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ABSTRACT

Background: The aim of this study is to describe inequalities in the use of breast and cervical cancer screening services according to education level in European countries in 2002, and to determine the influence of the type of screening program on the extent of inequality.

Methods: A cross-sectional study was performed using individual-level data from the WHO World Health Survey (2002) and data regarding the implementation of cancer screening programmes. The study population consisted of women from 22 European countries, aged 25 to 69 for cervical cancer screening (n=11 770) and 50 to 69 for breast cancer screening (n=4784). Dependent variables were having had a PAP smear and having had a mammography during the previous three years. The main independent variables were socio-economic position (SEP) and the type of screening program in the country. For each country the prevalence of screening was calculated, overall and for each level of education, and indices of relative (RII) and absolute (SII) inequality were computed by educational level. Multilevel logistic regression models were fitted.

Results: SEP inequalities in screening were found in countries with opportunistic screening (comparing highest to lowest educational level: RII=1.28, 95%CI:1.12-1.48 for cervical cancer; and RII=3.11, 95%CI:1.78-5.42 for breast cancer) but not in countries with nationwide population-based programs. Inequalities were also observed in countries with regional screening programs (RII=1.35, 95%CI:1.10-1.65 for cervical cancer; and RII=1.58, 95%CI:1.26-1.98 for breast cancer).

Conclusions: Inequalities in the use of cancer screening according to SEP are higher in countries without population-based cancer screening programs. These results highlight the potential benefits of population-based screening programs.

Key words: Socioeconomic factors, mass screening, breast neoplasm, uterine cervical neoplasm

INTRODUCTION

Breast and cervical cancer are the first and second most commonly diagnosed cancers among women worldwide[1], with cervical cancer being a relatively smaller problem in European countries[2].

Breast cancer risk factors are not modifiable, or are difficult to control at the population level so early detection, along with appropriate treatment, is an important strategy for improving the disease prognosis. Mammography is the only screening test that has been shown to improve breast cancer survival[3]. Human papilloma virus (HPV) infections have been causally linked to cervical cancer and the introduction of HPV vaccines may have an impact on cervical cancer control programs[4]. To date, the most common strategy employed to reduce cervical cancer incidence and mortality has been cytological screening using the Papanicolaou (Pap) smear test[3]. The Council of the European Union recommends mammography screening for breast cancer in women aged 50-69 and the start of pap smear screening between the ages of 20 and 30 years[5]. The Advisory Committee on Cancer Prevention recommended a screening frequency of 3-5 years for cervical cancer screening and 2-3 years for mammography screening[6].

Screening strategies differ between countries. Some countries have population-based programs, where in each round of screening the subjects in the target population are individually identified and invited to attend screening[7]. This type of program can be implemented nationwide or only in specific regions of the country. In opportunistic screening, invitations depend on the individual's decision or on encounters with health care providers[8]. Population-based programs have a greater potential ability to reduce cancer incidence and mortality due to their broader population coverage, follow-up and quality control[8]. However, a number of issues regarding the nature of the screening test and the disease should be taken into account when planning to initiate a population-based cancer screening programme[9].

Socio-economic position (SEP) refers to social and economic factors, such as education level, income or wealth, which influence the position an individual or group holds within society[10]. Inequalities in the use of breast and cervical cancer screening services due to SEP have been detected in some settings[11;12], with more deprived women less likely to be screened. A study comparing inequalities by educational level in the use of preventive services in Europe found that inequality is not a generalized phenomenon but that the level of inequality may vary between countries[13], and noted that the organization of health care services may play an important role.

Some studies highlight the fact that in opportunistic screening individual factors carry more weight, and differences in age, civil status and SEP may lead to inequalities in use[14]. A recent review on the effectiveness of interventions that promote screening attendance in reducing socio-economic inequalities reported that, while population-based screening may increase attendance rates, it is not so effective in reducing inequalities in attendance[15]. However, to our knowledge, there is no study that has used data from several countries to systematically analyse the association between the implementation of an organized program and the magnitude of inequality.

The aim of this study was to describe inequalities in the use of breast and cervical cancer screening services according to education level in European countries in 2002, and to determine the influence of the type of screening program on the magnitude of these inequalities.

METHODS

Design, study population and information sources

A cross-sectional study was performed using individual-level data regarding breast and cervical cancer screening practices and data regarding the type of screening program in the country. The study population consisted of women from 22 European countries, aged 25 to 69 for cervical cancer screening (n=11,770) and 50 to 69 for breast cancer screening (n=4,784). Individual-level data were extracted from the WHO World Health Survey[16], a survey that was implemented worldwide (in countries willing to participate) in the year 2002/03. A choice of survey modes with distinct sampling strategies were available to participating countries. The sampling frame included non-institutionalised male and female adults over 18 years of age and living in private households; all samples were selected from nationally representative sampling frames with known probabilities.

For the purposes of our study only European countries were considered. Two countries in which the survey was conducted did not collect data on screening practices (Norway and Turkey), two countries were removed because they had more than 15% of missing values in either of the two main outcomes (Slovakia and Ukraine) and four more were not considered because of lack of data regarding the type of screening program (Bosnia & Herzegovina, Georgia, Kazakhstan and Russian Federation). Finally, 22 countries were included in the study (Table 2). Among these countries, 5 conducted postal surveys, 10 face-to-face interviews, 4 used both modes, 1 used computer-assisted telephone interviews. Information regarding survey mode was not available for 2 countries. The survey response rates varied from 31% to 72% for the postal surveys, 39% to 80% for the face-to-face interviews, and 55% for the computer-assisted telephone interviews[16].

Data regarding the type of screening program in current use in the country was obtained from a review of the literature[3;17-21]. Health Ministries and screening specialists from the eight countries for which the information was not clear were contacted. Personal communications were obtained from Croatia, Estonia, Latvia and Slovenia.

Variables

Dependent variables

1) Mammography use in the previous three years was assessed using the question, "When was the last time you had a mammography, if ever? (That is, an x-ray of your breasts taken to detect breast cancer at an early stage). Within the last 3 years; 4-5 years ago; More than 5 years ago; Never had an exam; Don't know". A dichotomous variable was created, where individuals were coded 1 if their answer was "within the last three years" and 0 otherwise.

2) PAP smear screening in the previous three years was assessed using two questions: "When was the last time you had a pelvic examination, if ever? (By pelvic examination, we mean when a doctor or nurse examined your vagina and uterus). Within the last 3 years; 4-5 years ago; More than 5 years ago; Never had an exam; Don't know". Women who had an examination within the last 3 years, were also asked, "The last time you had a pelvic examination, did you have a PAP smear test? (By PAP smear test, we mean did a doctor or nurse use a swab or stick

to wipe from inside your vagina, take a sample and send it to a laboratory?). Yes; No; Don't know". A dichotomous variable was created, where individuals were coded 1 if their responses were "in the last three years" and "yes", respectively, and 0 otherwise. A cut-off point of three years was chosen as this was the screening interval in most programs[19].

Independent variables

The main independent variable was SEP, assessed as the maximum education level achieved using the question, "What is the highest level of education that you have completed? 1. No formal schooling; 2. Less than primary school; 3. Primary school completed; 4. Secondary school completed; 5. High school (or equivalent) completed; 6. College/Pre-university/University completed; 7. Post-graduate degree completed". Education levels were categorized as primary education or lower (1-3), secondary education (4), high school (5) and university studies (6-7).

Other covariates related to the adoption of preventive practices[11;12;22] were used to control for their possible confounding effects on SEP: age, marital status, rural or urban setting, working situation and perceived health status.

The contextual variable used in this study was the country's situation regarding population-based screening programs in 2000, which allowed a two year time span for all women in the target population to be invited. The program was considered to be national if in the year 2000 an organised screening program inviting all the women in the target group in an active way was fully implemented throughout the country. The program was considered to be regional if a population-based program was being piloted or present only in some regions of the country. The percentage of regions covered by regional cervical cancer screening programs varied from 4% in Austria to 60% in Belgium. In breast cancer screening these percentages varied from 2% to 50%. Countries with opportunistic screening or no formal program were considered together in the last category.

Data analysis

For each country the prevalence of breast and cervical cancer screening in the previous three years was calculated, overall and for each educational level. Age-adjusted robust Poisson regression models[23] were fitted to examine the association between screening and education level in each country. In these models, education level was introduced as a continuous variable, with four values from 0 to 1, which reflect the educational-level distribution in each country. As a result we obtained the Relative Index of Inequality (RII) and the Slope Index of Inequality[10] (SII), which can be interpreted as the prevalence ratio and the absolute difference in the prevalence at the two extremes of the educational spectrum (highest compared to lowest)[24], respectively.

To determine whether the magnitude of inequality was related to the type of screening program in the country, a multilevel logistic regression analysis was carried out. For each of the two dependent variables the same process was followed. First a model with all the individual variables was fitted, assuming that both the prevalence (intercept) and the inequalities due to SEP (coefficient of educational level) had a random component. Second, we fitted a model to determine whether the type of screening program was associated with screening prevalence and with the magnitude of SEP inequalities in screening, taking individual variables into account. The percentage change in the variance (PCV), that is, the percentage of variance explained by the type of program, was also calculated. The odds ratios provided were transformed into prevalence ratios and their confidence intervals were calculated using a derived formula of the variance of the log PR[25].

The results of the multilevel analyses were plotted to aid interpretation (figure 1). The prevalence ratios of screening between countries with regional or national screening programmes compared to those with opportunistic screening programs (reference group) and 95% confidence intervals were represented (figures 1a and 1c). To assess the effect of the type of program on the extent of inequality we derived the RII and 95% confidence interval for each type of program (figures 1b and 1d).

RESULTS

Table 1 shows the descriptive statistics of the individual variables under study in each of the two study populations. Subjects were generally educated to secondary level or less, married or cohabiting, and living in an urban setting and in paid employment.

(Table 1 here)

Prevalence of cancer screening and SEP inequalities by country

Tables 2 and 3 show the prevalence of screening overall and by educational level in each of the countries studied. Relative and absolute indices of inequality are reported after adjustment for age group.

In the five countries with a nationwide population-based cervical screening program, the prevalence of individuals who had undergone pap smear screening varied from 48% in the Netherlands to 65.6% in Finland. Inequalities were only found in Finland, with a RII of 1.54 (95%CI: 1.15-2.07), comparing the groups with the highest and lowest education level. Countries with regional population-based cervical screening services had screening prevalences from 37.8% in Ireland to 83.6% in Austria. Four of the seven countries had SEP inequalities, with the highest in Greece (RII=2.29, 95%CI:1.36-3.84; SII=36.8%, 95%CI:15.7-58). Among the nine countries with no organized cervical screening program, screening prevalence ranged from 54.2% to 82%, and inequalities were observed in four of these countries, with the highest relative inequalities in Estonia (RII=1.86, 95%CI:1.31-2.63) and absolute inequalities in Croatia (SII=44%, 95%CI:20.6-67.4).

In countries with a nationwide population-based breast screening program, the prevalence of screening varied from 69.8% in the United Kingdom to 87.9% in Finland. None of the countries with national programs showed inequalities in breast cancer screening. Screening prevalences in countries with regional programs ranged from 22% in Denmark to 79.4% in France. Inequalities were found in 4 of 12 countries, with the greatest inequalities being observed in Greece (RII=2.96, 95%CI:1.44-6.11; SII=46.4, 95%CI:16.9-75.4). Among the four countries with no organized breast cancer screening program, screening prevalences ranged from 38.1% (Latvia) to 50.5% (Czech Republic). Two of these four countries, Croatia and the Czech Republic, had screening inequalities with RII of 5.38 (95%CI:2.57-11.25) and 4.91 (95%CI:2.1-11.44) and SII of 47.9% (95%CI:18.4-77.3) and 82.8% (95%CI:36.3-129.3) respectively.

(Table 2 here)

(Table 3 here)

Influence of the type of screening program on the prevalence of cancer screening and on SEP inequalities

As shown in Figure 1, no differences in the prevalence of cervical cancer screening were found between countries with different types of screening program. Moreover, the between-country variability in screening prevalence could not be explained by differences in the type of screening program. Screening inequalities were observed in countries with regional (RII=1.35, 95%CI:1.10-1.65) and opportunistic (RII=1.28, 95%CI:1.12-1.48) screening programs, but not in those with a nationwide program (RII=1.13, 95%CI:0.92-1.40). The type of screening program in the country explained 13.6% of the variability in screening inequalities.

In breast cancer screening, the type of screening program affected both the prevalence of screening and the presence of inequality. Women in countries with regional programs had a 2.23 (95%CI:1.25-4.00) fold higher probability of having had a mammography during the previous three years than women in countries with opportunistic screening. The probability of having had a mammography in a country with a nationwide screening program was 3.85 (95%CI:2.19-6.74) times higher than that in countries with opportunistic screening programs. Socio-economic inequalities among women who had undergone mammographies were observed in countries with regional (RII=1.58, 95%CI:1.26-1.98) and opportunistic (RII=3.11, IC95%:1.78-5.42) screening programs, but not in those with national screening programs. The type of program explained 74.4% of the between-country variability in prevalence of breast cancer screening and 24.3% of inequality in SEP.

(Figure 1 here)

DISCUSSION

The main finding of this study is that SEP inequalities in the use of breast and cervical cancer screening services exist in some countries of Europe. When the type of screening program is taken into account, inequalities are found only in countries without a population-based cancer screening program. Women were more likely to have undergone screening in countries with nationwide breast cancer screening programs than in those with opportunistic screening. This pattern was not observed for cervical cancer screening.

Strengths and weaknesses of this study

This study has important strengths. It includes many countries from different parts of Europe, is representative of the state of cancer screening in Europe, and there is enough variability to apply the multilevel approach. It provides information on screening for two different cancers from representative samples of European countries.

This study, however, also has some limitations. For example, response rates are particularly low in some countries. Some studies suggest that non-respondents tend more often to have lower socio-economic status and less favourable health behaviours[26]. Thus, the prevalence of screening may be overestimated in countries with low response-rates, and inequalities would be under-estimated. However, since these countries have different types of screening programs, we would argue that this would not strongly effect the global results.

Information on the type of screening program was very difficult to obtain, and four countries could not be considered because of a lack of reliable sources. Moreover, regional and pilot programs were collapsed into a single category although the percentage of the population covered by these programs varies between countries. In Ireland, Finland and the Netherlands cervical screening programs offer testing every 5 years[19], although the screening variables have a 3-year frequency due to the phrasing of the question regarding PAP smear testing frequency. This may hide the potential effect an organised program can have on participation rates and on the extent of inequality. We could not consider having had a PAP smear in the last five years but we could compare our results with the ones of having had a pelvic examination in the last three years and having had a pelvic examination in the last 5 years. Inequalities diminished in magnitude and prevalences increased when we considered a wider interval. However these changes occurred in all categories, so the global results remained the same when modifying the practice queried and when changing the interval (results not shown).

Prevalence of cancer screening and type of screening program

We have observed that countries with population-based breast cancer screening programs achieve higher rates of attendance than those with opportunistic screening. This is in agreement with two Cochrane reviews[27;28], which found that interventions encouraging the uptake of breast and cervical cancer screening appeared to be effective in increasing screening attendance.

However, our study does not support a similar assertion for cervical cancer screening. This is partly because Eastern European countries have high cervical cancer screening rates even though they do not have organised screening programs. Cervical smear tests were previously included in yearly medical examinations in many institutions and factories during the Soviet era[29] and the health care system emphasized the responsibility of the medical profession for the timely detection and treatment of diseases[30]. For this reason, both women and physicians may be more conscious of the problem and may request screening more frequently. Compared to mammography, cervical cancer screening is also cheaper and easier to carry out by health professionals during visits. In fact several variables related to access to health services and to gynaecology visits have been found to be strong predictors of screening attendance[11]. In Luxembourg, for example, which only has opportunistic screening for cervical cancer, the prevalence of PAP smear testing is around 80%. In fact, this country does not have a program that invites women for screening, but one that is based on the cooperation of physicians and on contributions to physicians who carry out the smears tests[20]. For these reasons, we believe that cervical cancer screening behaviour may be more sensitive to other aspects of health care, such as access or visits to the gynaecologist.

In the Netherlands, a country with a nationwide population-based program, only half of women had had a pap smear test during the previous three years. This could be due to the fact that within the program, the screening interval following a negative result is 5 years.

SEP inequalities in cancer screening and type of screening program

Overall we have not found substantial socio-economic inequalities in countries with nation-wide population based screening programs, but have observed inequality in countries with regional or opportunistic screening. SEP inequalities in cervical cancer screening were observed in Finland. However, as mentioned above, Finland's screening interval is 5 years, so more socio-economically privileged women may undergo opportunistic screening more frequently and this could be reflected in the presence of inequalities.

In the approach based on personal invitations, equality of access ensures that screening is available to everyone and that no subgroup is excluded due to individual characteristics[8]. In contrast, opportunistic screening depends on an individual requesting screening or on health advisors recommending it, and women with higher SEP may have more information about preventive practices and more contact with the physician. In Europe, two studies on the impact of implementation of an organised program on the magnitude of inequality have been performed. In one, the level of inequality did not change after implementation of the program[31]. In the other[14], with organised screening the gradient in education level was less steep, although inequality persisted as socio-economically advantaged women also took benefit from the program. These studies were carried out very shortly after the implementation of the screening programs and a longer time may be necessary to observe the effects on the magnitude of inequality.

CONCLUSIONS

This study has found socio-economic inequalities in breast and cervical cancer screening practices in some European countries. It also highlights the fact that these inequalities are higher in countries without population-based cancer screening programs. These results highlight the potential benefits of population-based screening programs, although their implementation should be preceded by careful consideration of the principles of early disease detection[9].

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KEY FINDINGS:

- This study has found socio-economic inequalities in breast and cervical cancer screening practices in some European countries.

- Inequalities are more pronounced in countries that do not have population-based cancer screening programs.
- These results highlight the potential benefits of population-based screening programs, although their implementation should be preceded by careful consideration of the principles of early disease detection.

REFERENCES

(1) Garcia M, Jemal A, Ward EM, Center MM, Hao Y, Siegel RL et al. Global Cancer Facts and Figures 2007. Atlanta, GA: American Cancer Society. 2007. Available: http://www.cancer.org. Accessed 25 Nov 2008.

(2) Ferlay J, Autier P, Boniol M, Heanue M, Colombet M, Boyle P. Estimates of the cancer incidence and mortality in Europe in 2006. Ann Oncol 2007; 18(3):581-592.

(3) Hakama M, Coleman MP, Alexe DM, Auvinen A. Cancer screening: evidence and practice in Europe 2008. Eur J Cancer 2008; 44(10):1404-1413.

(4) Cervical cancer, human papillomavirus (HPV), and HPV vaccines – Key points for policy-makers and health professionals. World Health Organization, 2007. Available: http://www.who.int. Accessed 2 Dec 2009.

(5) Council Recommendation on cancer screening. Comission of the european communities, 2003. Available: http://ec.europa.eu. Accessed 20 Jan 2009.

(6) Recommendations on cancer screening in the European union. Advisory Committee on Cancer Prevention. Eur J Cancer 2000; 36(12):1473-1478.

(7) von Karsa L, Anttila A, Ronco G, Ponti A, Malila N, Arbyn M et al. Cancer screening in the European Union. Report on the implementation of the Council Recommendation on cancer screening - First Report. European Comission, 2008. Available: http://ec.europa.eu. Accessed 16 Dec 2008.

(8) Miles A, Cockburn J, Smith RA, Wardle J. A perspective from countries using organized screening programs. Cancer 2004; 101(5 Suppl):1201-1213.

(9) Wilson JMG, Jungner G. Principles and practice of screening for disease. Public Health Papers No. 34. World Health Organization. Geneva: 1968.

(10) Shaw M, Galobardes B, Lawlor DA, Lynch J, Wheeler B, Davey Smith G. The Handbook of Inequality and Socioeconomic Position: Concepts and Measures. Bristol,UK: The Policy Press, 2007.

(11) Duport N, Ancelle-Park R, Boussac-Zarebska M, Uhry Z, Bloch J. Are breast cancer screening practices associated with sociodemographic status and healthcare access? Analysis of a French cross-sectional study. Eur J Cancer Prev 2008; 17(3):218-224.

(12) Zackrisson S, Andersson I, Manjer J, Janzon L. Non-attendance in breast cancer screening is associated with unfavourable socio-economic circumstances and advanced carcinoma. Int J Cancer 2004; 108(5):754-760.

(13) Stirbu I, Kunst AE, Mielck A. Educational inequalities in utilization of preventive services among elderly in Europe. Submitted 2009.

(14) Ronco G, Segnan N, Giordano L, Pilutti S, Senore C, Ponti A et al. Interaction of spontaneous and organised screening for cervical cancer in Turin, Italy. Eur J Cancer 1997; 33(8):1262-1267.

(15) Spadea T, Bellini S, Kunst A, Stirbu A, Costa G. The impact on interventions to improve attendance in female cancer screening on social inequalities in attendance rates: a review. Submitted 2009.

(16) WHO World Health Survey. Available: http://www.who.int/healthinfo/survey/en. Acccessed 7 Jan 2009.

(17) Summary of cervical cancer screening practice across Europe. European Cervical Cancer Association (ECCA). Available: http://www.ecca.info. Accessed 11 Jun 2009.

(18) IARC Handbooks of Cancer Prevention. Volume 7. Breast Cancer Screening. Lyon: IARCPress, 2002.

(19) IARC Handbooks of Cancer Prevention. Volume 10. Cervix Cancer Screening. Lyon: IARCPress, 2005.

(20) Scheiden R, Knolle U, Wagener C, Wehenkel AM, Capesius C. Cervical cancer screening in Luxembourg. Eur J Cancer 2000; 36(17):2240-2243.

(21) Summary report on HPV and cervical cancer statistics in Israel. WHO/ICO Information Centre on HPV and Cervical Cancer. Available: http://www.who.int/hpvcentre/en. Accessed: 11 Jun 2009.

(22) Arrossi S, Ramos S, Paolino M, Sankaranarayanan R. Social inequality in Pap smear coverage: identifying under-users of cervical cancer screening in Argentina. Reprod Health Matters 2008; 16(32):50-58.

(23) Zou G. A modified poisson regression approach to prospective studies with binary data. Am J Epidemiol 2004; 159(7):702-706.

(24) Mackenbach JP, Kunst AE. Measuring the magnitude of socio-economic inequalities in health: an overview of available measures illustrated with two examples from Europe. Soc Sci Med 1997; 44(6):757-771.

(25) Thompson ML, Myers JE, Kriebel D. Prevalence odds ratio or prevalence ratio in the analysis of cross sectional data: what is to be done? Occup Environ Med 1998; 55(4):272-277.

(26) Tolonen H, Helakorpi S, Talala K, Helasoja V, Martelin T, Prättälä R. 25-year trends and socio-demographic differences in response rates: Finnish adult health behaviour survey. Eur J Epidemiol. 2006;21(6):409-15.

(27) Bonfill X, Marzo M, Pladevall M, Marti J, Emparanza JI. Strategies for increasing women participation in community breast cancer screening. Cochrane Database Syst Rev 2001;(1):CD002943.

(28) Forbes C, Jepson R, Martin-Hirsch P. Interventions targeted at women to encourage the uptake of cervical screening. Cochrane Database Syst Rev 2002;(3):CD002834.

(29) Jargin SV. Perspectives of cervical cytology in Russia. Am J Obstet Gynecol 2008; 199(2):e10.

(30) Remennick L. "I have no time for potential troubles": Russian immigrant women and breast cancer screening in Israel. J Immigr Health 2003; 5(4):153-163.

(31) Puddu M, Demarest S, Tafforeau J. Does a national screening programme reduce socioeconomic inequalities in mammography use? Int J Public Health 2009; 54(2):61-68.

Table 1. Distribution of study variables among women 25-69 years and women 50-69 years.

	Age group			
	25-69		50-69	
	N	%	N	%
Cervical cancer screening				
Yes	7,097	60.3		
No	4,094	34.8		
Missing	579	4.9		
Breast cancer screening				
Yes			2,938	61.4
No			1,635	34.2
Missing			211	4.4
Educational level				
Primary level or lower	2,249	19.1	1,518	31.7
Secondary	3,837	32.6	1,558	32.6
High School	3,334	28.3	1,045	21.8
College/University/Post graduate	2,345	19.9	661	13.8
Missing	5	0.1	2	0.1
Age group				
25-39	4,087	34.7		
40-49	2,899	24.6		
50-59	2,598	22.1	2,598	54.3
60-69	2,187	18.6	2,187	45.7
Missing				
Marital status				
Married or cohabiting	7,980	67.8	3,141	65.7
Not cohabiting	3,679	31.3	1,599	33.4
Missing	111	0.9	45	0.9
Settings				
Urban	8,151	69.2	3,244	67.8
Rural	2,847	24.2	1,159	24.2
Missing	772	6.6	382	8.0
Working situation				
Working	5,850	49.7	1,434	30.0
Homemaker	2,884	24.5	1,263	26.4
Unemployed	521	4.5	109	2.3
Retired	1,615	13.7	1,585	33.1
Others	744	6.3	313	6.5
Missing	155	1.3	81	1.7
Perceived health				
Good	7,449	63.3	2,331	48.7
Less than good	4,196	35.6	2,414	50.5
Missing	125	1.1	40	0.8
Total	11,770	100	4,785	100

Table 2. Number of cases and prevalence (%) (total and by educational level) of cervical cancer screening in the previous three years. Relative (RII) and absolute (SII) associations between educational level (highest compared to lowest) and cervical cancer screening in women of 25-69 years by country of residence and type of screening program.

Type of program and country	Total		By educational level											
			≤ Primary		Secondary		High school		University					
	N	%	N	%	N	%	N	%	N	%	RII	95% CI	SII	95% CI
National														
Denmark	405	64.9	2	50.0	163	55.2	81	72.8	159	71.1	1.16	(0.89-1.50)	10.2	(-7.9-28.3)
Finland	405	65.6	20	44.5	89	49.2	198	70.6	97	74.7	1.54	(1.15-2.07)	31.2	(11.4-51.0)
Netherlands	502	48.0	48	35.4	31	41.9	312	50.6	111	47.7	1.18	(0.83-1.67)	6.7	(-7.5-20.8)
Sweden	407	65.3	10	24.8	69	62.4	148	74.3	180	61.3	0.76	(0.49-1.17)	-16.2	(-40.4-8.1)
United Kingdom	521	58.3	10	50.0	268	57.5	74	56.8	169	60.9	1.08	(0.82-1.42)	4.8	(-11.8-21.4)
Pilot/Regional														
Austria	493	83.6	26	53.8	345	83.2	98	89.8	24	95.8	1.33	(1.13-1.57)	24.1	(10.5-37.7)
Belgium	404	71.0	70	61.4	88	55.7	139	82.0	107	75.7	1.31	(1.04-1.67)	20.9	(3.1-38.6)
France	401	73.0	73	53.8	83	76.0	119	79.2	126	76.2	1.08	(0.80-1.44)	5.8	(-17.1-28.6)
Greece	367	41.1	159	29.6	32	37.5	119	47.9	57	61.4	2.29	(1.36-3.84)	36.8	(15.7-58)
Ireland	345	37.8	76	21.1	210	41.7	12	28.3	45	48.1	1.80	(1.02-3.17)	27.9	(1.8-54)
Italy	400	64.8	79	55.7	102	63.7	152	70.4	67	64.2	1.22	(0.92-1.63)	11.3	(-4.4-26.9)
Portugal	426	57.4	295	52.3	49	70.0	41	73.6	41	62.2	1.36	(0.90-2.03)	18.9	(-5.3-43.2)
Opportunistic														
Croatia	453	64.3	159	47.0	209	71.9	38	70.1	46	84.3	1.78	(1.29-2.43)	44.0	(20.6-67.4)
Czech Republic	367	71.0	59	57.5	136	73.9	138	71.8	34	79.9	1.13	(0.80-1.61)	9.8	(-16.9-36.4)
Estonia	420	54.2	52	23.9	10	51.7	253	56.4	106	64.1	1.86	(1.31-2.63)	38.0	(16.3-59.7)
Germany	499	78.0	145	68.3	240	82.1	58	79.3	55	83.6	1.17	(0.96-1.41)	13.1	(-3.1-29.2)
Hungary	593	62.3	28	50.1	187	52.0	281	63.6	96	82.0	1.51	(1.18-1.93)	29.2	(12.3-46.2)
Israel	492	63.5	59	64.1	76	64.1	183	59.5	174	67.2	1.05	(0.80-1.37)	2.9	(-12.7-18.4)
Latvia	376	76.6	46	56.7	187	80.7	79	76.8	64	78.8	1.10	(0.86-1.41)	8.0	(-11.9-28)
Luxembourg	264	82.0	70	80.7	81	78.9	62	85.1	50	85.1	1.10	(0.91-1.34)	7.7	(-7.9-23.3)
Spain	2430	60.4	557	37.2	956	65.2	530	70.1	387	68.7	1.71	(1.45-2.02)	32.8	(23.0-42.6)
Slovenia	219	71.7	61	59.0	36	75.0	68	79.4	53	73.6	1.28	(0.91-1.79)	18.4	(-6.3-43.2)

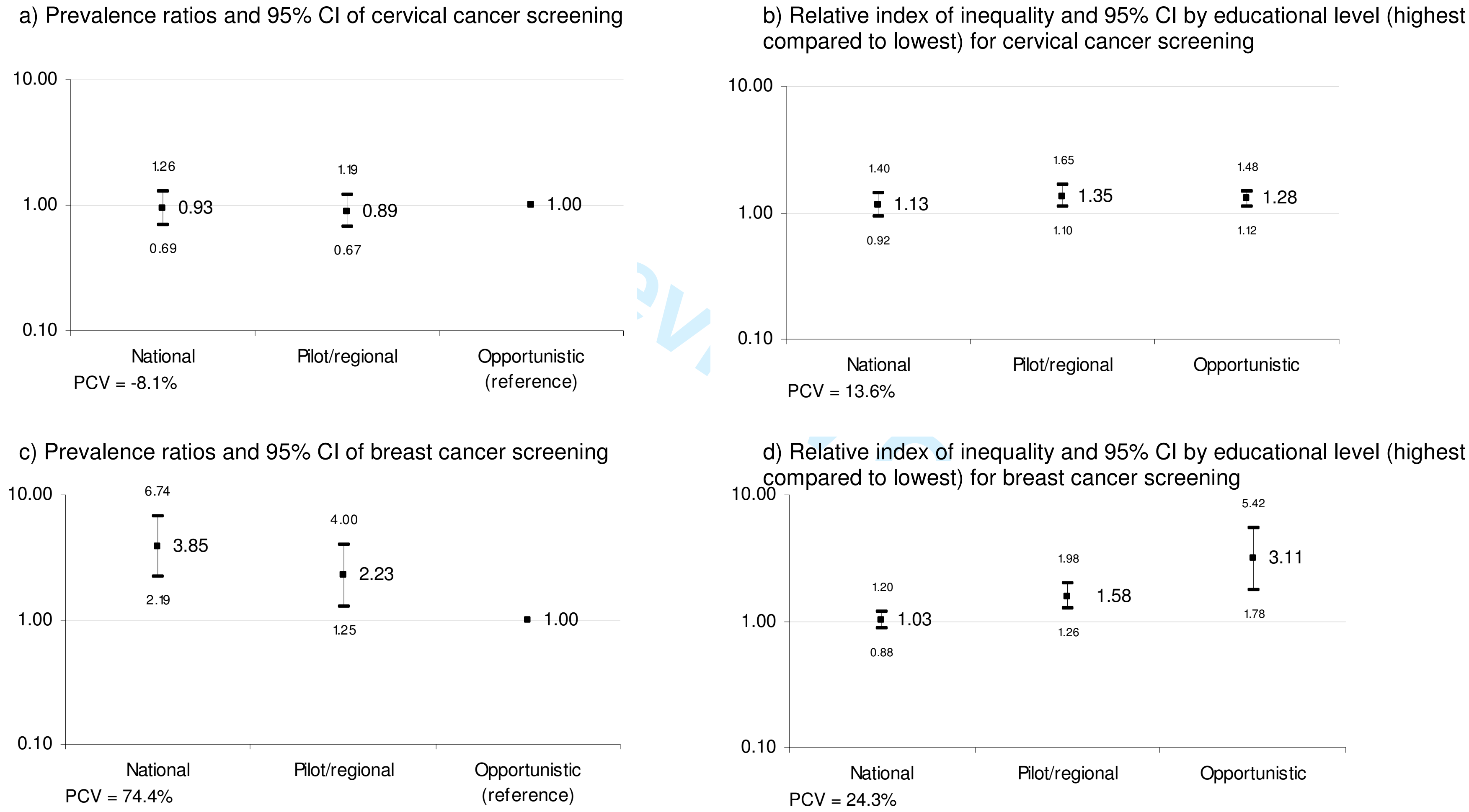
*RII and SII are age-adjusted
**95% CI: 95% Confidence interval

Table 3. Number of cases and prevalences (%) (total and by educational level) of breast cancer screening in the previous three years. Relative (RII) and absolute (SII) associations between educational level (highest compared to lowest) and breast cancer screening in women of 50-69 years by country of residence and type of screening program.

Type of program and country	Total		By educational level											
			≤ Primary		Secondary		High school		University					
	N	%	N	%	N	%	N	%	N	%	RII	95% CI	SII	95% CI
National														
Finland	184	87.9	16	70.3	70	85.5	67	92.7	31	92.4	1.18	(0.99-1.40)	15.2	(-1.1-31.6)
Israel	165	86.3	49	78.7	29	93.5	47	89.2	40	87.2	1.10	(0.85-1.41)	7.8	(-13.1-28.8)
Luxembourg	97	82.5	35	87.9	35	72.9	14	100.0	13	75.3	0.96	(0.70-1.30)	-3.9	(-32.1-24.4)
Netherlands	270	84.4	33	78.8	15	73.3	174	86.2	48	85.4	1.13	(0.90-1.42)	10.6	(-9.4-30.6)
Sweden	183	81.2	8	93.5	50	93.0	56	72.2	68	78.4	0.79	(0.56-1.10)	-20.1	(-47.4-7.1)
United Kingdom	205	69.8	5	80.0	116	69.0	36	69.4	48	70.8	1.01	(0.72-1.43)	0.8	(-23.3-24.9)
Pilot/Regional														
Austria	174	75.9	20	50.0	130	77.7	22	90.9	2	50.0	1.59	(1.07-2.37)	32.4	(4.4-60.4)
Belgium	147	70.1	41	65.9	41	56.1	41	82.9	24	79.2	1.45	(0.98-2.13)	23.4	(-1.1-47.9)
Denmark	168	22.0	1	0.0	91	20.9	20	25.0	56	23.2	1.10	(0.38-3.19)	1.8	(-18.0-21.7)
Estonia	193	40.1	37	30.9	3	23.9	102	39.1	51	49.8	1.67	(0.86-3.22)	15.4	(-5.4-36.3)
France	158	79.4	61	63.7	42	87.6	28	84.9	27	96.1	1.37	(0.91-2.06)	20.1	(-2.8-43.0)
Germany	221	56.1	107	52.3	75	57.3	13	53.8	25	68.0	1.23	(0.79-1.93)	10.9	(-12.5-34.2)
Greece	170	37.6	122	31.1	7	42.9	31	45.2	10	90.0	2.96	(1.44-6.10)	46.4	(16.9-75.9)
Hungary	250	62.9	19	35.1	105	58.1	97	67.4	30	82.5	1.64	(1.14-2.35)	25.7	(6.3-45.1)
Ireland	116	35.6	39	24.5	64	45.7	6	14.6	8	24.4	1.49	(0.57-3.86)	10.8	(-16.5-38.1)
Italy	169	66.9	70	58.6	42	66.7	42	78.6	15	73.3	1.46	(0.98-2.17)	24.4	(-1.4-50.2)
Portugal	166	66.2	147	64.8	11	89.0	0	0.0	8	61.2	1.34	(0.71-2.56)	19.4	(-23.8-62.6)
Spain	909	74.8	413	67.0	351	81.0	80	79.2	66	85.1	1.31	(1.11-1.55)	18.0	(6.6-29.4)
Opportunistic														
Croatia	217	40.6	99	19.4	82	51.5	18	68.3	19	77.3	5.38	(2.57-11.25)	47.9	(18.4-77.3)
Czech Republic	157	50.5	41	22.3	52	46.1	51	67.7	12	93.8	4.91	(2.10-11.44)	82.8	(36.3-129.3)
Latvia	158	38.1	32	25.6	70	45.0	38	39.6	17	30.2	1.20	(0.58-2.49)	7.2	(-21.2-35.6)
Slovenia	95	44.2	44	34.1	13	69.2	20	40.0	17	52.9	1.93	(0.83-4.50)	24.9	(-6.3-56.1)

*RII and SII are age-adjusted
**95% CI: 95% Confidence interval

Figure 1: Multilevel association between screening prevalence and type of screening program (prevalence ratio) and between educational level and cancer screening (RII) by type of screening program taking individual variables into account. Percentage change in variance (PCV) after taking into account the type of screening program.



*95% CI: 95% Confidence interval