Cervical cancer screening in Switzerland: cross-sectional trends (1992–2012) in social inequalities

Claudine Burton-Jeangros[1,3], Stéphane Cullati[2,3], Orly Manor[4], Delphine S. Courvoisier[5],
Christine Bouchardy[6], Idris Guessous[2,7,8]

1 Institute of Demography and Socioeconomics, University of Geneva, Geneva, Switzerland
2 Unit of Population Epidemiology, Department of Community Medicine, Primary Care and Emergency Medicine,
  University Hospitals of Geneva, Geneva, Switzerland
3 Swiss National Centre of Competence for Research 'LIVES - Overcoming Vulnerability: Life Course Perspectives', Institute
  of Demography and Socioeconomics, University of Geneva, Geneva, Switzerland
4 School of Public Health and Community Medicine, Hebrew University-Hadassah, Jerusalem, Israel
5 Division of Quality of Care, University Hospitals of Geneva, Geneva, Switzerland
6 Geneva Cancer Registry, Global Health Institute, University of Geneva, Geneva, Switzerland
7 Department of Epidemiology, Emory University, Atlanta, GA, USA
8 Division of Chronic Diseases, Institute of Social and Preventive Medicine, Lausanne University Hospital, Lausanne,
  Switzerland

Correspondence: Claudine Burton-Jeangros, Institute of Demographic and Socioeconomic Studies, University of Geneva,
40 bd du Pont d'Arve, 1211 Geneva 4, Switzerland. Tél: +41 22 379 88 72, e-mail: claudine.jeangros@unige.ch

Background: Incidence and mortality of cervical cancer declined thanks to Pap smear screening. However cervical cancer screening (CCS) inequalities are documented, including in high income countries. This population-based study aims to assess the importance and 20-year trends of CCS inequalities in Switzerland, where healthcare costs and medical coverage are among the highest in the world.   **Methods:** We analyzed data from five waves of the population-based Swiss Health Interview Survey (SHIS) covering the period 1992–2012. Multivariable Poisson regression were used to estimate weighted prevalence ratios (PR) of CCS and 95% Confidence Intervals (CI) adjusting for socio-economic, socio-demographic characteristics, family status, health status, and use of healthcare.   **Results:** The study included 32'651 women aged between 20 and 70 years old. Between 1992 and 2012, rates of CCS over the past 3 years fluctuated between 71.7 and 79.6% (adjusted $P < 0.001$). Lower CCS was observed among women with low education, low income, those having limited emotional support, who were non-Swiss, single, older, living in non-metropolitan area or in the French-speaking region, overweight. Over the analyzed period, differences in CCS across age groups diminished while rates among women who visited a GP over the previous year, versus those who did not, increased.   **Conclusions**: While important changes occurred in screening recommendations and in social circumstances of the targeted population, CCS rates remained fairly stable in Switzerland between 1992 and 2012. At the same time, inequalities in CCS persisted over that period.

Introduction

The decline in incidence and mortality of cervical cancer observed in high-income countries is mostly attributed to Pap smear screening.[1–3] Inequalities in cervical cancer screening (CCS) are observed in high-income countries in term of socio-economic and socio-demographic indicators.[4–9] In particular, older, single women, those with low socio-economic status (SES) or living in rural area are less often screened for cervical cancer. Further obstacles to CCS include insufficient knowledge about the procedure, limited access to health care, unsatisfactory relationships with health professionals, and discomfort with the procedure.[10,11] Important differences in screening participation exist across countries; with coverage in Western Europe ranging between 58% (Portugal) and 77% (Netherlands).[3] In opportunistic systems, CCS is left to the initiative of women and doctors whereas in organized programmes, eligible women are periodically invited to screening. The latter programmes are considered to be more effective in terms of both participation and equity.[9,12,13] Countries with opportunistic CCS screening show a steeper socio-economic gradient, than countries with organized programmes.[13]

The Swiss health care system is considered as 'high performing and responsive', with both high coverage and costs.[14] CCS is

opportunistic in Switzerland and no national or regional screening program exists for cervical cancer. After the introduction of CCS at the end of the 1960s, the incidence of cervical cancer has decreased importantly[2,15], a trend also observed in neighbouring countries with opportunistic screening such as Austria, Belgium, France, Germany and Luxemburg.[9] The cervical cancer incidence rate declined from 0.98% in 1993–97 to 0.37% in 2008–12, it is now among the lowest among Western countries.[16] Mortality also declined over that period, from 0.78 in 1993–97 to 0.08 in 2008–12. Current Swiss guidelines recommend that after two consecutive negative tests, a Pap smear should be performed every three years, among women aged 18–69 years.[17] According to those guidelines, CCS is reimbursed by health insurance. Barriers to, and facilitators of, CCS in Switzerland have been little investigated so far, but a recent qualitative study showed that a range of factors impact CCS participation, including issues related to access, information, attitudes and changing personal circumstances (like a divorce).[18] The Organisation for Economic Co-operation and Development 2011 review of the Swiss health care system concluded that so far too limited attention has been dedicated to health inequalities.[14] While the 2008 European guidelines encourage the adoption of organised CCS to improve the performance of the procedure, our

study aims to analyse whether CCS rates changed in the Swiss opportunistic system over a 20-year period, with a special interest for trends regarding CCS social inequalities.

Methods

The Swiss Health Interview Survey (SHIS) is a cross-sectional survey conducted every 5 years since 1992 by the Swiss Federal Office for Statistics. A random multistage probability sample is drawn from all residents in Switzerland. Data are collected through computer assisted telephone interview and a self-administered questionnaire (paper or online). The present study included data from women aged between 20 and 70 years of age who participated in the five SHIS available waves (1992–2012) ($N = 38\,806$). Respondents with missing data on CCS ($N = 2033$), or socio-economic ($N = 3648$), or socio-demographic ($N = 31$), or health status ($N = 477$), or health service use variables ($N = 742$) were excluded. The final analytic study population included 32 651 women. Survey weights were built to reflect the Swiss population aged 15 years old or older living in private households and to correct for bias associated with poor health status.

Dependent and independent variables

The dependent variable CCS was assessed by the following questions: 'Did you ever undergo CCS (Pap smear)?' (yes, no). Respondents who answered 'yes' were then asked: 'When was the last time?' Along the guidelines in use since 2004,[17] analyses are focused here on screening over the previous 3 years among women aged between 20 and 70. This has been considered the most appropriate measure to keep a constant outcome over time, based on the most recent recommendations.

Other variables of interest were women's socio-economic characteristics based on information on household monthly income (≤CHF 2000, CHF 2001–4000, CHF 4001–6000, >CHF 6000), education (compulsory, secondary, tertiary), employment status (employed full time, employed part time, out of the labour force) and, among employed, occupational class (superior and intermediate occupations; employee, non-manual occupations; independent/artisan; overseer/ qualified worker, skilled worker). Household income was weighted with the number of persons living the household and the number of children less than 15 years old. In June 2015, 1 Swiss franc (CHF) was about equivalent to 1 US dollar or 1 Euro. Educational levels generally matched the International Standard Classification of Education 1997:[19] compulsory education corresponded to primary and lower secondary education (approximately 9 years of education starting at age 4 or 5), secondary education included additional specialized training including vocational training (approximately 1– 3 years of additional education), and tertiary included more theory-based and specialized degrees which correspond to bachelors, masters and doctoral degrees (approximately 1–8 years of additional education). Occupational class was based on the Erikson, Goldthorpe and Portocarero social class classification defined along occupation based job duties, setting/environment and management responsibilities.[20]

Family variables encompass marital status (single, married/ registered partnership, widowed, divorced/separated/registered partnership dissolved), number of people in the household (1, 2 or more), children (14 years old or less) living the household (yes, no) and the number of close relations who can provide emotional support (several people, one person, none). Socio-demographic characteristics included age groups (20–29, 30–39, 40–49, 50–59, 60–69), citizenship (Swiss versus non-Swiss), area of residence (metropolitan, medium size urban, small size urban, rural) and linguistic regions of Switzerland (German, French, Italian).

Health-related independent variables included: body mass index (BMI) (categorized as underweight ($<18.5 \text{ kg/m}^2$), normal weight (18.5 to <25), overweight (25 to <30) and obesity (≥30)), general

practitioner (GP) or family doctor visit in the previous 12 months (yes, no), self-rated health (SRH), frequency of physical symptoms over the previous 4 weeks, and smoking status. The SRH questions differed across waves. Between 1992 and 2002, the question was: 'Let's start with the essential: How are you now?' with response categories including very good, good, like this like that (average), bad, and very bad. In 2007, the question was: 'How is your health in general?' with response categories including very good, good, average, bad, and very bad. In 2012, the question was: 'How is your health condition in general?' with response categories including very good, good, good enough, bad and very bad. To capture the different response categories used over the different waves, SRH was categorized as very good, good, average/good enough, bad and very bad.

Statistical analysis

Descriptive statistics of respondents' characteristics were reported using proportions of CCS weighted for survey sampling, and health-related bias of non-participation. Crude differences in proportions of screening between waves were tested using unweighted chi-square test. Variations in screening were examined using weighted prevalence ratios (PR) and 95% confidence intervals (CI). PR were estimated with unadjusted and adjusted Poisson regression and robust variance estimators. Collinearity between socio-economic position variables was examined with variance inflation factor, and no evidence of collinearity was found (variance inflation factors ranged from 1.02 to 1.21 and tolerance from 0.82 to 0.98).[21] Models were both pooled over the 1992–2012 period and stratified by survey years. Adjusted models included: education, household income, employment status, age, marital status, citizenship, area of residence (urban/rural), BMI, GP visits, SRH, physical symptoms and smoking. These variables were *a priori* considered given their potential associations with screening. For each socio-economic indicator, different coding schemes were tested (education with three to five levels, income as a continuous versus categorical variable, employment in three versus two levels, occupational class in four versus six levels) to check the robustness of results. Whatever the variables codification, results were unchanged (data not shown). Time trends were tested by adding a wave (1992 = 0, 1997 = 1, 2002 = 2, 2007 = 3, 2012 = 4) and a predictor product term (time∗predictor; predictors from the adjusted models) in the models. A model restricted to respondents in the labour force was conducted to examine the association between occupational class and CCS. All analyses were conducted with SPSS 22 and STATA 12.

Sensitivity analyses

We conducted two sensitivity analyses. First, we recoded the time-interval of CCS uptake among waves 1992, 1997 and 2002 to reflect CCS recommendation during this period (every year) and examined if findings would change. Second, we replicated the models by imputing missing data on predictors of CCS, using multiple imputations (20 imputations).

Results

About 85% of the 32 651 women included in the study reported having ever had CCS, this rate remained fairly stable between 1992 and 2012 (minimum 82.9% in 2007, maximum 86.5% in 1997). A smaller proportion reported attending CCS over the past 3 years, with a maximum rate of 79.6% in 1997 and a minimum rate of 71.7% in 1992 (Figure 1).

Major changes in the distribution of the population over the waves include an increase in education and income levels, a larger proportion of non-Swiss and of women living in metropolitan areas, as well as an increase in divorce (Supplementary Table S1). Tables 1 and 2 present the weighted proportions of CCS and the corresponding PR, respectively by socio-economic, socio-demographic, social
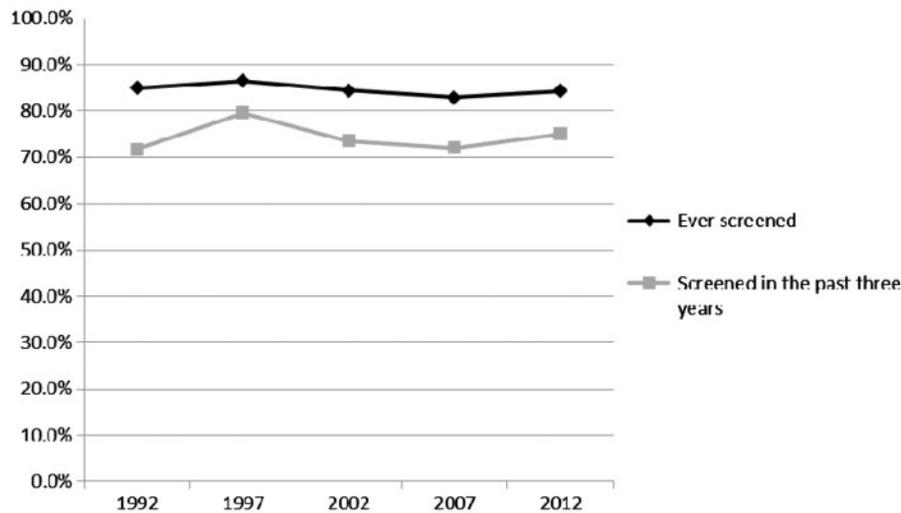
Figure 1 Weighted prevalence of cervical cancer screening among 20–70 years old women, Swiss Health Interview Survey data 1992–2012[a]
[a]Ever screened: *P* values for time < 0.001; Screened in the past 3 years: *P* values for time<0.001. P-values are adjusted for education, household income, employment, age groups, nationality, area of residence, linguistic regions, marital status, number of people in the household, kids in the household, emotional support, body mass index, self-rated health, physical symptoms, smoking and general practitioner visit in the last 12 months – see Table 2.

and family characteristics and health variables, according to survey waves. Over the period 1992–2012, the prevalence of CCS decreased by 1.8% by survey wave (PR = 0.98, 95% CI 0.98–0.99). Women with a lower education level, less income, who were older, non-Swiss, living in non-metropolitan areas or in the French-speaking region, single or widowed, having no emotional support were less often screened. Also those who were obese or did not visit a GP in the past 12 months reported lower CCS. Among women in the labour force, occupational class was not associated with CCS in adjusted analyses (results not shown). For example in 2012, the weighted proportion of CCS was 80.3% and adjusted PR 1.13 (95%CI: 1.04–1.23) for women with tertiary as compared with 62.4% and 1.00 (reference) for women with primary education (Tables 1 and 2).

The corresponding values were 80.9% and 1.22 (1.10–1.37) for women in the highest income category vs. 62.4%, 1.00 (reference) for women in the lowest category income; 82.5% and 1.22 (95%CI: 1.15–1.3) for women living in the Italian-speaking region vs. 68.3% and 1.00 (reference) for those in the French-speaking one; 78.7% and 1.49 (95%CI: 1.38–1.61) for women who had visited a GP in the past 12 months vs. 53.4 and 1.00 (reference) for those who had not.

Regarding trends over the period 1992-2012 (Table 2), CCS rate differences between women having children under 15 vs. not fluctuated significantly (*P* = 0.002), however no clear time-trend was observed. Differences in CCS rates across age groups varied significantly (*P* < 0.001) over the whole period, with the gap between women aged between 20 and 59 and those aged 60–70 diminishing over time. The difference between those who had attended a doctor and those who had not generally increased between 1992 and 2012 (*P* < 0.001), to the exception of a decrease in 1997. With regard to the evolution of the association between CCS and other indicators of social levels, no real changes were observed.

Results were similar in models using multiple imputation (data not shown), with the exception that *P* values for time trend over 1992–2012 for social support became significant (*P* = 0.028): lack of emotional support was not associated at the beginning of the study period but effect size increased over time.

Discussion

This population-based study assessed CCS trends in Switzerland over a 20-year period and the role of a range of determinants over

this period, using five waves of the SHIS, a large national survey. On the whole, CCS weighted prevalences slightly fluctuated between 1992 and 2012, with a small decreasing trend of 1.8% by survey wave. These prevalences were high compared to other cancer screening rates in Switzerland[22] and they also fared higher than what is observed for CCS in other European countries, including those with organized programmes.[3]

In the last decade, CCS guidelines and reimbursement changed towards less frequent pap smears (from a 1-year to a 3-year frequency in case of a normal result). Recent evidence suggests that both physicians and patients complied with this new recommendation, at least in the United States.[23] The adoption in January 1996 of a new national health insurance law (Lamal), taking into account more prevention strategies[14] might explain the slight increase in CCS in 1997; however this increase was limited in time and not observed in subsequent years. In addition, the HPV vaccine has been recommended in Switzerland since 2007 for women aged between 11 and 26 years.[24] Results do not show any decline since 2007, suggesting that so far vaccination had no effect on CCS. The impact of these changes (new guidelines, reimbursement scheme, HPV vaccine) are indeed difficult to assess since they have contrasted effects on CCS and the timing of their consequences might not be immediate (delayed adoption of new recommendations).

Next to this generally high CCS levels, findings show noteworthy persistent inequalities along social characteristics. Screening rates variations along socioeconomic indicators are similar to inequalities observed in other countries:[4,13] less educated and poorer women were less often screened. This could be explained by more negative attitudes toward cancer screening among the socio-economically disadvantaged.[25] Despite the mandatory Swiss health insurance system, deductibles imply that part of the costs can be at the patient's charge and women may therefore forgo medical visits for economic reasons.[26] The stability of differences over waves between women in lower and higher social positions suggests that health inequalities, as measured by screening attendance, are not changing in Switzerland. The persistence of these inequalities occur while significant changes are reported for the period under study, such as increasing levels of education and participation to the labour market for women[27], an increase in single-person households (from 32.4% in 1990 to 37.1% in 2008)[28] and in the divorce rate (from 35.8% in 1992 to 43.1% in 2012).[29] This stability of

Table 1 Weighted proportions of cervical cancer screening in the past three years among the 32 651 women aged 20–70 according to women characteristics and the Swiss Health Interview Survey (SHIS) waves

	1992 N = 6006	1997 N = 3863	2002 N = 7685	2007 N = 7099	2012 N = 7998	
Socio-economic characteristics	%	%	%	%	%	P values[a]
Education						<0.001
Primary	61.6	67.2	62.6	57.4	62.4	
Secondary	74.4	82.4	75.0	72.8	75.2	
Tertiary	76.1	82.3	79.2	75.3	80.3	
Household income[b]						<0.001
≤2000	62.4	72.1	62.2	69.4	62.4	
2001–4000	73.4	79.3	73.5	70.2	73.5	
4001–6000	77.5	83.4	76.3	74.6	77.8	
≥6001	77.7	87.2	79.0	77.9	80.9	
Employment						<0.001
Out of the labour force	71.5	76.7	69.3	65.2	70.2	
Employed/workers full time	68.9	76.6	71.1	71.2	73.2	
Employed/workers part time	76.0	85.5	79.2	77.6	78.8	
Occupational class of employed/workers						<0.001
Overseer, qualified worker, skilled worker	66.9	72.3	73.5	70.5	69.8	
Independent, artisan	66.4	77.9	73.7	73.7	76.1	
Employee, non-manual occupations	72.2	83.0	75.3	73.8	75.3	
Superior and intermediate occupations	75.1	84.9	78.1	78.4	80.0	
Socio-demographic characteristics						
Age groups						<0.001
20–29	68.8	72.6	68.0	63.6	70.6	
30–39	82.6	86.7	78.6	76.3	79.8	
40–49	80.6	85.7	78.9	80.6	80.2	
50–59	67.2	84.5	74.9	74.3	76.2	
60–70	51.6	60.5	61.7	60.6	65.3	
Nationality						<0.001
Swiss	72.9	81.3	75.1	73.3	76.2	
Not Swiss	64.4	71.7	66.8	66.6	71.1	
Areas of residence						<0.001
Metropolitan	74.2	82.2	75.9	74.4	76.3	
Medium size urban	68.2	78.0	71.9	70.4	74.3	
Small size urban	73.1	78.6	74.2	67.6	73.6	
Rural	70.0	78.8	71.2	69.7	72.7	
Linguistic regions						<0.001
French	65.9	74.2	65.5	59.8	68.3	
German	73.7	81.5	76.6	75.9	77.0	
Italian	66.8	81.1	71.6	74.8	82.5	
Social and family characteristics						
Marital status						<0.001
Single	65.9	73.0	67.3	68.2	70.2	
Married and registered partnership	74.6	82.8	75.9	74.5	78.4	
Widowed	54.9	62.7	62.3	61.6	67.1	
Divorced, separated, registered partnership dissolved	74.8	83.1	75.7	72.5	73.6	
Number of person(s) in the household						<0.001
1	64.3	73.8	68.2	67.7	66.0	
≥2	73.3	80.8	74.5	72.9	76.2	
Children under 15 living in the household						<0.001
No	65.7	76.4	70.6	69.9	71.3	
Yes	78.7	85.8	79.5	77.6	80.6	
Emotional support						<0.001
Yes, many people	73.1	81.5	76.2	73.6	77.5	
Yes, one person	70.9	76.9	68.2	67.6	69.8	
No	57.5	71.2	61.9	64.3	59.1	
Health status						
BMI						<0.001
Underweight	75.1	83.1	74.5	70.0	76.3	
Normal weight	73.0	81.6	76.2	73.8	76.9	
Overweight	65.8	74.2	69.6	70.1	72.9	
Obesity	59.5	68.2	64.7	64.2	66.4	
Self-rated health						<0.001
Very bad	52.7	51.7	58.2	58.4	65.3	
Bad	66.3	68.7	68.7	68.5	72.2	
So-so	68.8	79.6	73.6	68.5	71.4	
Good	72.4	80.2	73.9	73.3	74.8	
Very good	72.3	80.2	73.7	70.4	76.8	
Physical symptoms						<0.001
No, a few	70.9	77.4	72.7	72.1	73.1	
Some	72.4	80.0	73.6	72.9	76.2	
Important	71.9	80.6	75.0	71.4	76.6	

(continued)

Table 1 Continued

	1992 N = 6006	1997 N = 3863	2002 N = 7685	2007 N = 7099	2012 N = 7998	
Currently smoking						0.818
Yes	72.7	80.5	74.1	71.8	73.7	
No	71.3	79.2	73.4	72.3	75.6	
Health services access	%	%	%	%	%	P values[a]
Doctor visit in the last 12 months						<0.001
No	54.7	70.1	60.9	52.2	53.4	
Yes	75.1	81.6	76.5	75.3	78.7	

a: Pearson Chi-square test unweighted, see details in the Methods section.
b: In 2014, 1 CHF = 0.8 EUR.

Table 2 Adjusted[a] and weighted prevalence ratios (PR) for cervical screening in the past three years, among the 26'677 women aged 20-70 according to women characteristics and waves

	1992–2012 N = 26 677		P values for trend over 1992–2012[b]	1992 N = 4847		1997 N = 3121		2002 N = 6305		2007 N = 5520		2012 N = 6884	
	PR	95%CI		PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI
Socio-economic characteristics													
Education (ref: primary)			0.228										
Secondary	1.11	1.07–1.16		1.10	1.03–1.19	1.11	1.03–1.20	1.09	1.02–1.17	1.16	1.02–1.31	1.11	1.03–1.20
Tertiary	1.12	1.07–1.17		1.12	1.03–1.22	1.10	1.00–1.21	1.08	0.99–1.17	1.19	1.04–1.36	1.13	1.04–1.23
Household income (CHF) (ref: ≤2000)			0.965										
2001–4000	1.10	1.06–1.14		1.07	1.01–1.13	1.13	1.04–1.22	1.06	0.98–1.14	1.07	0.98–1.16	1.14	1.02–1.26
4001–6000	1.15	1.10–1.20		1.09	1.01–1.17	1.17	1.07–1.27	1.10	1.01–1.20	1.18	1.07–1.31	1.16	1.04–1.29
≥6001	1.19	1.14–1.25		1.13	1.02–1.25	1.16	1.05–1.30	1.19	1.08–1.30	1.12	0.99–1.26	1.22	1.10–1.37
Employment (ref: out of labour force)			0.164										
Full time	1.00	0.97–1.03		0.99	0.92–1.06	0.97	0.91–1.03	0.97	0.92–1.04	1.05	0.96–1.16	0.99	0.94–1.05
Part time	1.03	1.01–1.06		1.03	0.98–1.09	1.00	0.95–1.04	1.04	0.99–1.08	1.08	1.01–1.15	1.01	0.96–1.06
Socio-demographic characteristics													
Age groups (ref: 60–70)			<0.001										
20–29	1.10	1.05–1.16		1.22	1.09–1.37	1.18	1.05–1.32	1.21	1.11–1.33	0.89	0.76–1.05	1.06	0.96–1.16
30–39	1.22	1.17–1.28		1.42	1.28–1.57	1.32	1.18–1.48	1.26	1.16–1.36	1.11	1.00–1.23	1.15	1.07–1.24
40–49	1.21	1.16–1.26		1.37	1.23–1.51	1.31	1.18–1.46	1.27	1.17–1.37	1.18	1.07–1.31	1.10	1.03–1.19
50–59	1.19	1.15–1.24		1.25	1.13–1.39	1.36	1.23–1.50	1.21	1.13–1.29	1.16	1.06–1.27	1.15	1.08–1.22
Nationality (ref: Swiss) Non–Swiss	0.96	0.93–0.99	0.891	0.94	0.87–1.02	0.97	0.91–1.04	0.98	0.91–1.04	0.91	0.83–1.01	0.95	0.90–1.00
Area of residence (ref: metropolitan)			0.077										
Medium size urban	0.93	0.91–0.95		0.93	0.88–0.99	0.96	0.91–1.01	0.92	0.87–0.96	0.92	0.86–0.98	0.96	0.92–1.00
Small size urban	0.95	0.92–0.97		0.93	0.87–0.99	0.94	0.89–1.00	0.95	0.90–0.99	0.96	0.90–1.03	0.97	0.93–1.02
Rural	0.90	0.87–0.93		0.96	0.90–1.03	0.97	0.92–1.04	0.86	0.81–0.91	0.86	0.78–0.94	0.92	0.87–0.98
Linguistic region (ref: French)			0.500										
German	1.17	1.14–1.20		1.09	1.03–1.15	1.08	1.03–1.14	1.15	1.10–1.21	1.31	1.23–1.40	1.13	1.09–1.18
Italian	1.22	1.17–1.26		1.09	0.98–1.22	1.14	1.06–1.23	1.11	1.03–1.20	1.39	1.27–1.52	1.22	1.15–1.30
Social and family characteristics													
Marital status (ref: single)			0.833										
Married and registered partnership	1.08	1.05–1.12		1.06	0.98–1.15	1.07	0.99–1.16	1.10	1.03–1.17	1.08	0.99–1.18	1.08	1.01–1.15
Widowed	1.04	0.98–1.10		1.04	0.91–1.18	0.97	0.85–1.10	1.09	0.99–1.21	1.01	0.87–1.17	1.07	0.94–1.22
Divorced, separated, registered partnership dissolved	1.08	1.04–1.12		1.10	1.02–1.20	1.07	0.99–1.16	1.05	0.98–1.12	1.09	0.99–1.20	1.08	1.00–1.16
People in the household (ref:1 person) ≥2	1.03	1.00–1.07	0.802	1.01	0.95–1.08	1.02	0.96–1.08	1.00	0.94–1.06	1.04	0.96–1.13	1.05	0.98–1.12
Children under 15 living in the household (ref: no) ≥1	1.07	1.04–1.10	0.002	1.09	1.03–1.15	1.04	0.98–1.10	1.06	1.01–1.12	1.11	1.02–1.20	1.07	1.02–1.13
Emotional support (ref: ≥1) None	0.85	0.80–0.92	0.120	0.97	0.86–1.09	0.85	0.75–0.97	0.82	0.71–0.95	0.87	0.72–1.04	0.78	0.67–0.91
Health status													
BMI (ref: normal weight)			0.136										
Underweight	0.99	0.97–1.02		0.98	0.93–1.03	1.01	0.96–1.05	1.01	0.96–1.05	0.89	0.78–1.01	0.93	0.85–1.02
Overweight	0.96	0.93–0.99		0.93	0.87–1.00	0.96	0.90–1.02	0.97	0.92–1.02	0.97	0.90–1.04	0.96	0.91–1.00
Obesity	0.91	0.86–0.95		0.87	0.76–1.01	0.87	0.77–0.98	0.88	0.81–0.97	0.94	0.84–1.05	0.91	0.84–0.99
Health services access													
GP or family doctor visit last 12 months (ref: no) Yes	1.41	1.35–1.46	<0.001	1.30	1.20–1.40	1.19	1.10–1.27	1.38	1.29–1.47	1.52	1.35–1.72	1.49	1.38–1.61
Time	0.98	0.98–0.99	—	—	—	—	—	—	—	—	—	—	—

a: Prevalence ratio (PR) was adjusted for all variables in the table and for self-rated health, physical symptom and smoking.
b: *P* values for time-trend were estimated as follows: for each predictor (marital status, education, income, etc.), we estimated separately one multivariate model including all predictors plus the interaction term between the predictor and the wave. We reported only the *P* value.

inequalities might be associated with the absence of a CCS organized program and no promotion campaign over the observed period; the limited attention dedicated to health inequalities in the Swiss health care system might further account for this stability.[14] Considering the high general CCS coverage over time, policy efforts should be targeted towards under-screened population, to make sure that all eligible women can benefit from CCS.

The increasing CCS rate over time among elderly women is in line with observations in the United States.[30,31] It could result from a growing attention of doctors to this category of the population, or it could result from a cohort effect: women who got used to screening during their reproductive years continue to attend a gynecologist-obstetrician as they age, which could have been less frequent among previous cohorts. The fact that differences between age groups significantly decreased in adjusted analyses further support this hypothesis. Results suggest a fairly strong regional influence with women in the French-speaking part being less screened that those living in the German- and Italian-speaking regions. Available data do not allow to clarify whether this is due to variations in women's or doctors' attitudes across the regions.

Higher screening rates among married women, those living with children aged under 15 and those aged between 30 and 59 can be associated with their higher likelihood to attend a gynecologist due to pregnancy or contraception. It confirms that attendance is associated with women's reproductive age, as observed in the United States.[5] The significant association with emotional support over the two decades, with the exception of the 2007 wave, is in line with previous findings assessing the relationship between social support and colorectal cancer screening.[32]

Obese women's lower attendance for CCS has been reported elsewhere.[33–35] One study suggested that these women are more likely to feel uncomfortable or embarrassed with the test.[35] The systematic association between attending a GP and CCS, in line with the literature,[36] further suggests that being in contact with a medical doctor is related with preventive behaviors, either as a result of his/her recommendation or as a personal predisposition towards screening and preventive behavior among women who attend a GP regularly.

Our study has several limitations. (i) Results are based on self-reported data on screening, while previous studies have shown that misclassification can occur. (ii) A sensitivity analysis adjusting the reference period along the changed recommendation (CSS over the previous year for waves 1992, 1997 and 2002 and CSS over the previous 3 years for 2007 and 2012) did not change the results (not shown). (iii) Even though the outcome did not match the official guideline throughout the analysed timeframe, keeping a stable reference period (3 years) seemed preferable for the trend analysis. (iv) Another limitation is that results cannot be adjusted for women having undergone hysterectomy, since this information is not available in the SHIS survey. While analyses were adjusted for age—a major proxy of hysterectomy—we cannot exclude residual confounding.

Conclusions

Using a large national health survey, we showed that, despite changes over the period 1992–2012 in both the characteristics of the targeted population and the medical practices related to the prevention of cervical cancer, screening rates remained high and fairly stable during those 20 years. Regarding CCS determinants, inequalities along education, income, degree of urbanization, linguistic regions, household composition, emotional support and obesity persisted over time. Differences across age groups diminished over time, thanks to more systematic screening behaviors of older women. The positive influence of attending a GP increased over the years. The findings confirm well-known obstacles to screening but more importantly reveal that in Switzerland inequalities along socio-economic parameters are not diminishing over time.

Conflicts of interest: None declared.

Key points

- While important changes occurred in screening recommendations and in social circumstances of the targeted population, CCS rates remained fairly stable in Switzerland between 1992 and 2012
- Over that 20-year period, inequalities in screening diminished across age groups, but persisted over a range of social determinants.
- These results confirm that the Swiss health care system, characterized by a high medical coverage, needs to pay more attention to health inequalities, including in preventive measures.
- These findings call for policy efforts to improve CCS attendance among under-screened populations, which might be facilitated by the adoption of an organized screening program.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Breast cancer trends differ by ethnicity: a report from the South African National Cancer Registry (1994–2009)

E. Singh[1,2], M. Joffe[3], H. Cubasch[4], P. Ruff[5], S.A. Norris[3], P.T. Pisa[6]

1 National Cancer Registry, National Health Laboratory Service, Johannesburg, South Africa
2 School of Public Health, University of Witwatersrand, Johannesburg, South Africa
3 MRC/Wits Developmental Pathways for Health Research Unit, Department of Paediatrics, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa
4 Breast Unit, Department of Surgery, Chris Hani Baragwanath Academic Hospital, Soweto, South Africa
5 Faculty of Health Sciences, Division of Medical Oncology, University of Witwatersrand, Johannesburg, South Africa
6 Wits Reproductive Health & HIV Institute, University of Witwatersrand, Johannesburg, South Africa

Correspondence: Elvira Singh, National Cancer Registry, 1 Modderfontein Road, Sandringham, Johannesburg 2010, South Africa, Tel: +27 (0) 11 386 6407, e-mail: elvira.singh@nioh.nhls.ac.za

Background: To describe breast cancer (BC) incidence and mortality by ethnicity in South Africa (SA). **Methods:** Sources of data included the South African National Cancer Registry (NCR) pathology-based reports (1994–2009) and Statistics South Africa (SSA) mortality data (1997–2009). Numbers of cases, age-standardised incidence rates (ASIR) and lifetime risk (LR) were extracted from the NCR database for 1994–2009. Age-specific incidence rates were calculated for five-year age categories. The direct method of standardisation was employed to calculate age-standardised mortality rates (ASMR) using mortality data. **Results:** Between 1994 and 2009, there were 85 561 female BC. For the Black, Coloured and Asian groups, increases in ASIR and LR were observed between 1994 and 2009. In 2009, the ASIR for the total population, Blacks, Whites, Coloureds and Asians were 26.9, 18.7, 50.2, 40.9 and 51.2 per 100 000, respectively. For Asians, an increase in proportion of BC as a percentage of all female cancers was observed between 1994 and 2002 (11.1%) and continued to increase to 2009 (a further 4.5%). Whites and Asians presented higher incidences of BC at earlier ages compared with Blacks and Coloureds in 2009. In 1998, there were 1618 BC deaths in SA compared with 2784 deaths in 2009. ASMR between 1997 and 2004 increased but stabilised thereafter. **Conclusion:** This paper demonstrated that SA BC incidence rates are similar to other countries in the region, but lower than other countries with similar health systems. Ethnic differences in BC trends were observed. However, the reasons for observed ethnic differences are unclear.