who declared their best (*i.e.*, very good) self-evaluated health status were characterized by the highest percentage of cervical cancer screening within the last three years (68.9%), and women who declared their worst

health status (bad and very bad) had the lowest participation rate within < 3 years (41.4%).

**Cervical cancer screening in Poland in 2019 by geographical region**

The lowest rate of women who performed a Pap smear test in the last three years was recorded in the south-eastern voivodships (regions) of Poland (Opolskie 51.9%, Podkarpackie 52.2%, Lubelskie 54.0%), and the highest in the north-western regions (Wielkopolskie 70%, Warmińsko-Mazurskie 69.5%, Lubuskie 69.2%; Tab. S4). The highest rate of never-screened was observed in Podkarpackie (22.5%) and the lowest in Warmińsko-Mazurskie (5.6%).

## DISCUSSION

### Findings of the study in the context of the European data

Cervical screening coverage is traditionally defined as the proportion of women eligible for screening at a specific moment in time who were sufficiently screened within a specified time frame [16]. Since the recommendations vary greatly between countries regarding age to begin screening, age to end screening, and interval for cytology-based screening [6], to enable international comparisons, in this study, we assumed a proxy of the coverage, following Eurostat, defined as women aged 20–69 years, screened within < 3 years [16]. In 2019, the approximate coverage in Poland was 72.9%, which was higher than that observed for EU-27 (70.8%). However, it is worth noting that the comparison of such an indicator is not entirely justified because, in most Western European countries, population programs for cervical cancer screening currently deploy HPV testing, which is indicated, depending on the age group, approximately every five years [6].

### Findings of the study in the context of screening gaps and targets for improvement

Even with the noticeable improvement in screening participation rates over 15 years, reflected by an increase of ever screened by 16.6 pp, there is still room for improvement in specific socioeconomic groups and regions of the country. Several modifiable factors affecting population coverage with cervical screening tests include access to healthcare, cultural and social barriers, and individual attitudes toward cervical cancer screening. Some studies have found that increasing access to healthcare, addressing cultural and social barriers, and promoting positive attitudes toward screening can improve population coverage [17, 18]. Our study indicates that women whom awareness campaigns should primarily target are those from older age groups, characterized by a lower level of education, living in rural areas, coming from the poorest households, southeastern regions of the country, and declaring bad health status (independently).

There is a need to debate what actions should be undertaken to improve participation rates in these groups and the best channels to access these women. One possible solution is the proper motivation of primary health care midwives and the implementation of HPV-based screening with vaginal sample collection without the requirement for a gynecological bed. Currently, approximately 75% of primary healthcare units do not have a gynecological bed, and the majority declares low interest in cervical cancer screening for many reasons [19, 20]. Currently, every woman living in Poland has an assigned community midwife in primary healthcare setting [21]. For the last decade midwives in

Poland are allowed to contract such services with the Polish National Health Fund, however only small percent of them is exercising this possibility, often patients are not aware of the availability of such services. Finally, a central registry of cervical cancer procedures is crucial for planning any kind of intervention using high-quality national and regional data.

### Strengths and limitations of the study

The main strength of this study is that the results involve organized and opportunistic tests performed within the Polish population screening program, other services of public healthcare systems, and tests performed within the private healthcare sector. In addition, the data collected through the survey are representative on the national and regional levels.

Still, this study inherited some limitations from the Polish edition of EHIS. First, the non-response rate was high (approximately 50%), which might have resulted in non-response bias. Furthermore, biases such as response bias, recall bias, social or cultural acceptability, ambiguity about the performed test, and decreased inclusion of women from vulnerable groups may occur in survey-based studies [22]. These limitations can only be overcome by implementing high-quality data registration in a national cervical screening registry.

Finally, with the available data, we could only answer a few questions posed by clinicians and policymakers regarding their daily work. Many other questions still need to be addressed, including the number of tests a woman has ever received, what type of tests women received (liquid-based cytology or conventional pap smear), and what actions took place after screening.

## CONCLUSIONS

In Poland in 2019, the approximate coverage by cervical cancer screening was almost 73%, and more than 86% of Polish women aged  $\geq 15$  years had ever participated in the screening. Since 2004, the rate of ever-screened women has improved by almost 17 pp. The highest proportion of women who performed the test within the last three years was observed in younger age groups, women characterized by a higher level of education, living in large cities, coming from the wealthiest households, northwestern regions of the country, and declaring a very good health status. Further studies are needed to establish the barriers that influence low participation in other regions and socioeconomic groups.

### Article information and declarations

#### Acknowledgments

None.

**Author contributions**

Study concept and design: IMM, MM, AN

Statistical analysis: IMM and FLCS

Figures: IMM and FLCS

Drafting of the manuscript: IMM

Critical revision of the manuscript for important intellectual content: all authors.

All authors had full access to all of the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis.

**Funding**

This research received no specific grants from any funding agency in the public, commercial, or not-for-profit sectors.

**Data sharing**

Data analyzed in this study were a re-analysis of existing data, which are openly available at locations cited in the Materials and methods section.

**Compliance with ethical standards**

The data evaluated in this study were a re-analysis of existing data freely available at the locations indicated in the Data sources section. Statistics were submitted according to the EQUATOR network's SAMPL criteria for statistical reporting. All analyzed data were collected anonymously.

**Conflicts of interest**

None declared.

**Supplementary material**

Supplementary material — 4 tables.

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