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Original Article

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Cytology screening tests and the incidence of cervical cancer in the Lower Silesia province in 2005-2014*

Wpływ cytologicznych badań przesiewowych na zachorowania na raka szyjki macicy w województwie dolnośląskim w latach 2005-2014

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Summary

Introduction: Cervical cancer is the sixth most common malignant cancer in Poland, whereas in most EU countries it has not been included in the top ten in many years. The aim of this paper was to evaluate the impact of screening on the incidence of invasive and preinvasive cervical cancer in the Lower Silesia Province in 2005-2014.

Material/Methods: 3,298 cervical cancer cases were analyzed (2,563 invasive cervical cancers and 735 preinvasive cancers) in women in the Lower Silesia Province, registered at the Lower Silesian Cancer Registry in 2005-2014.

Results: Since the "Population-Based Cervical Cancer Prevention and Early Detection Program" was introduced in 2006, there has been a steady decrease in the incidence of invasive cervical cancer in the Lower Silesia Province in the group of women (aged 25-59) who receive screening tests. Unfortunately, there has also been a systematic increase in the number of women diagnosed with cervical cancer in the over-59 age group. In women who had screening tests in 2006-2014, cancer in situ accounted for 20-43% of all cervical cancer cases, while in women aged over 60 it was only 3-11%.

Discussion: Analysis of trends in the incidence of invasive and preinvasive cervical cancer suggests positive effects of screening for early signs of cervical cancer, even though only a small percentage of the population receives such tests. In the entire Lower Silesian population of women, a downward trend (6 fewer cases per year) in the incidence of invasive cancer, and an upward trend (4 more cases per year) in the incidence of preinvasive cervical cancer are observed.

Keywords: **cervical cancer • screening tests • cancer epidemiology**

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Introduction

Cervical cancer is a serious epidemiological and social problem both in Poland and globally. According to the data published by IARC (International Agency for Research on Cancer) in 2012, in a global population of women cervical cancer was the fourth most common cancer as regards incidence (estimated 530,000 new cases per year) and mortality (estimated 275,000 deaths per year) (Fig. 1) [1,10]. Significant differences are observed in cervical cancer incidence in different regions of the world. South-west African countries are reported as highest-risk areas, while the lowest risk is observed in the Middle East [6].

In Poland cervical cancer incidence is medium, with approximately 3,000-3,500 new cases and 1,800 deaths recorded every year. As regards the incidence of cancer in Poland generally, cervical cancer is the 6th most common cancer, while in the majority of European Union member states it has not been included in the top ten for several years now [3,6,7,9,12].

In Europe cervical cancer incidence rate in 2012 was 11.2/100,000, and mortality was 3.8/100,000. These rates were lower than the rates for the global population (incidence 14.0/100,000; mortality 6.8/100,000) and Polish population (incidence 12.2/100,000; mortality 5.4/100,000) [6].

In the face of very strong evidence from observational studies that confirm the effectiveness of cytology screening tests in cervical cancer prevention and reduction of mortality rate [3,8], there was no need to further check this diagnostic method in randomized studies. In Finland, where in the late 1950s mortality was higher than in Poland, it has decreased significantly after the population-based cytology screening was introduced (mortality 1.0/100,000) and is now one of the lowest in Europe [6,8]. Considering the above statistics, it is estimated that the risk of invasive cervical cancer in women who do not receive the test is three to nine times higher than in patients who undergo the tests.

In 2006 Poland introduced the Population-Based Cervical Cancer Prevention and Early Detection Program for women aged 25-59, in which a cytology test performed every 3 years serves as the screening test [13]. Every year over 3 million invitations for the test were sent to women across Poland; however, adherence was only approximately 20% (Fig. 2).

Despite continuous efforts aimed not only at improving the quality of screening tests but also health awareness of women, it proved impossible to obtain 70% coverage of the population, which is the minimal level ensuring a positive population effect. Also adherence of patients with advanced disease is a big problem (Fig. 6), as this has a negative influence on chances of recovery [5,6,14]. Despite the fact that cytology screening tests are becoming increasingly available and in spite of better access to more detailed examinations if necessary, the number of new cases (Table 1) has remained very high [11].

Materials and methods

Epidemiological data was obtained from the Lower Silesian Cancer Registry in Wroclaw. 3,298 cases of cervical cancer diagnosed in women residing in Lower Silesia Province recorded in 2005-2014 were analyzed. The patients were divided into groups with malignant neoplasm of cervix uteri (C53 in ICD-10), which in this paper corresponds to invasive cervical cancer, and in situ cervical cancer (D06 in ICD-10), which corresponds to preinvasive disease. Standardized incidence rates for which the population is the "Standard global population" were sourced from the Polish National Cancer Registry available at www.onkologia.org. Trends in screening coverage were presented and trends in the changes in the incidence of invasive and preinvasive cervical cancer in three age cohorts: pre-screening (below 25 years of age), screening (25-59) and post-screening (over 59 years of age) were calculated. An analysis of invasive cervical cancer advancement stages in the Lower Silesian population in 2005-2014 was performed: local stage was TxN0M0, regional stage was TxN1M0 and metastatic disease was TxNxM1. Calculations were performed using Microsoft Excel and Minitab 16, and One-way ANOVA was used.

Results

The standardized rates for Poland published by the Polish National Cancer Registry in 2015 indicate that in 2005-2013 in the Lower Silesia Province (Table 1) no higher incidence of invasive (P=0.26890) or preinvasive cervical cancer (P=0.13319) was noted in comparison with other regions of Poland [9].

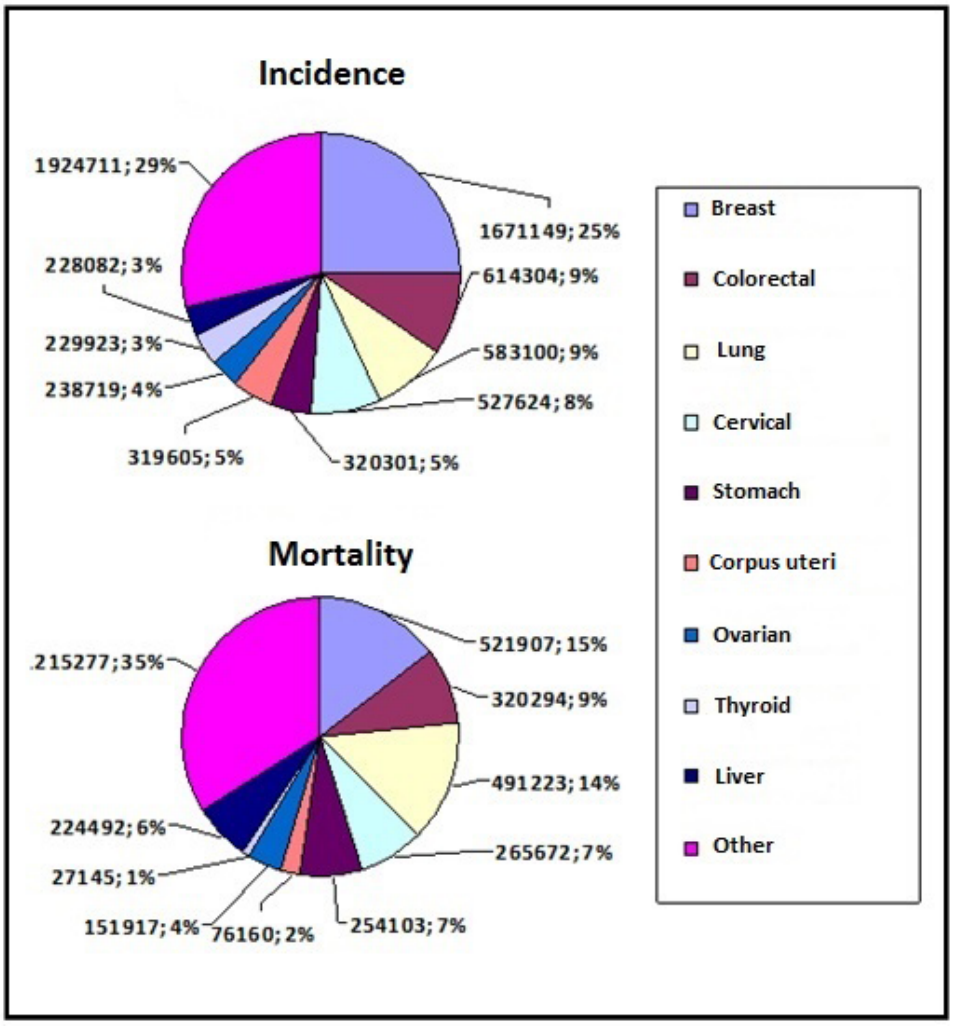

Fig. 1. Cancer incidence and mortality in the global population of women according to Globocan 2012 data [6]

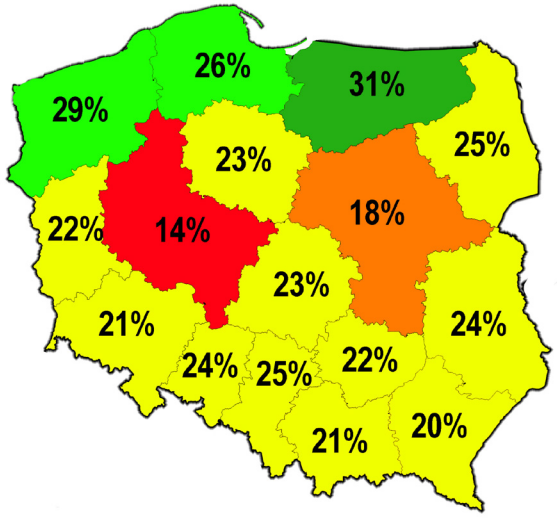

Fig. 2. Cervical cancer prevention program coverage; data as of 2014

In 2005-2014, 2,563 new cases of invasive cervical cancer (C53) and 735 new cases of preinvasive cancer (D06) were reported to the Lower Silesian Cancer Registry. In the analyzed period the incidence of invasive cervical cancer (C53) decreased by 6 cases per year and the incidence of preinvasive cancer (D06) increased by 4 cases per year. In the last decade between 296 and 235 cases of invasive cancer (C53) and between 18 and 108 preinvasive cancer (D06) cases were reported every year (Fig. 3).

The comparison of invasive cancer and preinvasive cancer incidence in screened (25-59 years) and unscreened (below 25 years of age and over 59 years of age) age groups results in notable differences (Table 2; Fig. 3). In women at the pre-screening age (below 25 years of age) cervical cancer in the Lower Silesia Province occurred seldom: 1-4 new cases were diagnosed per year; in total, between 2005 and 2014 17 new cases were diagnosed, of which 11 (65%) were pre-invasive cancers (D06).

Table 1. Incidence of cervical cancer in Poland in 2005-2013 [11]

	Standardized incidence rate (per 100,000 women)																	
	Invasive cervical cancer - C53									Preinvasive cervical cancer - D06								
Year Province	2005	2006	2007	2008	2009	2010	2011	2012	2013	2005	2006	2007	2008	2009	2010	2011	2012	2013
Lower Silesia: figures	291	267	281	267	235	255	236	245	251	20	48	55	100	111	100	96	71	74
% MV	91.9	96.1	95.8	93.5	98.4	96.9	96.4	98.0	95.7	100	100	100	100	100	100	100	100	100
crude rate	17.7	18.7	18.8	16.6	15.7	15.5	14.9	14.0	14.6	1.0	2.6	3.5	6.4	7.3	6.6	6.9	4.0	4.5
standardized rate	11.9	12.3	12.1	11.6	10.2	11.0	10.4	10.0	9.9	0.8	2.1	2.6	5.3	6.1	5.6	5.5	3.3	3.6
Cuiavia-Pomerania	11.3	11.3	12.8	11.8	10.8	13.4	6.9	7.6	10.8	2.0	1.6	2.5	2.2	3.6	7.4	8.0	8.3	6.4
Lublin	11.3	10.6	11.6	13.1	11.2	8.1	8.6	9.6	10.2	5.5	5.1	5.1	4.7	4.9	5.2	5.0	3.7	4.0
Lubusz	13.4	12.0	11.8	13.7	11.3	12.2	11.0	12.7	12.2	0.9	1.7	5.1	4.3	5.4	3.1	1.7	1.4	0.2
Łódź	12.2	11.4	12.0	11.2	11.0	9.3	9.1	8.8	7.6	1.0	0.7	0.5	1.1	1.0	0.7	0.4	0.2	0.5
Lesser Poland	11.4	11.0	13.0	10.1	10.3	9.8	10.5	8.9	8.3	1.0	1.3	2.2	3.0	2.6	3.1	2.6	5.6	5.8
Mazovia	10.7	9.9	10.5	10.3	10.8	10.1	8.4	8.3	8.3	2.1	1.8	2.3	2.0	2.4	1.9	2.3	2.6	1.9
Opole	9.5	12.3	12.7	11.8	10.6	8.5	10.5	8.7	8.8	2.6	2.0	4.5	4.9	2.5	2.8	3.1	2.2	1.3
Sub-Carpathia	10.0	10.1	10.3	8.4	8.2	8.0	7.3	8.2	8.0	1.8	2.3	1.9	2.3	2.3	1.7	2.2	1.0	1.5
Podlassia	13.0	12.3	13.1	12.2	13.1	11.2	11.7	8.0	9.3	4.9	2.5	5.1	4.5	5.5	4.1	4.3	3.2	3.4
Pomerania	11.9	13.5	12.5	12.7	12.8	13.3	14.7	12.2	12.6	0.5	0.7	2.5	2.5	4.4	2.0	4.3	5.5	5.9
Silesia	11.1	11.4	11.7	9.9	10.6	9.6	9.6	8.8	9.8	1.7	1.5	2.2	2.7	3.3	2.5	1.9	2.7	2.5
Kielce	11.1	13.9	12.1	9.9	8.1	10.1	11.2	7.8	6.9	2.8	1.0	1.5	5.2	8.9	10.4	8.4	8.0	8.8
Varmia and Masuria	13.2	10.7	14.0	13.3	12.2	14.5	12.6	8.5	9.9	1.1	0.3	1.2	0.6	3.3	3.4	2.9	3.8	1.6
Greater Poland	12.6	10.7	11.0	11.9	8.9	8.9	9.3	7.5	8.8	3.5	1.9	4.3	3.9	3.2	2.8	2.8	1.9	3.0
Western Pomerania	12.4	11.3	11.7	13.7	9.0	10.4	9.7	10.1	9.2	2.2	1.9	1.1	0.8	1.4	0.7	0.6	0.7	0.7
Poland	11.5	11.3	11.8	11.2	10.5	10.3	9.8	8.9	9.3	2.0	1.8	2.6	3.0	3.5	3.2	3.2	3.2	3.2

In a screened group (25-59 years) in 2005-2014 a systematic increase of preinvasive cancers (D06) was observed: from 8% in 2005, to 20% in 2006-2007 and the highest percentage, i.e. 36-43% in 2008-2011. In 2012-2014 the percentage of preinvasive cancers stabilized at 30-35%. To sum up, analysis of incidence trends observed in women at the screening age indicates that before screening was introduced less than every tenth case of cervical cancer was diagnosed as preinvasive cancer (D06), while now every third one is diagnosed at this fully treatable stage (Fig. 4). At the same time, there was a steady decrease in the incidence of invasive cancer in this group of patients (Table 2 Fig. 4) from 206 in 2005 to 114 in 2014.

In 2005-2009 in women at the post-screening age (over 59 years of age), in contrast to screened women, no upward trend in preinvasive cancer (D06) incidence was noted. In situ cancers in 2005-2009 accounted for only 3-4% of all cases (Fig. 4 and Table 2). In 2010 the percentage increased to 5%, and in 2011 to 11%. From 2012 a decrease to 8%, in 2013 to 5%, and in 2014 to 6% was noted, which may be related to the fact that the women who participated in screening tests reached 59 years of age and were trans-

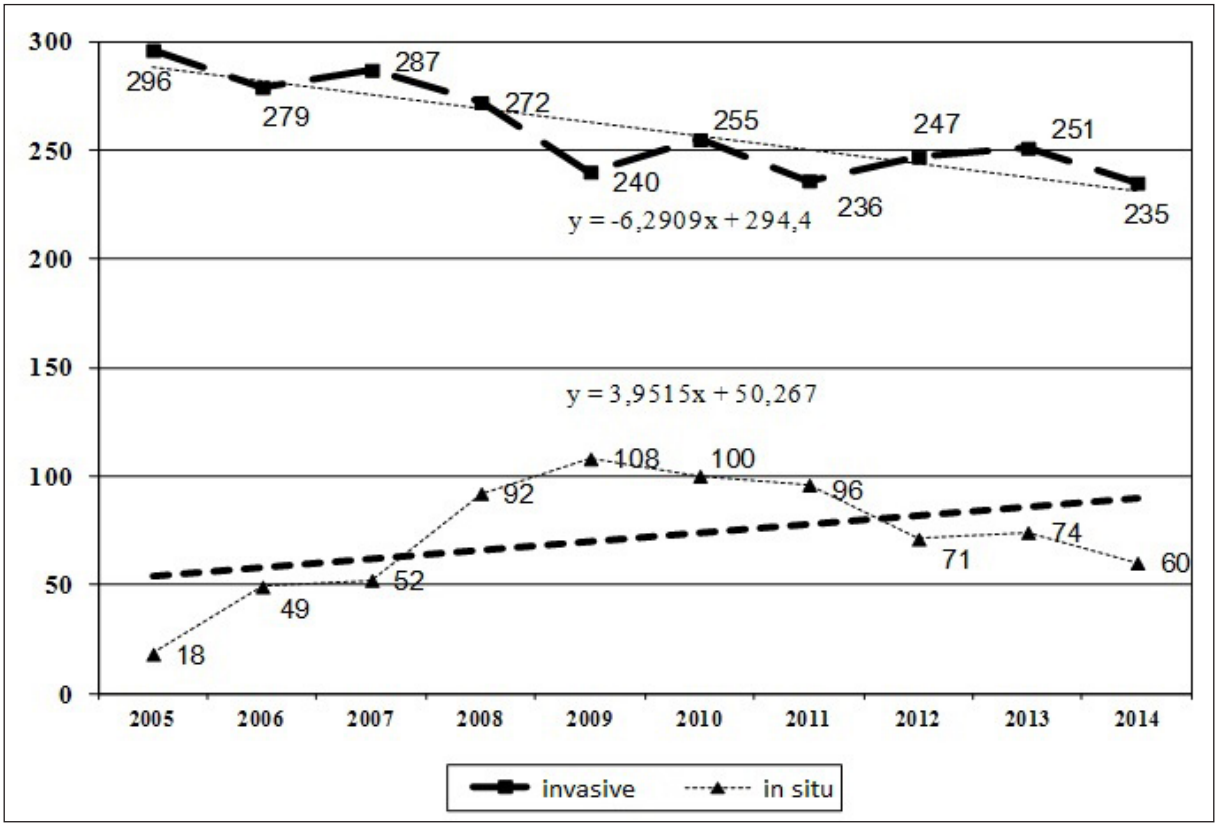

Fig. 3. Incidence of invasive and preinvasive cervical cancer in Lower Silesia Province in 2005-2014 [4]

ferred from the so-called screening to post-screening age group. Unfortunately, in this age group of patients we observe a systematic increase of invasive cervical cancer (Table 2) - from 83 in 2005 to 121 in 2014.

After introducing the Population-Based Cervical Cancer Prevention and Early Detection Program (in 2006-2014), in patients at post-screening age invasive cervical cancer (C53) was diagnosed significantly more frequently ($P<0.0001$) than in a screened group (Table 2). The comparison of the change trends discussed above (Fig. 4) clearly shows the effectiveness of screening as regards early detection of cervical cancer.

The first European countries that introduced cervical cancer screening tests as early as in the 1960s were Finland, Iceland, Denmark, Sweden, Luxembourg and Czech Republic. In the 1970s and 1980s they were followed by Germany, the Netherlands, United Kingdom and Italy [2,7]. In Poland it was only in 2006 that the Population-Based Cervical Cancer Prevention and Early Detection Program was introduced. It covers the entire country and all women aged 25-59 are invited for tests. To be effective, screening must be a mass test and must be implemented over a long time. Unfortunately, in Poland these conditions have not been fulfilled, and very few women respond to invitations [7]. In 2007-2014 the response rate in Poland was on average 23.4% (Fig. 2). In the Lower Silesia Province the response rate in cervical cancer screening program was similar to the percentage noted for the country. The average response rate in the Lower Silesia Province was 24.0% (Fig. 5).

Since 2009 we have observed a downward trend as regards screening coverage, both in Lower Silesia and across Poland. The above change is, among others, due to the cytology tests performed within the outpatient specialist care being valuated higher by the National Health Fund (NFZ) than tests carried out under the prevention program. The data reported by both service providers indicate that in Poland in 2012 the total response rate achieved was at the level of at least 37.46%, and of 46.00% in 2013. In the Lower Silesia Province a total of 33.4% women were examined in 2012, and in 2013 40.1% of the female population aged 25-59 underwent the test. [11]

Despite the screening tests, in the Lower Silesia Province invasive cervical cancer (C53) accounted for as much as 77.5% of all diagnosed cases. Noted in this group (Fig. 6) were local advancement stage (70% of cases), regional advancement stage (20% of cases), and metastatic disease accounted for approximately 10% of cases (a downward trend). The reports contained less favorable advancement stages only in the case of incidence of disease in 2012: local stage accounted for 50%, regional for 30%, and metastatic disease for 20% of cases.

Table 2. Incidence of invasive cervical cancer (C53) and in situ cervical cancer (D06) in Lower Silesia Province in 2005-2014 per age group

Age	Below 25 years of age		25-59 years of age			Over 59 years of age		
Year	C53	D06	C53	D06	% D06	C53	D06	% D06
2005	2	0	206	17	8%	83	3	3%
2006	0	1	171	44	20%	96	3	3%
2007	1	0	193	51	21%	87	4	4%
2008	1	2	168	94	36%	98	4	4%
2009	1	3	142	105	43%	92	3	3%
2010	0	1	157	94	36%	98	5	5%
2011	1	2	135	82	38%	100	12	11%
2012	0	2	141	61	30%	104	8	8%
2013	0	0	128	68	35%	123	6	5%
2014	0	0	114	52	31%	121	8	6%

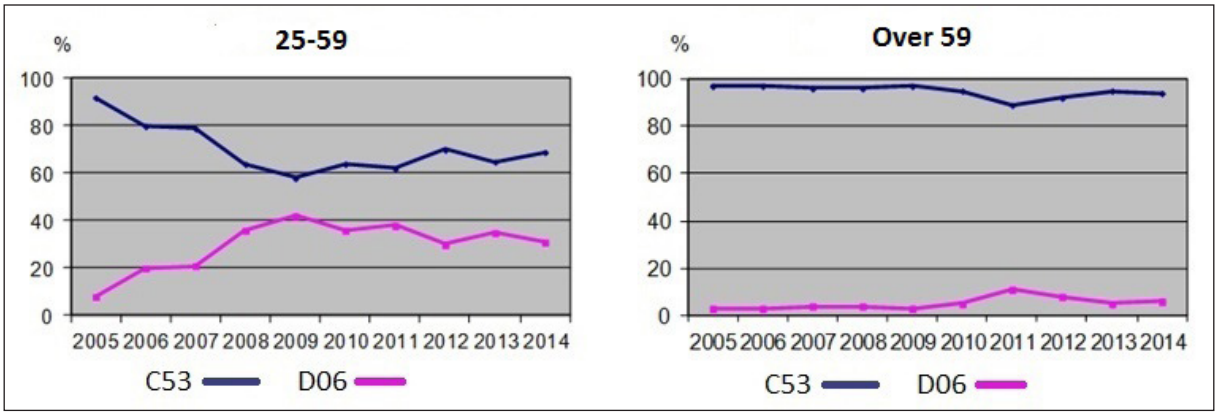

Fig. 4. Incidence of invasive and preinvasive cervical cancer in the 25-59 and over-59 age groups in Lower Silesia Province in 2005-2014

Discussion

Since the introduction of the Population-Based Cervical Cancer Prevention and Early Detection Program in the Lower Silesia Province, we have observed a steady decrease in the number of new cases of invasive cervical cancer in a group of screened women. In the population studied, we have noted an upward trend in incidence of preinvasive cancers (D06). Since 2010 we have also observed a declining incidence of invasive cervical cancer (C53), which does not differ significantly from that of the Polish population. Even though screening does not cover 70% of the population, the results confirm high effectiveness of the diagnostic method (cytology test) and the program's concept itself. Unfortunately, full population effects of the program will only be available for assessment in a few years. Precancerous lesions observed during cytology tests and then treated will not evolve to cancerous lesions. Unfortunately, so far the optimal 70% adherence rate has not been achieved – the percentage of women who respond to invitations in Lower Silesia Province is 20% and does not differ significantly when compared to the rate for the rest of Poland. The low coverage is partly due to the lack of consistency on the part of the payer financing the screening tests and cytology performed in gynecologic clinics; the valuation of this procedure as part of the screening program is over five times lower than cytology tests refunded as part of specialized gynecological care. This dichotomy of payment gave rise to the undesired phenomenon of patients responding to the screening program being reinvoiced to the specialized outpatient care in order to acquire better paid procedures. It is estimated that thanks to these two procedures approximately 40% of the female population residing in the Lower Silesia has been examined. The sector of private practices and networks of private

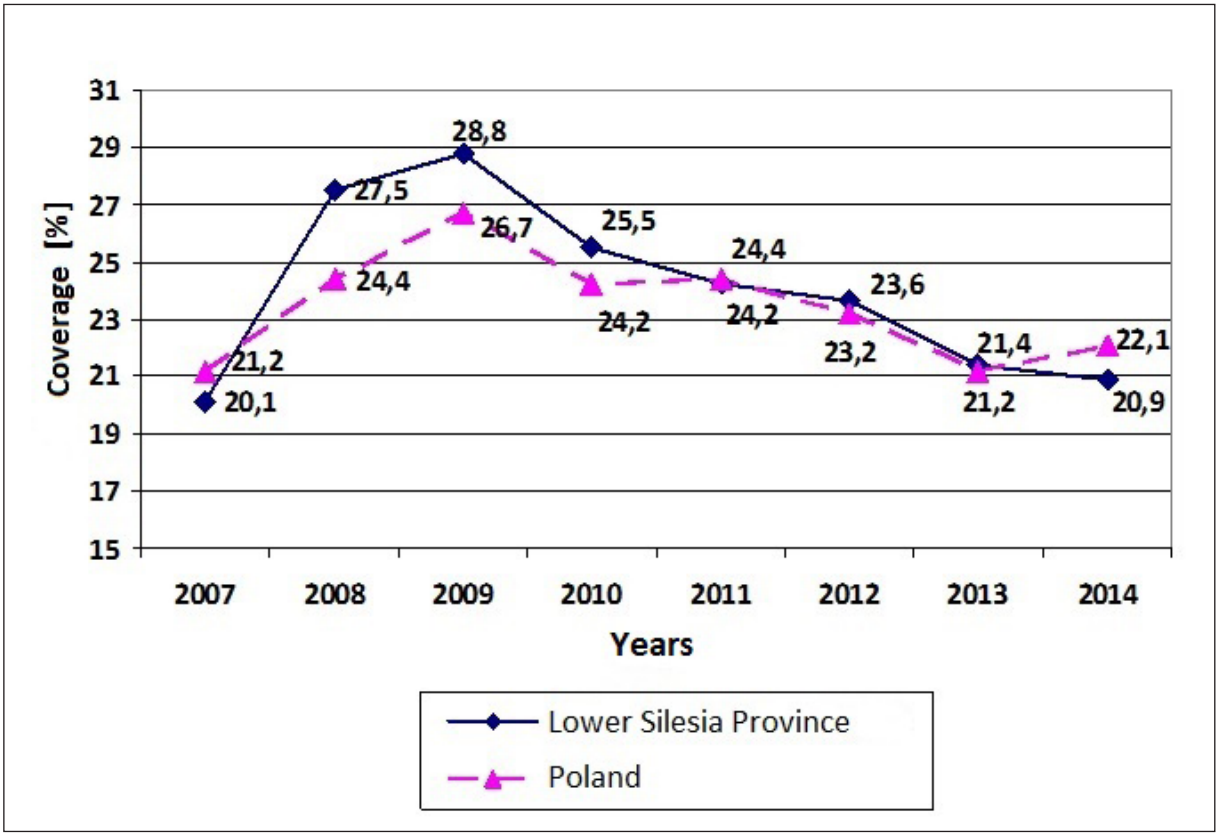

Fig. 5. Cervical cancer screening program coverage in Poland and Lower Silesia in 2007-2014 [7,11]

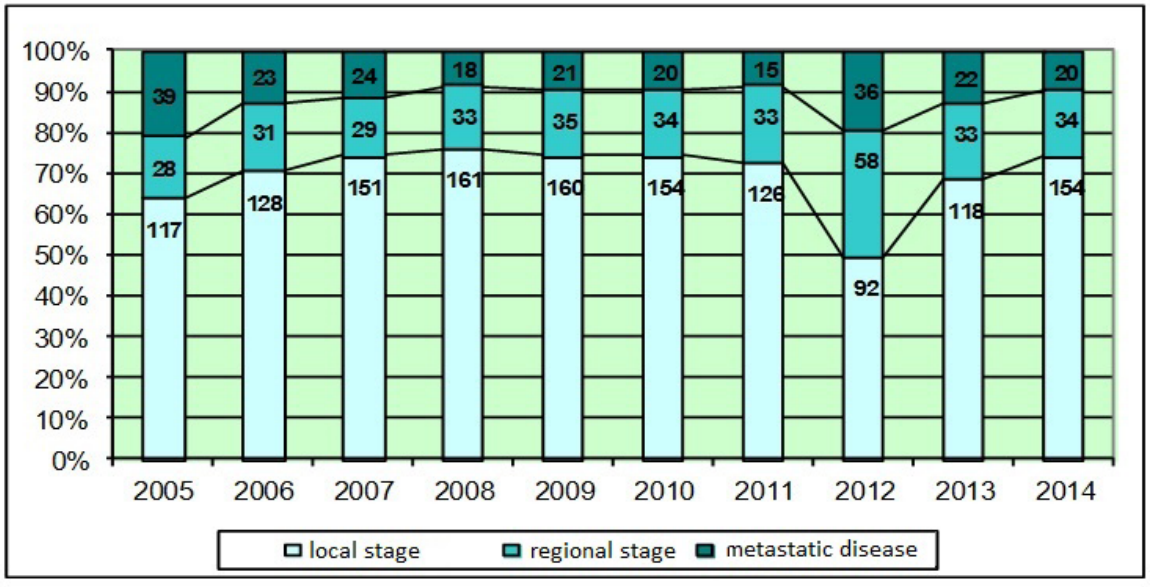

Fig. 6. Clinical stage of invasive cervical cancers in patients from Lower Silesia in 2005-2014

clinics where cytology tests are performed is an additional area that hinders estimation. Private cytology tests are particularly common in highly industrialized areas as a result of higher material status of the women living there and the fact that they are more frequently covered by private medical insurance that offers such tests. The underestimation of the number of women covered by cytology tests has been reported several times, yet neither the Ministry of Health nor the National Health Fund have undertaken effective actions aimed at audi-

ting the quality of cytology tests performed outside the population-based program or introducing the obligation to report on the findings. The above-mentioned limitations hinder accurate assessment of the effects of the population-based screening program, and at the same time point to the mechanisms reducing adherence in the population-based program for the opportunistic screening. Undoubtedly, an important effect of all-Poland screening program is, aside from educational aspects, improved quality of tests and standardization of this method across Poland, which results in significant improvement of cytology test's effectiveness.

Conclusions

In the Lower Silesia Province a downward trend in incidence (6 fewer cases per year) of invasive cervical cancer and an upward trend (4 more cases per year) of preinvasive cervical cancer are observed. Additionally, in women covered by the screening program in 2006-2014 in situ cancers accounted for 20-43% of all cervical cancers, while in women over 60 years of age they accounted for only 3-11%. Analysis of change trends in incidence of invasive and preinvasive cervical cancer indicates beneficial effects of screening for early signs of cervical cancer, despite low coverage.

Acknowledgments

As authors and friends we wish to dedicate this paper to Mrs Jolanta Kotowska – long-time Head of the Provincial Center for Coordinating Preventive Programs at the Lower Silesian Oncology Center in Wrocław who passed before her time in 2015. Jola – thank you for you deep commitment in promoting participation in screening programs and your effective activities.

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The authors have no potential conflicts of interest to declare.