Preventive Medicine 129 (2019) 105829

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

Review Article

Skin cancer screening in Switzerland: Cross-sectional trends (1997–2012) in socioeconomic inequalities

Shireen Dumont[a,*], Stéphane Cullati[b,c,d], Orly Manor[e], Delphine S. Courvoisier[c,d], Christine Bouchardy[f], Rastine Merat[g], Idris Guessous[a]

[a] Division of Primary Care Medicine, Department of Primary Care Medicine, Geneva University Hospitals, Switzerland
[b] Institute of Sociological Research, University of Geneva, Switzerland
[c] Department of Readaptation and Geriatrics, University of Geneva, Switzerland
[d] Division of Quality of Care, Geneva University Hospitals, Switzerland
[e] School of Public Health and Community Medicine, Hebrew University-Hadassah, Israel
[f] Geneva Cancer Registry, Global Health Institute, University of Geneva, Switzerland
[g] Division of Dermatology and Venereology, Geneva University Hospitals, Switzerland

ARTICLE INFO

Keywords:
Skin cancer
Screening
Socioeconomic status
Disparities
Switzerland
Trends

ABSTRACT

Introduction: Skin cancer is one of the most common malignancies. Despite controversy over its efficacy, skin cancer screening has become widespread although socioeconomic screening inequalities have been documented. Switzerland has the highest rate of melanoma in Europe but Swiss trends in skin cancer screening and social disparities have not been investigated. This study aims to evaluate trends in skin cancer screening and its association with socioeconomic indicators in Switzerland between 1997 and 2012.

Method: We used data from four waves (from 1997 to 2012) of the population-based Swiss Health Interview Survey. Multivariable Poisson regressions with robust variance were used to estimate weighted prevalence ratio (PR) and 95% Confidence Intervals (CI) adjusting for demographics, health status and use of healthcare.

Results: This study included 60,764 participants with a mean age of 49.1 years (standard deviation (SD) 17.2) and 53.6% of women. Between 1997 and 2012, the weighted prevalence of ever life-time skin examination and skin examination in the current year increased by 38.2% and 35.3% respectively (p-value < 0.001). Participants with a lower education level, lower income and living in non-metropolitan areas were less often screened than their counterparts. Educational differences in ever life-time skin examination increased over time (p-value for trend = 0.036).

Conclusion: While skin cancer screening prevalence in Switzerland increased from 1997 to 2012, most social inequalities persisted over time and educational inequalities increased. Dermatologists should be alerted that populations with lower education should be given special attention.

1. Introduction

Skin cancer, including malignant melanoma (MM) and non-melanocytic skin cancer (NMSC), represent the most common malignancies. Worldwide, melanoma accounted in 2012 for 232,000 new cases with highest incidence rates in Australia/New Zealand of 40.3 per 100,000 and 30.5 per 100 00 respectively followed by rates over 10 per 100,000 for Northern America and Western Europe (Ferlay et al., 2015). Estimated age-standardized rates of mortality ranged from 0.1 to 6 per 100, 000 according to different regions with a total of 55,000 deaths annually (Ferlay et al., 2015).

In Switzerland, melanoma incidence was in 2012 about 26.8 cases per 100,000 for men and 25.4 in women and mortality rate was 4.9 per 100,000 in men and 2.4 per 100,000 in women (Ferlay, 2013; Badertscher et al., 2014). Switzerland appears to have among the highest incidence rates of NMSC in Europe with 70 per 100, 000 person-year for basal cell carcinoma (BCC) and 28.9 per 100,000 for squamous cell carcinoma (SCC), BCC and SCC being the most common subtypes of NMSC (Lomas et al., 2012). Non melanomatous carcinomas accounted for 15,000 new cases diagnosed each year (Bulliard et al., 2009). In terms of temporal trends, incidence of melanoma has increased in Switzerland but the mortality rate has remained stable (Bordoni et al.,

* Corresponding author at: Division of Primary Care Medicine, Department of Primary Care Medicine, Geneva University Hospitals, Rue Gabrielle-Perret-Gentil 4, 1211 Geneva, Switzerland.
E-mail address: shireen.dumont@gmail.com (S. Dumont).

https://doi.org/10.1016/j.ypmed.2019.105829
Received 6 May 2019; Received in revised form 25 August 2019; Accepted 28 August 2019
Available online 30 August 2019
0091-7435/

2013). A similar trend has been observed in many European countries (Bordoni et al., 2013).

In order to reduce skin cancer mortality, efforts have been made to raise awareness of skin cancer- related risk factors and skin cancer screening campaigns started in the late 80s in Switzerland. Yet, little is known about the potential benefits of skin cancer screening in reducing mortality and most organizations, including the U.S Preventing Services Task Force, report insufficient evidence to recommend visual skin cancer screening in adults (US Preventive Services Task Force, 2016).

The Swiss Cancer League recommends a periodic skin cancer screening evaluation only for high-risk individuals (> 100 pigmented lesions, family history of melanoma or skin cancer, history of irregular moles, history of immunosuppression), acknowledging that there is limited scientific evidence to extend it to the general population (Déceler le cancer de la peau, n.d.). Thus, nationally coordinated skin cancer screening program does not exist but opportunistic skin cancer screening is performed (Badertscher et al., 2014; Heinzerling et al., 2002). In Switzerland, melanoma ten-year survival rate has improved from 79% to 83% for men and 84% to 87% for women between 1998 and 2012 (Arndt, 2016). It is not clear whether opportunistic skin cancer screening had an influence on this ten year survival improvement of melanoma cases.

Attitude regarding routine cancer screening differs within populations (Cullati et al., 2009). Gender and socioeconomic differences toward skin cancer screening have been reported with men and individuals with lower income or education being less likely to have a past-year skin examination (Koh et al., 1991; Swetter et al., 2009a; Coups et al., 2010). Skin cancer at later-stage of diagnosis is found more frequently in those with lower socio-economic status, reflecting partly and indirectly a lower rate of screening in this category (Eriksson et al., 2013, 2014; Hamilton et al., 2016; Hu et al., 2014; Eide et al., 2009; Kirsner et al., 2005; McLaughlin et al., 2011; Ortiz et al., 2005; Roetzheim et al., 1999; Rutherford et al., 2015; Strömberg et al., 2016; Van Durme et al., 2000).

To our knowledge, no studies investigated temporal trends of skin cancer screening by socioeconomic status (SES) in Switzerland. The aim of this study was to examine the 1997–2012 trends in skin cancer screening, its associations and changes over time with SES using data from a Swiss national health survey.

2. Methods

2.1. Survey design

Every five years since 1992, the Swiss Federal Office of Statistics has conducted a nationally representative survey to assess the health status of the Swiss general population (the Swiss Health Survey, or SHS). The SHS is a cross-sectional survey repeated every five years and respondents were selected randomly following a two-stage sampling strategy. First, they were contacted by phone and interviewed using a computer-assisted telephone interview. Second, respondents received at home a self-administered questionnaire (either paper or online). The questions assessing skin cancer screening were introduced in 1997; thus, the present study includes data from 1997 to 2012 waves. Mean response rate across waves was 63.0% (Table 1).

2.2. Dependent variables

Participants were asked several skin cancer screening related questions as follows: “Have you ever had your skin or moles examined by a doctor?” (yes, no) If respondents answered “yes”, he/she was asked about the date of the examination.

2.3. Independent variables

Sociodemographic characteristics included age (18–29, 30–39, 40–49, 50–64 and ≥65 years old), gender, marital status (single, married and registered partnership, widow, divorced or separated or registered partnership dissolved), origin (Swiss, not Swiss) and urban development of the dwelling place (metropolitan areas, medium size urban areas, small size urban areas and rural areas).

SES was measured with four indicators: education, household monthly income, employment and occupational class. Education levels matched the International Standard Classification of Education 1997 (The United Nations Educational, Scientific and Cultural Organization (UNESCO), 1997): primary education corresponded to compulsory education and lower secondary education (approximately 9 years of education starting at age 4 or 5), secondary education included additional specialized or vocational training (approximately 1–3 years of additional education), and tertiary included more theory-based and specialized degrees which corresponded to bachelors, masters and doctoral degrees (approximately an extra 1–8 years of education). Household income was weighed by the number of persons living in the household and included five levels: ≤2000, 2001–4000, 4001–6000, 6001–9000 and ≥9001. In 1997, 1 Swiss Franc (CHF) was equal to 0.69 USD and in 2012, it corresponded to 1.04 USD. Employment included being out of the labor force, working full time and working part time. For respondents in the labor force and in working status, occupational class was based on the Erikson social class scheme (Erikson et al., 2010) and included: overseers (including qualified workers) and skilled workers, independent professionals (including artisans), non-manual employees, liberal professions, intermediate professions.

Health status and health behavior variables encompassed self-rated health (very bad, bad, so-so, good, very good), body mass index (underweight, normal weight, overweight, obesity), physical symptoms (no or a few, some, important), smoking status (currently smoking versus no). For the health service use, one item assessed if respondents had had a general practitioner or family doctor visit in the last 12 months (yes, no).

We excluded participants aged < 18 years old and those with missing data on the skin screening questions, SES indicators, sociodemographic attributes, health status, or health service use (flow diagram of respondents inclusion in Fig. 1). The final study sample included 60,764 participants. We reported 49,169 and 47,737 participants in Tables 2 and 3 because of data missing for the following outcomes: exam in the current year (n = 1824), physical symptoms (n = 3897), and statistical weights (n = 8491). Missing data were assumed to be at random.

2.4. Statistical analysis

Descriptive statistics of respondents' characteristics were reported using weighted proportions. These weights were used to correct for the complex survey design and non-participation bias. Differences between waves were tested using unweighted chi-square test. Socioeconomic inequalities in skin cancer screening were examined using prevalence ratio (PR) and 95% confidence intervals (CI) estimated with adjusted and unadjusted Poisson regression. Robust variance estimators were used to relax the assumption that the outcome distributions follow a Poisson distribution. Prevalence ratios were estimated using weights provided by the SHS. Weights accounted for differences in probability of inclusion into the sample (due to the stratified sampling frame) and for non-answer. Probabilities of non-answer were estimated using self-rated health, chronic problem (“Do you have a chronic disease or long-term health problem?”), education level, age groups, sex, regions, type of household, smoking, and alcohol consumption (“What is your usual consumption of alcohol, that is to say beer, wine, liquors, aperitifs?”).

For the main analyses, models were stratified by year. Adjusted models included: age groups, sex, marital status, education, household income, employment status, occupational class of employed/workers, origin, urban areas, self-rated health, BMI, physical symptoms, smoking status, general practitioner or family doctor visit in the last 12 months,

Table 1
Characteristics of the 60,764 respondents, aged 18 years and older, Switzerland.

	1997 N = 9667	2002 N = 16,653	2007 N = 15,998	2012 N = 18,446	
Survey participation rates	68.8	63.9	66.3	53.1	
Characteristics	N (%)[a]	N (%)[a]	N (%)[a]	N (%)[a]	p-Value[b]
Age classes					< 0.001
18–29	1698(17.9)	1785(14.5)	1995(17.9)	2939(18.1)	
30–39	2331(22.1)	3817(23.1)	2989(18.9)	2832(17.0)	
40–49	1595(18.6)	3190(19.9)	3224(21.1)	4002(21.7)	
50–64	2095(22.4)	4221(23.6)	4039(24.1)	4814(23.8)	
≥65	1948(18.9)	3640(18.9)	3751(17.9)	3859(19.4)	
Sex					< 0.001
Male	4361(49.8)	7544(48.6)	7305(50.0)	8978(50.4)	
Female	5306(50.2)	9109(51.4)	8693(50.0)	9468(49.6)	
Marital status					< 0.001
Single	2507(23.0)	3986(22.8)	4111(27.6)	4997(29.9)	
Married and registered partnership	5201(62.3)	9332(64.1)	8316(57.3)	10,570(53.5)	
Widow	966(7.2)	1525(5.7)	1572(5.8)	990(5.6)	
Divorced, separated, registered partnership dissolved	993(7.5)	1810(7.4)	1999(9.4)	1889(11.1)	
Education					< 0.001
Compulsory	1744(17.4)	2457(14.6)	1623(8.6)	2410(13.1)	
Secondary	6287(65.0)	11,212(67.7)	9840(62.4)	10,341(55.5)	
Tertiary	1636(17.6)	2984(17.7)	4535(29.0)	5695(31.4)	
Household income in CHF[c]					< 0.001
≤2000	1538(15.6)	1640(10.6)	2444(14.9)	1333(7.7)	
2001–4000	4949(52.8)	8307(52.3)	7081(45.3)	8103(45.1)	
4001–6000	2386(23.6)	4623(25.5)	4126(24.8)	5751(30.6)	
6001–9000	659(6.6)	1656(9.2)	1745(11.0)	2461(12.7)	
≥9001	135(1.4)	427(2.4)	602(4.0)	798(4.0)	
Employment status					< 0.001
Out of the labor force	3675(36.6)	6163(34.0)	5781(31.0)	5390(27.6)	
Employed/workers full time	4371(46.8)	7113(45.5)	6616(45.8)	8316(46.8)	
Employed/workers part time	1621(16.6)	3377(20.4)	3601(23.1)	4740(25.7)	
Occupational class of employed/workers (N = 39,755)					< 0.001
Overseer, qualified worker, skilled worker	1584(27.9)	2485(26.4)	2371(25.4)	2935(23.6)	
Independent, artisan	620(10.5)	1198(10.8)	1204(10.8)	1884(13.8)	
Employee, non-manual professions	1438(22.7)	2418(22.6)	2120(20.2)	2533(18.7)	
Superior and intermediate professions	2350(38.8)	4389(40.2)	4522(43.5)	5704(43.9)	
Origin					< 0.001
Swiss	8289(83.4)	14,803(82.4)	14,113(81.8)	15,489(78.2)	
Not Swiss	1378(16.6)	1850(17.6)	1885(18.2)	2957(21.8)	
Urban areas					< 0.001
Metropolitan areas	2833(32.8)	4322(33.0)	6740(52.9)	8795(52.5)	
Medium size urban areas	2898(26.6)	5229(27.0)	4226(23.1)	4345(23.6)	
Small size urban areas	2333(23.7)	3735(22.3)	2596(11.8)	2940(11.7)	
Rural areas	1603(17.0)	3367(17.8)	2436(12.2)	2366(12.1)	
Health status	N (%)[a]	N (%)[a]	N (%)[a]	N (%)[a]	p-Value[b]
Self-rated health					< 0.001
Very bad	64(0.7)	79(0.4)	88(0.4)	109(0.6)	
Bad	318(3.0)	452(2.7)	413(2.2)	507(2.5)	
So-so	1257(12.6)	1910(10.7)	1689(9.3)	2504(13.0)	
Good	5531(57.9)	10,396(62.6)	10,599(66.9)	8149(44.2)	
Very good	2497(25.7)	3816(23.7)	3209(21.2)	7177(39.7)	
Body mass index					< 0.001
Underweight	1220(11.5)	1938(11.3)	527(3.1)	594(3.1)	
Normal weight	4992(51.1)	8246(49.6)	9189(58.1)	10,047(54.7)	
Overweight	2761(30.2)	5077(31.0)	4903(30.6)	5870(31.9)	
Obesity	694(7.2)	1392(8.0)	1379(8.1)	1935(10.3)	
Physical symptoms (missings 3897)					< 0.001
No, a few	2940(34.4)	6277(40.9)	5720(39.4)	8052(46.4)	
Some	3425(38.3)	5612(35.8)	5384(36.5)	5842(33.0)	
Important	2496(27.3)	3776(23.3)	3861(24.1)	3643(20.6)	
Currently smoking					< 0.001
No	6411(66.6)	11,564(69.1)	11,545(71.4)	13,276(71.3)	
Yes	3256(33.4)	5089(30.9)	4453(28.6)	5170(28.7)	
Health services uses	N (%)[a]	N (%)[a]	N (%)[a]	N (%)[a]	p-Value[b]
General practitioner or family doctor visit in the last 12 months					< 0.001
No	1924(21.2)	3751(23.3)	3086(20.1)	3813(21.6)	

(*continued on next page*)

Table 1 (*continued*)

Health services uses	N (%)[a]	N (%)[a]	N (%)[a]	N (%)[a]	p-Value[b]
Yes	7743(78.8)	12,902(76.7)	12,912(79.9)	14,633(78.4)	
Skin screening	**N (%)[a]**	**N (%)[a]**	**N (%)[a]**	**N (%)[a]**	**p-Value[b]**
Life-time skin examination					< 0.001
No	7211(75.2)	11,806(71.3)	10,301(64.5)	10,848(59.9)	
Yes	2456(24.8)	4847(28.7)	5697(35.5)	7598(40.1)	
Skin examination in the current year (missings 1824)					< 0.001
No	8491(90.1)	14,228(89.1)	13,168(86.3)	15,200(84.7)	
Yes	965(9.9)	1809(10.9)	2178(13.7)	2901(15.3)	

[a] All proportions are weighted.
[b] Unweighted Pearson Chi-square test.
[c] In 2018, 1 CHF = 0.88 EUR.

life-time skin examination and skin examination in the current year. For each SES indicator, we examined different coding schemes (education with three to five levels, income as continuous versus by category, employment three versus two levels) to check if results would change (data not shown). Time trends were tested by adding a wave (1997 = 1, 2002 = 2, 2007 = 3, 2012 = 4) and predictor product term model. A model restricted to those employed was conducted to examine the association between occupational class and skin cancer screening. Two sensitivity analyses were performed. The first targeted the age range of 35–75 years. This group was established based on the slope of incidence and mortality curves for melanoma and the percentage of cases falling into the age ranges adopted for each (Johnson et al., 2017). The second sensitivity analysis tested if findings of main analysis remained similar after multiple imputations on main (i.e., SES variables), creating 20 imputed datasets (Sterne et al., 2009).

Statistical tests were two-sided and p-value considered significant at alpha 5%. All analyses were conducted with SPSS 25 and STATA 12.

3. Results

Table 1 reports the characteristics of the 60,764 respondents included in the analysis of wave 1997 to 2012. The mean age was 49.1 years (standard deviation (SD) 17.2) with a participation of 53.6% women. We observed changes in participants' socioeconomic characteristics with an increase between 1997 and 2012 in adults with tertiary education and a slight decrease in adults with compulsory and secondary education. Distribution in income levels also varied from 1997 and 2012 with an increase in adults having a household income of 4000–6000 CHF and of 6000–9000 CHF. Household income < 4000 CHF tended to decrease. Over periods, a larger proportion of non-Swiss and people living in metropolitan areas compared to rural areas was reported.

Between 1997 and 2012, the weighted prevalence of ever life-time skin examination and skin examination in the current year increased by 38.2% and 35.3% respectively.

Tables 2 and 3 present adjusted prevalence ratios for life-time skin examination and skin examination in the current year according to participants' characteristics and waves. Participants with a lower education level, less income and living in non-metropolitan areas were less often screened than their counterparts.

Education but not employment was independently associated with life-time skin examination and skin examination in the current year. Respondents with tertiary education had a screening prevalence rate (PR) in the current year 44% higher and 69% higher compared to those with primary education (PR = 1.44, 95%CI: 1.06–1.97) in 2007 and (PR = 1.69, 95%CI: 1.40–2.05) in 2012. For life-time skin examination, temporal trends were significant (p-value 0.036). In analyses restricted to respondents in the labor force (n = 39,755, 65.4% of the total sample), superior and intermediate professions had significantly higher prevalence of life-time skin examination compared to overseers, qualified and skilled workers (Supplementary Table S1). These results were not apparent for skin examination in the current year, except in the recent waves, 2007 and 2012 (Supplementary Table S2).

Household income was positively associated with life-time skin

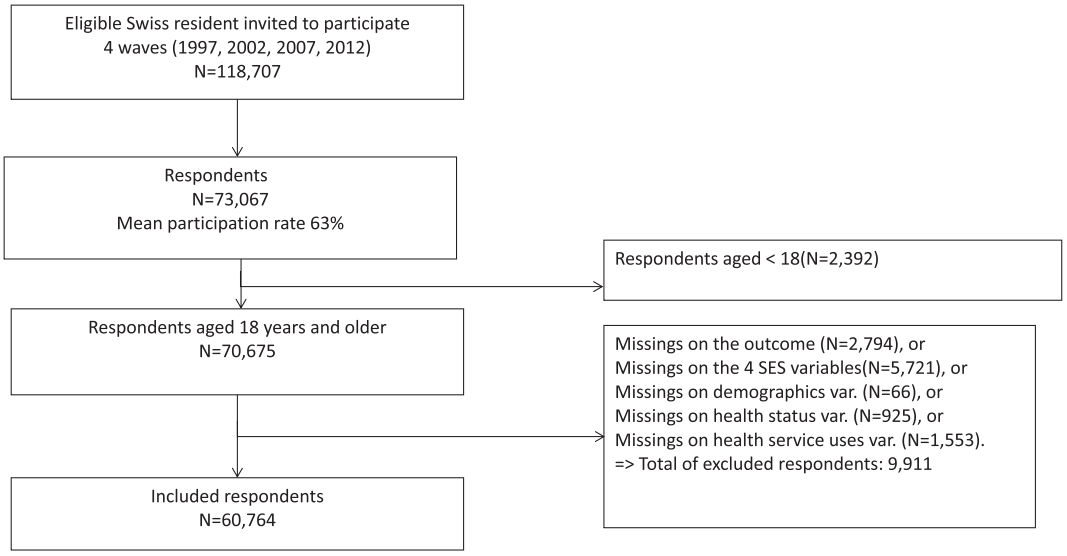

Fig. 1. Flow diagram of the respondents' inclusion.

Table 2
Adjusted[a] and weighted prevalence ratios (PR) for life-time skin examination, among the 49,169 participants (missing data for physical symptoms, statistical weights and exam in the current year are excluded), aged 18 years and older, from the Swiss Health Interview Survey 1997 and 2012.

	1997		2002		2007		2012		p-Value for trend[b]
	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	
Education (ref: primary)									0.036
Secondary	1.33	1.14–1.55	1.23	1.10–1.39	1.22	1.04–1.42	1.50	1.35–1.67	
Tertiary	1.62	1.36–1.93	1.35	1.18–1.55	1.38	1.17–1.62	1.80	1.61–2.01	
Household income (ref ≤ 2000)									0.791
2001–4000	1.22	1.04–1.42	1.12	0.98–1.28	1.19	1.06–1.34	1.26	1.11–1.43	
4001–6000	1.49	1.26–1.77	1.31	1.14–1.50	1.23	1.09–1.40	1.37	1.20–1.56	
6001–9000	1.49	1.21–1.84	1.34	1.14–1.58	1.50	1.30–1.74	1.51	1.31–1.73	
≥9001	1.57	1.12–2.21	1.81	1.49–2.21	1.57	1.29–1.90	1.61	1.37–1.89	
Employment (ref: employed/workers full time)									0.137
Out of the labor force	1.11	0.98–1.25	1.10	1.00–1.21	1.09	0.98–1.21	1.08	1.01–1.16	
Employed/workers part time	1.06	0.93–1.21	1.07	0.97–1.17	1.00	0.91–1.11	1.10	1.03–1.18	
Urbans areas (ref. Metropolitan areas)									0.681
Medium size urban areas	0.84	0.76–0.93	0.84	0.77–0.90	0.88	0.82–0.95	0.95	0.90–1.00	
Small size urban areas	0.72	0.63–0.81	0.79	0.72–0.86	0.84	0.76–0.92	0.91	0.85–0.97	
Rural areas	0.79	0.69–0.91	0.81	0.74–0.89	0.74	0.66–0.84	0.79	0.71–0.86	
Self-rated health (ref. very bad and bad)									0.135
So-so	1.20	0.90–1.60	0.94	0.76–1.15	1.00	0.79–1.27	1.00	0.86–1.17	
Good	1.12	0.85–1.47	1.02	0.84–1.23	0.96	0.77–1.20	1.04	0.90–1.20	
Very good	1.12	0.84–1.48	0.94	0.77–1.15	0.91	0.72–1.16	1.02	0.88–1.19	
BMI (ref. normal weight)									0.127
Underweight	1.18	1.05–1.34	1.12	1.01–1.23	1.12	0.96–1.32	1.02	0.90–1.15	
Overweight	0.88	0.79–0.99	0.94	0.87–1.01	0.92	0.85–1.00	0.87	0.82–0.92	
Obesity	0.92	0.76–1.11	0.87	0.76–0.99	0.88	0.76–1.03	0.88	0.80–0.96	
Smoking (ref. no)	1.01	0.92–1.11	0.99	0.92–1.07	1.01	0.93–1.09	0.97	0.92–1.03	0.391

[a] With age, sex, marital status, nationality, physical symptoms, and general practitioner or family doctor visit last 12 m.
[b] P-value for time-trend were estimated as follow: for each predictor (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.

examination with a screening prevalence 57% higher in high income respondents (≥ 9001$) compared to low income respondents (≤ 2000$) in 1997 (PR = 1.57, 95%CI: 1.12–2.21). In 2012, life-time skin examination was 61% higher in high income adults compared to adults with low income (PR = 1.61, 95%CI: 1.37–1.89). However, the test for temporal trend in life-time skin examination by household income was not significant (p-value for trend = 0.791). Similar results were found for skin examination in the current year (Table 3).

Table 3
Adjusted[a] and weighted prevalence ratios (PR) for skin examination in the current year, among the 47,737 participants (missing data for physical symptoms, statistical weights and exam in the current year are excluded), aged 18 years and older, from the Swiss Health Interview Survey 1997 and 2012.

	1997		2002		2007		2012		p-Value for trend[b]
	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	
Education (ref: primary)									0.103
Secondary	1.39	1.07–1.80	1.11	0.91–1.35	1.46	1.11–1.94	1.39	1.17–1.66	
Tertiary	1.44	1.06–1.97	1.17	0.93–1.48	1.69	1.25–2.29	1.69	1.40–2.05	
Household income (ref ≤ 2000)									0.400
2001–4000	1.10	0.84–1.43	1.25	0.98–1.58	1.21	0.97–1.51	1.31	1.04–1.66	
4001–6000	1.57	1.18–2.09	1.56	1.22–2.01	1.25	0.99–1.57	1.53	1.21–1.94	
6001–9000	1.49	1.04–2.14	1.58	1.18–2.11	1.28	0.97–1.69	1.81	1.40–2.33	
≥9001	1.93	1.11–3.35	2.04	1.41–2.95	1.67	1.14–2.45	1.93	1.41–2.63	
Employment (ref: employed/workers full time)									0.194
Out of the labor force	1.26	1.01–1.59	1.31	1.11–1.55	1.14	0.94–1.39	1.17	1.03–1.32	
Employed/workers part time	1.25	0.97–1.60	1.32	1.10–1.57	0.94	0.78–1.13	1.03	0.91–1.18	
Urbans areas (ref. Metropolitan areas)									0.969
Medium size urban areas	0.77	0.64–0.93	0.85	0.74–0.99	0.85	0.74–0.98	0.96	0.86–1.07	
Small size urban areas	0.71	0.57–0.88	0.81	0.69–0.96	0.80	0.67–0.94	0.95	0.83–1.08	
Rural areas	0.60	0.46–0.78	0.85	0.71–1.01	0.86	0.71–1.05	0.71	0.59–0.86	
Self-rated health (ref. very bad and bad)									0.744
So-so	1.01	0.62–1.63	0.76	0.54–1.05	0.87	0.60–1.25	0.94	0.72–1.21	
Good	0.98	0.62–1.55	0.76	0.56–1.03	0.83	0.60–1.16	0.96	0.75–1.22	
Very good	1.06	0.66–1.71	0.68	0.49–0.94	0.78	0.54–1.14	0.91	0.70–1.18	
BMI (ref. normal weight)									0.682
Underweight	1.15	0.92–1.45	1.21	1.01–1.45	1.29	0.95–1.77	1.04	0.81–1.32	
Overweight	0.87	0.71–1.07	0.88	0.76–1.00	0.83	0.71–0.97	0.86	0.77–0.96	
Obesity	0.89	0.64–1.24	0.80	0.63–1.03	0.92	0.71–1.21	0.84	0.71–0.99	
Smoking (ref. no)	1.12	0.94–1.32	0.97	0.84–1.11	0.86	0.74–1.00	0.90	0.80–1.00	0.033

[a] With age, sex, marital status, nationality, physical symptoms, and general practitioner or family doctor visit last 12 m.
[b] P-value for time-trend were estimated as follow: for each predictor (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.

Rural areas, small size and medium size urban areas were associated with lower rates of life-time skin examination and skin examination in the current year compared to metropolitan residence. In 2012, the weighted proportion of life-time skin examination was 33.8% and adjusted prevalence ratio 0.79 (95%CI: 0.71–0.86) for participants living in rural areas as compared with 43.6% and 1.00 (reference) for those living in metropolitan areas (Table 2 and Supplementary S3). Results were similar for skin examination in the current year. No consistent associations were found of self-rated health, BMI status and smoking status with skin examination (life-time or in the current year).

In sensitivity analysis, we found similar findings when restricting the sample to participants aged 35 to 75 years and when imputing missing data on the three SES predictors (Table S5).

4. Discussion

To our knowledge, this study is the first to assess nationwide trends over 15 years of skin cancer screening in Switzerland. Both life-time skin examination and skin examination in the current year increased by one third from 1997 to 2012. Social inequalities in skin cancer screening exist and persisted over time.

The efficacy of skin cancer screening is controversial and guidelines differ internationally and within the same country. In the US, as in Switzerland, there is no national consensus on skin cancer screening. Recently, the US Preventive Services Task Force recommendation reported that there was insufficient evidence to make a clear statement on the benefit of skin cancer screening (Johnson et al., 2017). On the other hand, Johnson et al. propose to identify a target age range of individuals to screen and to identify a high-risk group of individuals (based on relative risk and odds ratio data) that could mostly benefit from skin cancer screening. The term “high-risk” was defined as non-Hispanic, white men and women aged > 65 years; individuals with a history of sunburn; and/or individuals with a family history of skin cancer (Johnson et al., 2017). Beyond these recommendations, the lack of evidence on the benefits of skin cancer screening did not limit skin examination from growing over time in Switzerland.

The Swiss Cancer League recommends periodic skin cancer screening evaluation only for high-risk individuals (Badertscher et al., 2014; Déceler le cancer de la peau, n.d.; Heinzerling et al., 2002). Overall weighted proportion (1997–2012) for both life-time skin examination and examination in the current year increased, probably due to a number of campaigns in Switzerland and also to the increasing awareness over the past decades of health risks and health prevention in the general population in Switzerland and in high-income countries (Relecom et al., 2018; Leiss et al., 1995). Many studies underline the effect of national prevention campaigns and support their crucial impact on raising awareness of risk factors, skin cancer (primary and secondary), prevention methods and educating high-risk and at-risk individuals (Lieberherr et al., 2017; Braun et al., 2017). In the United States, contrary to our results, skin cancer exam rates decreased in the general population from 21% in 1992 to 15% in 2000. This decrease has been explained by inconsistent medical recommendations and underreporting exams, skin examinations being particularly challenging to measure; for example, a physician could have checked the patient's skin during an annual general exam, without telling him it has been done (Saraiya et al., 2004).

Similarly to other studies (Koh et al., 1991; Coups et al., 2010; Eriksson et al., 2013, 2014; Hamilton et al., 2016; Hu et al., 2014; Eide et al., 2009; Kirsner et al., 2005; McLaughlin et al., 2011; Ortiz et al., 2005; Roetzheim et al., 1999; Rutherford et al., 2015; Strömberg et al., 2016; Saraiya et al., 2004; Cullati et al., 2009; Janda et al., 2004; Kasparian et al., 2010; LeBlanc et al., 2008; Martires et al., 2014; Pollitt et al., 2012; Swetter et al., 2009b; Van Durme et al., 2000), our results highlighted inequalities in skin cancer screening according to the level of education and income with higher rates of skin examination among participants with higher income and those with higher education. These disparities remained stable over the time period except for life-time skin examination along with education: our study showed growing differences between low and high educational level over time. The prevalence increased by 5.5% among the primary educated and by 18.7% among the tertiary educated (primary: 18.3% in 1997, 23.8 in 2012; tertiary: 31.0 in 1997, 49.7 in 2012). Such growing educational differences in life-time skin examination suggests that advantaged people are more incline and quick to adopt preventive health services, leading to a growing gap in health inequalities, a result potentially in line with the diffusion of innovation theory (Rogers, 2002; Hahm et al., 2011). Lower rates of screening may lead to more advanced skin cancer at diagnosis. More advanced stage at diagnosis was found in men living alone, low educated people, Hispanics and residents of rural areas (Eriksson et al., 2013, 2014; Hamilton et al., 2016; Hu et al., 2014; Eide et al., 2009; Kirsner et al., 2005; McLaughlin et al., 2011; Ortiz et al., 2005; Roetzheim et al., 1999; Rutherford et al., 2015; Strömberg et al., 2016; Van Durme et al., 2000). Differences in time before seeking medical advices because of a lack of knowledge of cancer symptoms and risk factors or a fear to consult a specialist can also explain more advanced stage at diagnosis. In general, it is known that time delay between symptom onset and presentation to a general practitioner among melanoma patients is longer than those observed for patients with other cancers, probably due to the slow onset of symptoms and their lack of specificity (Rutherford et al., 2015).

The national health care system could have played a role in terms of access to screening. In Switzerland, a country characterized by universal healthcare coverage (De Pietro et al., 2015), a fee-for-service payment system in the ambulatory sector and the highest out-of-pocket expenses among OECD countries (De Pietro et al., 2015; OECD, 2019). Between 2007 and 2010, one out of seven adults forwent healthcare in the past 12 months and among them 25.4% forwent a specialist consultation for economic reasons (Guessous et al., 2012). The prevalence of forgoing healthcare for economic reasons is strongly associated with SES, the highest rate being among participants with the lowest income (Guessous et al., 2012).

We observed strong regional differences with a higher rate of skin cancer screening in the metropolitan compared to rural areas. A population-based study in Ireland investigated the urban-rural variations in the incidence of 18 cancers. After adjusting for SES, they found that the risk of non-melanoma and melanoma skin cancer was slightly higher in urban than rural areas, explained partly by a lower rate of primary care utilization in rural than urban areas, and differences in sun radiation exposure. The authors suggested that: “divergences in cancer risk factors, belief and help-seeking behaviour in rural inhabitants could be the reasons of the geographical differences observed” (Sharp et al., 2014; Carsin et al., 2011).

4.1. Limitations and strengths

Our study has several limitations. First, it was based on self-reported data on screening, where recall bias cannot be excluded.(Aitken et al., 2004) Self-reported life-time skin examination can be more affected by this bias by asking participants of a clinical exam that might happen many years ago. However for self-reported skin examination in the current year, errors can be due to “telescoping” (Gordon et al., 1993; Warnecke et al., 1997), by underestimating the amount of time passed since the last examination. Thus, even questioning with wide time frame, self-reports of whole-body skin examination seem to be a reliable source of data for epidemiologic studies (Aitken et al., 2004). Second, selection bias may also be possible in our study as SHIS response rate ranged from 53.1 to 68.8%. The use of weighted prevalence ratio should have decreased the effect of this bias. Thirdly, the large target age group from 18 and above can, however, be considered not relevant (Johnson et al., 2017). By choosing the age group 18 and older, we followed the strategy of the SCREEN project (Skin Cancer Research to Provide Evidence for Effectiveness of Screening in Northern Germany),

the first nationwide skin cancer screening program conduct in Germany in 2008 (Breitbart et al., 2012). Our analysis restricted to adults between 35 and 75 years showed similar results compared to the main analysis in terms of socioeconomic inequalities. Another limitation is that we did not have information about the participants' exposition to skin cancer prevention campaign, which may clearly influence individual skin cancer screening. Finally, while we adjusted for multiple potential confounders, we cannot exclude residual confounding, especially considering the changes in the context and environment that occurred throughout de study period.

Despite these limitations, our study has several strengths including the large population-based sample, the long study period and the analysis of the socioeconomic position by including several indicators. Moreover, all analyses were weighted and corrected for the sampling strategy and the health selection bias, and were adjusted with sociodemographic, health status and health behaviors confounders.

5. Conclusion

This study is the first to assess nationwide trends over time of skin cancer screening in Switzerland, a country with the highest rates of skin cancer in Europe. Skin cancer screening prevalence increased from 1997 to 2012 but strong socioeconomic disparities persisted over time. Similarly to what has been observed in the United States and Europe, we found a lower rate of screening among adults with lower education, lower income and living more frequently in rural areas compared to their counterparts (Koh et al., 1991; Coups et al., 2010; Eriksson et al., 2013, 2014; Hamilton et al., 2016; Hu et al., 2014; Eide et al., 2009; Kirsner et al., 2005; McLaughlin et al., 2011; Ortiz et al., 2005; Roetzheim et al., 1999; Rutherford et al., 2015; Strömberg et al., 2016; Saraiya et al., 2004; Cullati et al., 2009; Janda et al., 2004; Kasparian et al., 2010; LeBlanc et al., 2008; Martires et al., 2014; Pollitt et al., 2012; Swetter et al., 2009b; Van Durme et al., 2000). Identifying these socioeconomic risk factors is mandatory to improve screening practices and strategies. Unlike other countries, however, we observed worrisome growing educational disparities. The evidence that the benefits of skin cancer screening for the general population outweigh the risks is unclear and current guidelines recommend periodic skin cancer screening evaluation only for high-risk individuals.

Funding

This work was supported by a grant of the Swiss Cancer League (KLS 3144-02-2013).

Data availability

This study used the data from the Swiss Interview Survey (SIS). Data are available for fee (1500 Swiss Francs, plus 8.0% tax) and users must request permission from the Swiss Federal Statistical Office (sgb12@bfs.admin.ch). Data must be destroyed after five years.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.105829.

References

Aitken, J.F., et al., 2004. Validity of self-reported skin screening histories. Am. J. Epidemiol. 159, 1098–1105.
Arndt, Volker, 2016. Le cancer en Suisse, rapport 2015 Etat des lieux et évolutions. Office fédéral de la statistique (OFS).
Badertscher, N., et al., 2014. The role of skin self-examination at the Swiss skin cancer day. BMC Health Serv. Res. 14, 581.
Bordoni, A., et al., 2013. Opportunistic screening strategy for cutaneous melanoma does not change the incidence of nodular and thick lesions nor reduce mortality: a population-based descriptive study in the European region with the highest incidence. Melanoma Res. 23, 402–407.
Braun, R.-P., et al., 2017. Evaluation of the national Swiss skin cancer screening campaign 2013: do we do the right thing? Dermatol. Basel Switz. https://doi.org/10.1159/000484946.
Breitbart, E.W., et al., 2012. Systematic skin cancer screening in Northern Germany. J. Am. Acad. Dermatol. 66, 201–211.
Bulliard, J.-L., Panizzon, R.G., Levi, F., 2009. Epidemiology of epithelial skin cancers. Rev. Med. Suisse 5 (882), 884–888.
Carsin, A.E., Sharp, L., Comber, H., 2011. Geographical, urban/rural and socioeconomic variations in nonmelanoma skin cancer incidence: a population-based study in Ireland. Br. J. Dermatol. 164, 822–829.
Coups, E.J., Geller, A.C., Weinstock, M.A., Heckman, C.J., Manne, S.L., 2010. Prevalence and correlates of skin cancer screening among middle-aged and older white adults in the United States. Am. J. Med. 123, 439–445.
Cullati, S., Charvet-Bérard, A.I., Perneger, T.V., 2009. Cancer screening in a middle-aged general population: factors associated with practices and attitudes. BMC Public Health 9 (118).
De Pietro, C., et al., 2015. Switzerland: health system review. Health Syst. Transit. 17 (xix), 1–288.
Déceler le cancer de la peau Ligue contre le cancer. Available at. https://www.liguecancer.ch/prevenir-le-cancer/depistage-et-prevention-du-cancer/deceler-le-cancer-de-la-peau/ (Accessed: 7th November 2018).
Eide, M.J., Weinstock, M.A., Clark, M.A., 2009. Demographic and socioeconomic predictors of melanoma prognosis in the United States. J. Health Care Poor Underserved 20, 227–245.
Erikson, R., Goldthorpe, J.H., Portocarero, L., 2010. Intergenerational class mobility and the convergence thesis: England, France and Sweden. 1979. Br. J. Sociol. 61 (Suppl. 1), 185–219.
Eriksson, H., et al., 2013. Low level of education is associated with later stage at diagnosis and reduced survival in cutaneous malignant melanoma: a nationwide population-based study in Sweden. Eur. J. Cancer Oxf. Engl. 1990 49, 2705–2716.
Eriksson, H., et al., 2014. Later stage at diagnosis and worse survival in cutaneous malignant melanoma among men living alone: a nationwide population-based study from Sweden. J. Clin. Oncol. Off. J. Am. Soc. Clin. Oncol. 32, 1356–1364.
Ferlay, J., et al., 2013. Cancer incidence and mortality patterns in Europe: estimates for 40 countries in 2012. Eur. J. Cancer Oxf. Engl. 1990 49, 1374–1403.
Ferlay, J., et al., 2015. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int. J. Cancer 136, E359–E386.
Gordon, N.P., Hiatt, R.A., Lampert, D.I., 1993. Concordance of self-reported data and medical record audit for six cancer screening procedures. J. Natl. Cancer Inst. 85, 566–570.
Guessous, I., Gaspoz, J.M., Theler, J.M., Wolff, H., 2012. High prevalence of forgoing healthcare for economic reasons in Switzerland: a population-based study in a region with universal health insurance coverage. Prev. Med. 55, 521–527.
Hahm, M.-I., et al., 2011. Inequalities in adoption of cancer screening from a diffusion of innovation perspective: identification of late adopters. Cancer Epidemiol. 35, 90–96.
Hamilton, E.C., et al., 2016. Health disparities influence childhood melanoma stage at diagnosis and outcome. J. Pediatr. 175, 182–187.
Heinzerling, L.M., et al., 2002. Prevention campaign against skin cancer. Dermatol. Basel Switz. 205, 229–233.
Hu, S., Sherman, R., Arheart, K., Kirsner, R.S., 2014. Predictors of neighborhood risk for late-stage melanoma: addressing disparities through spatial analysis and area-based measures. J. Invest. Dermatol. 134, 937–945.
Janda, M., et al., 2004. Attitudes and intentions in relation to skin checks for early signs of skin cancer. Prev. Med. 39, 11–18.
Johnson, M.M., et al., 2017. Skin cancer screening: recommendations for data-driven screening guidelines and a review of the US Preventive Services Task Force controversy. Melanoma Manag. 4, 13–37.
Kasparian, N.A., et al., 2010. Skin cancer screening behaviours among individuals with a strong family history of malignant melanoma. Br. J. Cancer 103, 1502–1509.
Kirsner, R.S., Wilkinson, J.D., Ma, F., Pacheco, H., Federman, D.G., 2005. The association of Medicare health care delivery systems with stage at diagnosis and survival for patients with melanoma. Arch. Dermatol. 141, 753–757.
Koh, H.K., et al., 1991. Who is being screened for melanoma/skin cancer? Characteristics of persons screened in Massachusetts. J. Am. Acad. Dermatol. 24, 271–277.
LeBlanc, W.G., et al., 2008. Reported skin cancer screening of US adult workers. J. Am. Acad. Dermatol. 59, 55–63.
Leiss, William, Beck, Ulrich, Ritter, Mark, Lash, Scott, Wynne, Brian, 1995. Risk Society, Towards a New Modernity. pp. 544.
Lieberherr, S., et al., 2017. Evaluation of the national skin cancer campaign: a Swiss experience of euromelanoma. Swiss Med. Wkly. 147, w14511.
Lomas, A., Leonardi-Bee, J., Bath-Hextall, F., 2012. A systematic review of worldwide incidence of nonmelanoma skin cancer. Br. J. Dermatol. 166, 1069–1080.
Martires, K.J., Kurlander, D.E., Minwell, G.J., Dahms, E.B., Bordeaux, J.S., 2014. Patterns of cancer screening in primary care from 2005 to 2010. Cancer 120, 253–261.
McLaughlin, J.M., Fisher, J.L., Paskett, E.D., 2011. Marital status and stage at diagnosis of cutaneous melanoma: results from the Surveillance Epidemiology and End Results (SEER) program, 1973–2006. Cancer 117, 1984–1993.
OECD, 2019. Health Spending (Indicator). https://doi.org/10.1787/8643de7e-en. (Accessed on 09 February 2019).

Ortiz, C.A.R., Goodwin, J.S., Freeman, J.L., 2005. The effect of socioeconomic factors on incidence, stage at diagnosis and survival of cutaneous melanoma. Med. Sci. Monit. Int. Med. J. Exp. Clin. Res. 11, RA163–172.
Pollitt, R.A., Swetter, S.M., Johnson, T.M., Patil, P., Geller, A.C., 2012. Examining the pathways linking lower socioeconomic status and advanced melanoma. Cancer 118, 4004–4013.
Relecom, A., Arzel, B., Perneger, T., 2018. Effect of an organised screening program on socioeconomic inequalities in mammography practice, knowledge and attitudes. Int. J. Equity Health 17 (95).
Roetzheim, R.G., et al., 1999. Effects of health insurance and race on early detection of cancer. J. Natl. Cancer Inst. 91, 1409–1415.
Rogers, E.M., 2002. Diffusion of preventive innovations. Addict. Behav. 27, 989–993.
Rutherford, M.J., et al., 2015. Estimating the potential survival gains by eliminating socioeconomic and sex inequalities in stage at diagnosis of melanoma. Br. J. Cancer 112 (Suppl. 1), S116–S123.
Saraiya, M., et al., 2004. Skin cancer screening among U.S. adults from 1992, 1998, and 2000 National Health Interview Surveys. Prev. Med. 39, 308–314.
Sharp, L., et al., 2014. Risk of several cancers is higher in urban areas after adjusting for socioeconomic status. Results from a two-country population-based study of 18 common cancers. J. Urban Health Bull. N. Y. Acad. Med. 91, 510–525.
Sterne, J.A.C., et al., 2009. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. BMJ 338, b2393.
Strömberg, U., et al., 2016. Cutaneous malignant melanoma show geographic and socioeconomic disparities in stage at diagnosis and excess mortality. Acta Oncol. Stockh. Swed. 55, 993–1000.
Swetter, S.M., et al., 2009a. Gender differences in melanoma awareness and detection practices between middle-aged and older men with melanoma and their female spouses. Arch. Dermatol. 145 (488–490).
Swetter, S.M., et al., 2009b. Melanoma in middle-aged and older men: a multi-institutional survey study of factors related to tumor thickness. Arch. Dermatol. 145, 397–404.
The United Nations Educational, Scientific and Cultural Organization (UNESCO), 1997. International. Standard. Classification of Education (ISCED).
US Preventive Services Task Force, et al., 2016. Screening for skin cancer: US preventive services task force recommendation statement. JAMA 316, 429–435.
Van Durme, D.J., et al., 2000. Demographic predictors of melanoma stage at diagnosis. Arch. Fam. Med. 9, 606–611.
Warnecke, R.B., et al., 1997. Cognitive aspects of recalling and reporting health-related events: Papanicolaou smears, clinical breast examinations, and mammograms. Am. J. Epidemiol. 146, 982–992.