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Public smoking ban and socioeconomic inequalities in smoking prevalence and cessation: a cross-sectional population-based study in Geneva, Switzerland (1995–2014)

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ABSTRACT

Introduction Smoking bans were suggested to reduce smoking prevalence and increase quit ratio but their equity impact remains unclear. We aimed to characterise the socioeconomic status (SES)-related inequalities in smoking prevalence and quit ratio before and after the implementation of a public smoking ban.

Methods We included data from 17 544 participants in the population-based cross-sectional Bus Santé study in Geneva, Switzerland, between 1995 and 2014. We considered educational attainment (primary, secondary and tertiary) as a SES indicator. Outcomes were smoking prevalence (proportion of current smokers) and quit ratio (ex-smokers to ever-smokers ratio). We used segmented linear regression to assess the overall impact of smoking ban on outcome trends. We calculated the relative (RII) and slope (SII, absolute difference) indexes of inequality, quantifying disparities between educational groups in outcomes overall (1995–2014), before and after ban implementation (November 2009).

Results Least educated participants displayed higher smoking prevalence (RII=2.04, P<0.001; SII=0.15, P<0.001) and lower quit ratio (RII=0.73, P<0.001; SII=−0.18, P<0.001). As in other studies, smoking ban implementation coincided with a temporary reduction of smoking prevalence (P=0.003) and increase in quit ratio (P=0.02), with a progressive return to preban levels. Inequalities increased (P<0.05) in relative terms for smoking prevalence (RII_{before}=1.84, P<0.001 and RII_{after}=3.01, P<0.001) and absolute terms for both outcomes (smoking prevalence: SII_{before}=0.14, P<0.001 and SII_{after}=0.19, P<0.001; quit ratio: SII_{before}=−0.15, P<0.001 and SII_{after}=−0.27, P<0.001).

Conclusions Implementation of a public smoking ban coincided with a short-lived decrease in smoking prevalence and increase in quit ratio but also with a widening in SES inequalities in smoking-related outcomes.

INTRODUCTION

Smoking is associated with a higher risk of cancer and cardiovascular disease in a dose-dependent relation.[1–5] As such, smoking prevention and smoking cessation have been two main goals in public health to reduce the worldwide burden of cancer and cardiovascular disease.[6]

To improve tobacco control, several interventions are recommended to increase quit ratio (ratio of ex-smokers to ever-smokers) and reduce smoking prevalence: increasing tobacco prices through taxation, smoking bans in workplaces and public places, advertising bans, health warning labels on tobacco products, education programmes and increased support to smoking cessation.[7–9]

Of note, smoking prevalence and cessation have been closely linked to socioeconomic status (SES), with higher prevalence and lower cessation being observed in individuals with lower SES in high income countries.[10–13] Consequently, these SES disparities in smoking outcomes generate inequalities in mortality and morbidity due to tobacco-related diseases.[14 15] In fact, the cigarette epidemic model proposed by Lopez *et al* suggests that SES inequalities will increase in high-income countries[16 17] and this has been observed in European countries.[12]

The aforementioned tobacco control interventions have been shown to differently affect various population strata, potentially leading to outcomes that differ according to SES.[18] Thus, in addition to assessing the impact of tobacco control interventions on producing the desired outcome, understanding if the desired benefit is delivered to the totality of the population or those at higher risk of negative outcome is necessary to reduce or prevent a widening of SES inequalities.

Switzerland is a federal republic where each of the 26 states has a certain degree of legislative independence,[19] resulting in a heterogeneous implementation of antismoking measures. In the State of Geneva, a partial smoking ban came definitively into effect in November 2009 (https://www.ge.ch/legislation/rsg/f/s/rsg_K1_18.html) and includes governmental public buildings and spaces, healthcare facilities, schools, nurseries, sports facilities, gambling venues, shops and shopping malls, public transportation, hotels restaurants, bars and clubs. Smoking in these locations is only allowed in ventilated and isolated smoke houses where no public service can be provided. For private facilities, such as rooms in detention centres, hotel rooms and healthcare facility rooms, these must be isolated and well ventilated. Workplaces were not targeted by the 2009 ban.

While a previous study reported SES inequalities in smoking in Switzerland,[20] no studies explored the impact of tobacco control interventions on smoking SES inequalities in Switzerland. Studies set in other countries reported contradictory results

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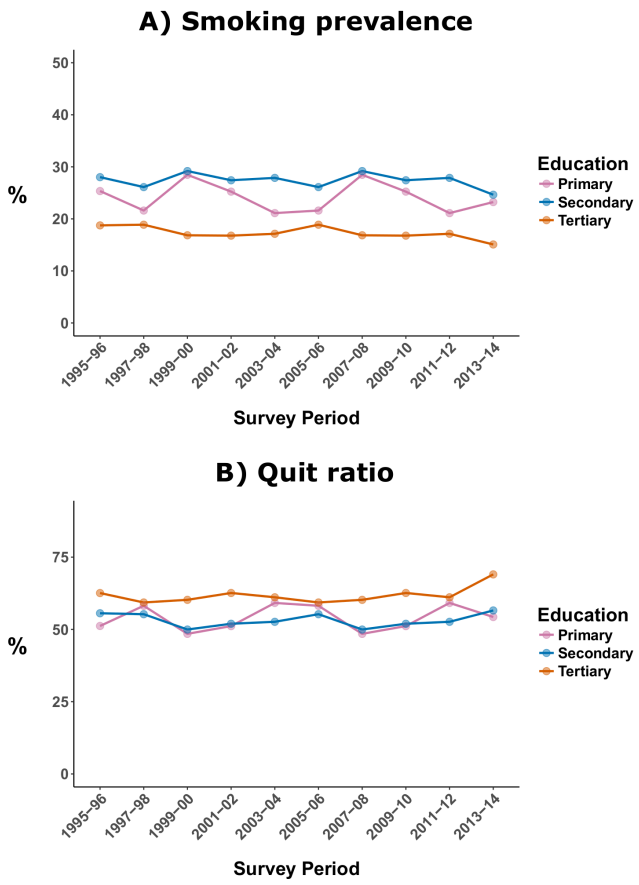

Figure 1 (A) Smoking prevalence and (B) quit ratio by survey period and educational attainment. Proportions are age-adjusted.

with interventions either coinciding with a reduction in SES inequalities in smoking or having no impact on them.[21–24]

In order to inform policy makers on the existence of SES inequalities and their impact, using both relative and absolute measures has been recommended.[25 26] We used data from a population-based study conducted in Geneva, with educational attainment as an indicator of SES, in order to assess whether absolute and relative SES inequalities in smoking prevalence and smoking cessation existed. We then explored whether the implementation of a smoking ban had an impact on smoking prevalence and cessation levels, and in SES inequalities, if any.

METHODS

Participants

We used data from a cross-sectional population-based study ongoing in the State of Geneva (population of ≈500 000 in 2014), aiming at monitoring health risk factors at a state level (the Bus Santé Study). Sampling methodology has been previously described.[27] Briefly, annual health examination surveys were conducted in independent samples of residents since 1993. Participant selection was based on a residents list provided by the local government, including individuals aged 35–74 years until 2011 and 20–74 years afterwards. Stratified random sampling was conducted based on gender and 10-year age strata. Participants were invited to one of the three Bus Santé study units, at which trained collaborators examine the participants and administer the questionnaires. Two of the units are fixed at the Geneva University Hospitals and a third one is a mobile unit which visits various parts of the Geneva Canton. Invited participants who do not respond are called by telephone up to seven times at different times of the day and at various days of the week. If telephone contact is unsuccessful, two additional invitations are mailed. Unreachable participants are considered non-responders and replaced using the same selection strategy.

Annual participation rate ranged from 60.1% for the 1996–2003 period to 50.8% for 2010–2014. A decrease in participant recruitment was observed for the period between 2005 and 2008 due to a concomitant study taking place sharing logistical resources but not the same target population.

Written consent was obtained for all participants, and the Bus Santé study complied with the Declaration of Helsinki.

We included participants with ages between 35 and 74 years, representing the age group that was consistently recruited during the totality of the study and to avoid potentially distorting trend analyses. For the years 1993 and 1994, missing data for smoking status was >40% and all participants from this period were excluded (n=1665, 7.4%). We also excluded participants for which educational attainment data were missing (n=450, 2.5%), which we assumed were missing completely at random.

Variables

We created a binary variable identifying participants who were surveyed before or after the introduction of the smoking ban in November 2009.

We considered three levels of educational attainment as in Huisman *et al*[28]: (1) no end of school certification,—'no Maturité'—or no professional apprenticeship (primary), (2) attaining secondary education—obtaining 'Maturité' or professional apprenticeship (secondary) and (3) University degree (tertiary).

The outcome variables were smoking prevalence (proportion of current smokers among all participants) and quit ratio (ratio of ex-smokers to ever-smokers). Smokers were defined as individuals who consumed five cigarettes per day or more. We chose to exclude very light smokers (<5 cigarettes per day, n=1432, 7.2%) since they seem to differ from heavier smokers in relation to probability of trying to quit and tobacco dependence, namely cravings before and after quitting smoking.[29 30] We performed a sensitivity analysis including very light smokers (online supplementary tables 3—5) which did not change the overall results.

We considered the following potential confounders: gender (female/male), age (in continuous), nationality (Swiss or other) and pack-year units consumption quantifier (number of cigarettes per day/20*(total number years as a smoker)).

Statistical analysis

Numbers and frequencies are presented for categorical values and means±SD for continuous. Smoking prevalence and quit ratio in different survey periods, as displayed in figure 1, were age-adjusted using the 2015 Swiss population age distribution, obtained from the Swiss Federal Statistical Office (https://www.bfs.admin.ch/bfs/en/home/statistics/population.html).

Differences in categorical and continuous variables were tested using the χ^2 test of independence and one-way analysis of variance, respectively.

We used unadjusted and multivariable Poisson regression models adjusting for confounders to estimate prevalence ratios (PR) and determine the association between exposure and

outcome variables. In addition, models were adjusted for secular trends using the survey date in calendar years.[21 31 32]

In order to quantify absolute and relative differences between SES-defined strata, we calculated the slope index of inequality (SII) and the relative index of inequality (RII), which describe the absolute and relative differences, respectively, between the two SES extremes and take into account the intermediate categories.[26]

For example, RII=1.1 means an additional 10% prevalence of the outcome in the least educated group when compared with the most educated. The RII can be interpreted similarly to a PR.

SII, an impact measure, represents an absolute difference in outcome prevalence between the least and most educated groups. An SII=0.1, for example, indicates 10 more participants with the outcome per 100 individuals of the least educated group compared with the most educated one.

To determine if SES inequalities in outcome variables changed after the introduction of the smoking ban, SII and RII were calculated before and after introduction of the ban and compared. We used the STATA package *RIIGEN* which applies previously described formula.[26 33] RII and SII were compared between different periods using Wald tests.

A segmented linear regression model was used to determine the effect of the introduction of the smoking ban on the probability of being a current smoker or an ex-smoker. Model was as follows: SP_t or $QR_t = \beta_0 + \beta_1\, time + \beta_{proportion}\, intervention + \beta_{trend}\, time\ after\ intervention + \varepsilon_t$, where SP_t is smoking prevalence in year t, QR_t is quit ratio in year t, β_0 estimates outcome baseline level, β_1 estimates overall outcome time trend, *time* indicates time in years at time t since the start of the studied period, *intervention* is coded as 0 (before smoking ban) and 1 (after smoking ban), *time after intervention* is an interaction term between *time* and *intervention* and denotes the number of years after intervention with years preceding it being coded as 0, and ε_t referrers to random variability not explained by this model. In addition, this model allows quantifying the mean change in outcome proportion (level change after the ban, $\beta_{proportion}$) and also the change in time trend after the intervention (trend change after the ban, β_{trend}), as previously described.[21]

We assessed the level of tobacco consumption as a mediator of the effect of educational attainment on quit ratio by calculating the RII and SII overall, before and after the introduction of the smoking ban adjusted for pack-year units. Effect modification by this variable was assessed by adding an interaction term between smoking ban and pack-year units to the regression analyses.

All data were analysed using R V.3.2.2 and STATA V.13.1. A two-sided $P<0.05$ was considered significant.

RESULTS

Baseline characteristics of participants

Characteristics of participants are reported in table 1. We included a total of 17 544 adults with a mean age of 51.9±10.8 years. Seventy per cent were Swiss nationals, 52.1% female, 48.6% never smokers, 29.8% ex-smokers, 21.6% current smokers and overall quit ratio was 57.9%. Nineteen per cent had primary education, while 44.5% and 36.0% had secondary and tertiary education, respectively. Mean pack-year units for current smokers were 26.5±19.5 and 18.1±17.6 for ex-smokers. Twenty-three per cent (23.4%) were surveyed after the introduction of the smoking ban.

When stratified by educational attainment, groups with higher education were younger, more often Swiss and surveyed after the introduction of the smoking ban. The mean number of pack-year units was lower (P<0.001) in more educated participants both for current and ex-smokers (23.0±17.9 vs 28.6±19.1 and 15.7±15.1 vs 20.4±20.0, respectively).

Participants with tertiary education, when compared with least educated, had a lower proportion (P<0.001) of current smokers (16.2% vs 23.3%) and higher quit ratio (64.8% vs 53.9%) (table 1, figure 1A,B).

Table 1 Participants' characteristics (1995–2014, Bus Santé study, State of Geneva, Switzerland)

	All participants	Primary	Secondary	Tertiary	P value
Number (N) of participants (%)	17 544 (100%)	3419 (19.5)	7799 (44.5)	6326 (36.0)	
Mean age±SD, years	51.9±10.8	53.5±11.0	52.6±10.8	50.2±10.6	<0.001
Swiss nationality, N (%)	12 322 (70.4%)	1853 (54.3%)	6152 (79.1%)	4317 (68.4%)	<0.001
Gender, N (%)					<0.001
Male	8398 (47.9%)	1307 (38.2%)	3968 (50.9%)	3123 (49.4%)	
Female	9146 (52.1%)	2112 (61.8%)	3831 (49.1%)	3203 (50.6%)	
Smoking status, N (%)					<0.001
Never smoker	8486 (48.6%)	1685 (49.4%)	3405 (43.9%)	3396 (54.0%)	
Ex-smoker	5201 (29.8%)	929 (27.3%)	2393 (30.8%)	1879 (29.9%)	
Current smoker	3775 (21.6%)	795 (23.3%)	1961 (25.3%)	1019 (16.2%)	
Quit ratio %	57.9%	53.9%	55.0%	64.8%	<0.001
Mean pack-year units±SD					
Current smokers	26.5±19.5	28.6±19.1	27.4±20.1	23.0±17.9	<0.001
Ex-smokers	18.1±17.6	20.4±20.0	19.0±18.2	15.7±15.1	<0.001
After introduction of smoking ban, N (%)	4104 (23.4%)	577 (16.9%)	1729 (22.2%)	1798 (28.4%)	<0.001
Year of survey, N (%)					<0.001
1995–1998	4398 (25.1%)	1057 (30.9%)	2044 (26.2%)	1297 (20.5%)	
1999–2002	4962 (28.3%)	1062 (31.1%)	2261 (29.0%)	1639 (25.9%)	
2003–2007	2810 (16.0%)	538 (15.7%)	1192 (15.3%)	1080 (17.1%)	
2008–2011	3192 (18.2%)	428 (12.5%)	1446 (18.5%)	1318 (20.8%)	
2012–2014	2182 (12.4%)	334 (9.8%)	856 (11.0%)	992 (15.7%)	

Table 2 Education as a determinant of smoking prevalence and quit ratio

	Unadjusted estimate (95% CI)***	Adjusted* estimate (95% CI)***
Smoking prevalence		
Prevalence ratio		
Primary vs tertiary education	1.44 (1.31 to 1.58)	1.58 (1.43 to 1.73)
Secondary vs tertiary education	1.56 (1.45 to 1.68)	1.62 (1.50 to 1.74)
RII (least to most educated)	1.79 (1.58 to 2.01)	2.04 (1.80 to 2.30)
SII (least to most educated)	0.13 (0.10 to 0.15)	0.15 (0.13 to 0.18)
Smoking cessation (quit ratio)		
Prevalence ratio		
Primary vs tertiary education	0.83 (0.77 to 0.90)	0.82 (0.76 to 0.89)
Secondary vs tertiary education	0.84 (0.80 to 0.90)	0.83 (0.78 to 0.88)
RII (least to most educated)	0.75 (0.68 to 0.83)	0.73 (0.66 to 0.81)
SII (least to most educated)	−0.17 (−0.20 to −0.13)	−0.18 (−0.22 to −0.14)

***All P values are <0.001.
*Age, gender, nationality and time trend.
RII, relative index of inequality; SII, slope index of inequality.

Association between education and smoking prevalence

Over the 1995–2014 period, lower education was associated with a higher probability of being a current smoker in unadjusted ($PR_{\text{primary vs tertiary education}}$=1.44 (1.31 to 1.58), P<0.001; $PR_{\text{secondary vs tertiary education}}$=1.56 (1.45 to 1.68), P<0.001) and adjusted analysis ($PR_{\text{primary vs tertiary education}}$=1.58 (1.43 to 1.73), P<0.001; $PR_{\text{secondary vs tertiary education}}$=1.62 (1.50 to 1.74), P<0.001). The RII and SII were significant even after adjustment for all covariates (RII=2.04 (1.80 to 2.30), P<0.001; SII=0.15 (0.13 to 0.18), P<0.001), identifying significant relative and absolute SES-inequalities in smoking prevalence, respectively (table 2).

Introduction of a smoking ban, smoking prevalence and SES inequalities

The introduction of the smoking ban was associated with a reduction in mean smoking prevalence in the postban period ($\beta_{\text{proportion}}$=−0.043 (−0.073 to −0.014), P=0.003) but did not impact on the trend during this period (β_{trend}=0.006 (−0.003 to 0.014), P=0.17) (figure 2 and online supplementary table 1), with the smoking prevalence gradually returning to preban levels.

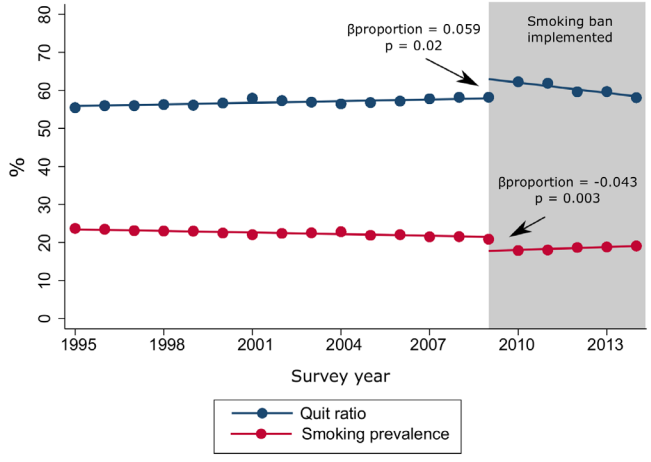

Figure 2 Yearly quit ratios and smoking prevalence before and after implementation of smoking ban. Yearly estimations (January–December) were obtained from the adjusted segmented regression analysis. $\beta_{\text{proportion}}$ are presented as well as their significance.

The RII before (RII=1.84 (1.60 to 2.11), P<0.001) and after (RII=3.01 (2.27 to 3.99), P<0.001) the smoking ban differed, with a significant increase in the RII after the smoking ban (P<0.01) (figure 3A). We observed similar results for the absolute measure SII (SII_{before}=0.14 (0.11 to 0.16), P<0.001 and SII_{after}=0.19 (0.15 to 0.24), P<0.001), with a significant increase being observed after the introduction of the smoking ban (P=0.03) (figure 3B).

Association between education and quit ratio

Compared with higher education, lower education was associated with a lower quit ratio in both unadjusted ($PR_{\text{primary vs tertiary}}$=0.83 (0.77 to 0.90), P<0.001; $PR_{\text{secondary vs tertiary}}$=0.84 (0.80 to 0.90), P<0.001) and adjusted models ($PR_{\text{primary vs tertiary}}$=0.82 (0.76 to 0.89), P<0.001; $PR_{\text{secondary vs tertiary}}$ = 0.83 (0.78 to 0.88), P<0.001). The adjusted RII and SII with quit ratio as outcome were significant (RII=0.73 (0.66 to 0.81), P<0.001, SII=−0.18 (−0.22 to −0.14), P<0.001) (table 2).

Introduction of a smoking ban, quit ratio and SES inequalities

We found a significant increase in quit ratio after smoking ban introduction ($\beta_{\text{proportion}}$=0.059 (0.009 to 0.108), P=0.02), but not in its trend thereafter (β_{trend}=−0.011 (−0.026 to 0.003), P=0.13), with a return to preban levels of quit ratio being observed (figure 2 and online supplementary table 1).

The RII for quit ratio before (RII=0.76 (0.68 to 0.86), P<0.001) and after (RII=0.65 (0.53 to 0.81), P<0.001) the introduction of the smoking ban were significant, and the introduction of the ban was not associated with a significant change towards inequality in relative terms (P=0.05) (figure 3A). However, when using an absolute measure (SII) a significant change towards inequality (P=0.02) was observed after the introduction of the smoking ban (SII_{before}=−0.15 (−0.20 to −0.11), P<0.001 and SII_{after}=−0.27 (−0.35 to −0.19), P<0.001) (figure 3B).

Degree of tobacco exposure as mediator or effect modifier of SES inequalities in smoking cessation

Pack-year unit consumption level was negatively associated with quit ratio in adjusted analysis ($PR_{\text{per five pack-year units}}$= 0.92 (0.92 to 0.93), P<0.001).

Both inequality indexes, RII (RII=0.80 (0.72 to 0.89), P<0.001) and SII (SII=−0.13 (−0.16 to −0.09), P<0.001), remained significant after adjustment for exposure level. Likewise, the previously observed increase in SII after the introduction of the smoking ban remained significant after adjustment for consumption level (P=0.03) (online supplementary table 2). Furthermore, we did not observe an effect modification by pack-year units of the equity impact of the smoking ban (P=0.40).

DISCUSSION

In a representative sample of adults from the State of Geneva (Switzerland), we have identified a SES inequality in smoking prevalence and quit ratio, with lower educated individuals being more likely current smokers and less likely being ex-smokers as well as displaying higher pack-year units, for both current and ex-smokers. These results are in agreement with previous studies showing that smoking prevalence and quit ratio are closely related to SES.[10 11 20–22]

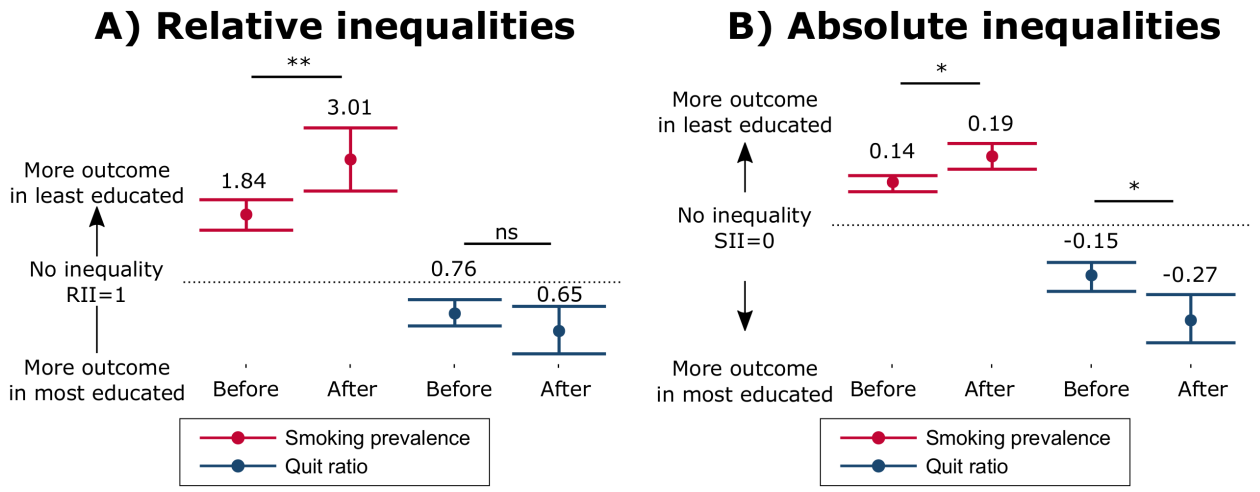

Figure 3 (A) Relative (RII) and (B) absolute (SII) inequality indexes with corresponding 95% CI, before and after implementation of the smoking ban, for quit ratio and smoking prevalence. Wald test P values comparing indexes in the two periods, *P<0.05 and **P<0.01; ns (not significant).

We observed that the introduction of the smoking ban had a significant impact on the overall proportion of smokers and quit ratio in the period after its implementation, with a progressive return to preban levels being observed. This suggests a temporary impact of the ban, as observed in the study by Federico *et al*,[23] in Italy. A possible explanation for this fact was that the effect of the ban faded as people adapted their behaviour to circumvent the ban or changed their preferred smoking locations. It is also expectable that the number of venues with dedicated areas for smoking has gradually increased, reducing the impact of this partial ban.

Our analysis of the equity impact of the smoking ban was performed comparing the absolute and relative indexes of inequality (SII and RII, respectively) before and after smoking ban implementation.

Unlike studies performed in other countries focusing on the same question, we observed an increase in inequalities in smoking prevalence and quit ratio after the introduction of the smoking ban. In these studies, smoking-related SES inequalities either remained unchanged or were reduced.[21–24] Our results are in line with theories suggesting that smoking bans preferably target individuals with higher SES.[34] Our results are in agreement with another study in Spain that suggests the widening of inequalities despite a smoking ban introduction; however, outcomes in this study were compared over time and not between SES groups.[35] We observed small differences in smoking outcomes between participants with primary and secondary educational levels. This was not observed in a similar study in Luxembourg using educational attainment divided into three categories.[22] This may reflect, for instance, more pronounced differences in income or health education and awareness between individuals with secondary and tertiary education in Switzerland than in Luxembourg.

A time-dependent trend towards a widening of socioeconomic inequalities has been previously described in cross-sectional studies using data from various European countries,[10 36] but intercountry variability in the results is evident. We adjusted our analyses for time trend, with the identified SES inequalities and their evolution being independent of secular trends.

Studying the time trends of quit ratio of 11 European countries, Bosdriesz *et al*[36] observed a widening of inequalities in the 2000s, implying that implemented tobacco control policies may have failed to address this issue. Our results suggest that in a population from a high-income country, the introduction of a smoking ban might have had differential impact depending on SES, contributing to the maintenance or increase of inequalities, despite a temporary positive effect on outcomes overall.

Smoking cessation depends on behavioural change which is more easily achieved in individuals with higher literacy, autonomy and higher expectations regarding their lives, probably contributing to the observed inequalities in this outcome.[37] The equity impact of smoking bans could be of importance to policy makers, stressing the need of considering equity when devising new tobacco control measures in order to ensure that their objectives are met.

As a consequence of tobacco's addictive characteristics, the probability of smoking cessation could be inversely correlated with the level of consumption and explain our results. In our study, while participants with lower SES had higher levels of tobacco consumption for both current and ex-smokers, level of consumption was neither a mediator nor an effect modifier of the influence of educational attainment on smoking cessation or related to the increase in SES inequalities after introduction of the smoking ban. Since previous studies did not account for this variable, we cannot determine if SES inequalities in smoking cessation in other countries are also independent of tobacco consumption level or if this characteristic is unique to our population.

A recent review by Hill *et al*[34] found strong evidence suggesting that increasing tobacco price has a pro-equity effect on smoking socioeconomic disparities. However, the evidence is inconclusive for the equity impact of other interventions. Our study, taken together with others addressing the same question, reinforces the notion of heterogeneity in the impact of a smoking ban on smoking inequalities. Other factors such as the existence of additional tobacco control measures, tobacco affordability and availability may explain the different results obtained in different settings and countries, contributing to the inconclusiveness of the existing meta-analysis.

Strengths

Our study was done in a single city using a relatively large cohort of participants. The relative homogeneity of the studied population could help identifying clearer smoking prevalence and quit ratio patterns than studies including different cities, regions or countries. This study spans a 20-year period with yearly cross-sectional waves allowing the evaluation of time trends with yearly resolution. Information on pack-year unit consumption allowed us to exclude that different quit ratios between SES strata are a result of different levels of consumption and, potentially, addiction. We used both relative and absolute measures to study the time trends in SES smoking inequalities, with the discrepancies between the two in assessing changes in quit ratio inequalities further reinforcing the importance of using both measures.[25 26]

Limitations

Besides residual confounding which cannot be excluded, our study has several limitations. First, we could not determine whether smoking cessation was achieved mainly because of the introduction of the smoking ban. Second, we studied the evolution of the quit ratio and did not focus on when smoking cessation was achieved. Third, it is possible that the effects of the introduction of the ban are delayed in time and the 5-year postban period not sufficient to capture them. However, Tchicaya *et al*[22] reported a reduction of quit ratio inequalities within 5 years of smoking ban introduction. Fourth, we used only one variable (educational attainment) to define SES, yet other variables might be more strongly associated with SES inequalities, such as income.[38] Fifth, the data were cross-sectional, not longitudinal, which would allow observing individual changes through time and better characterise the effect of the smoking ban. Sixth, since this study used stratified random sampling, analyses were not survey weighted. Seventh, no data were available concerning other tobacco control measures which could be important confounder variables, such as exposure to media campaigns, smoking ban policy changes, availability of smoking cessation therapies and cigarette availability and advertisement in retail outlets in areas with different SES. Finally, while we adjusted for secular time trends, it is worth noting that the implementation of the smoking ban in Geneva coincided with a period posterior to the 2008 subprime crisis which is in itself a potential confounder with unpredictable impact on the results. A study by Gallus *et al*,[39] demonstrated that the 2008 economical crisis coincided with an increase in smoking in unemployed and a decrease among employed individuals.

What this paper adds

- The impact of a partial public smoking ban on both relative and absolute socioeconomic status inequalities of smoking prevalence and quit ratio has not been established. Previous studies have produced contradictory results, even within the same country.
- We used data from a permanent cross-sectional survey-study of an urban region of Switzerland (Geneva) spanning 20 years, to assess the equity impact of public smoking ban implementation on smoking prevalence and quit ratio using absolute and relative inequality measures.
- While smoking prevalence decreased and quit ratio increased, inequalities widened despite the implementation of a public smoking ban. Taken together with those from previous studies, our results reinforce the notion of a context-specific heterogeneity in the equity impact of a partial public smoking ban in urban regions of high-income countries.

CONCLUSION

Using population-based data, we have identified SES inequalities in smoking prevalence and quit ratio in Geneva, Switzerland. We observed that the introduction of a smoking ban, while coinciding with a decrease in smoking prevalence and an increase in quit ratio, was not sufficient to avoid an increase in SES inequalities in both outcomes. Our results suggest that there is a need for further measures, in addition to partial smoking bans, targeting subpopulations at higher risk. Furthermore, our results, taken together with studies with similar and contradictory findings, suggest heterogeneity in the equity impact of a partial public smoking ban in urban areas of high-income countries. However, we must acknowledge the limited external validity of our study, since it is based on data from a single city. Additional studies are needed to identify similar inequalities and their trends in order to properly address them and close SES smoking inequality gaps.

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