

RESEARCH REPORT

Tobacco control policies and smoking in a population of low education women, 1992–2002

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Study objective: To examine recent trends and the role of tobacco control policies associated with smoking among women of low socioeconomic status.**Design:** Using four waves of the nationally representative tobacco use supplement to the current population survey (TUS-CPS)—(1992–2002), the study examined trends and used multivariate logistic models of smoking prevalence among low education women to examine the role of cigarette prices, clean air regulations, and tobacco control media campaigns, while controlling for other personal characteristics.**Setting:** USA.**Participants:** Women ages 18 and older who report not having completed high school, compared with other women with greater educational attainment and men ages 18 and older with less than a high school degree.**Main results:** Smoking among low education women declined at a greater rate over the study period than among more highly educated women, in contrast with trends of earlier periods. Low education women were found to be particularly responsive to media messages as well as price, especially in comparison with high education women.**Conclusions:** The relation between health and socioeconomic status is not immutable; selected tobacco control policies, such as tax increases and media campaigns targeting low education women, may make inroads in reducing the smoking prevalence of this population.

The public health history of reporting the impact of smoking spans more than 50 years,¹ but disparities in smoking related health outcomes among subpopulations has only recently become a focal point.² Socioeconomic status (SES) and gender have been identified as areas of special concern.

SES, both at the individual and the community level, is generally related to diminished health outcomes, such as high risks of heart disease and cancer.^{3–4} An important part of these risks is associated with smoking behaviour.^{5–11} Smoking rates are high among those with low levels of education and income, important components of SES. Low education and income also have been linked to lower rates of quit attempts and quit success.^{12–13} In particular, low education and employment rates are linked to a low success rate for quit attempts among women.^{12–14}

Although smoking rates and smoking related deaths among women have always been lower than among men, smoking rates have been converging and the evidence suggests a similar profile of health risk.¹⁵ Moreover, marketing campaigns by the tobacco industry have been targeting women.^{14–15} SES differentials apply to smoking related outcomes as well.¹⁵ Women with less than a high school education are three times more likely to be current smokers than women with a college education, and female current smokers are less likely to be employed than non-smoking women. Regarding health, evidence of differential overall mortality for women has been linked to income differentials, although the analyses are sensitive to the income data source and time lags related to health outcomes.^{16–17}

Tobacco control policies have generally been shown to be an important tool in reducing smoking rates.¹⁸ Since 1997, total smoking prevalence for the USA has steeply declined^{19–20} with much of this reduction attributable to public policies, such as price increases, media campaigns, and clean air laws.¹⁹ States with active tobacco control policies, such as

California, Massachusetts, and Arizona, have seen particularly large reductions in smoking rates.¹⁸ However, smoking rates are high among low SES and particular racial/ethnic groups.¹⁵ Increasingly, the focus of national and state programmes has been on how to target particular socio-demographic groups.^{21–22}

A limited number of studies have considered how taxes or clean air policies have affected particular sociodemographic groups. For example, some studies have found that men and women respond differently to price changes, although others have failed to find gender differences.^{14–23–24} Townsend²⁵ and the US Centers for Disease Control and Prevention (CDC)¹⁵ found greater price responsiveness in low income populations. CDC¹⁵ also has reported that black people and Latinos were more price sensitive than other ethnic groups. Policies such as bans on smoking in the workplace might be expected to have a differential impact on both women and lower SES people, because of lower work participation rates. Ohsfeldt *et al*²⁶ found less prominent effects on women, and Farrelly *et al*²⁷ found smaller reductions in smoking rates among low income people. Besides price and work restrictions, the effect on different sociodemographic groups of media/comprehensive campaigns and other policies has not been systematically studied. In particular, studies have focused on either taxes or clear air restrictions, and none has considered the simultaneous implementation of those policies with media campaigns.

Although studies of female smoking have examined SES and some studies of tobacco control policies have looked at the impact on women and those of lower SES, further study is needed, especially regarding women and low SES in conjunction. This paper is intended to begin to fill those gaps. Using a 10 year span of nationally representative data, we examine the role of tobacco control policies associated with smoking among women of low SES. We describe the prevalence of smoking in the selected population, comparing

these data to three reference groups—women of two different higher SES groups and men of low SES—and we assess whether tobacco control policies have a differential effect on the selected population compared with the three reference groups. These analyses are intended to inform more precise policy formulation to target the high rate of smoking among low SES women.

METHODS
Individual level data

Four waves of the tobacco use supplement to the current population survey (TUS-CPS)—1992/93, 1995/96, 1998/99, and 2001–02, each with three sample months (usually September, January, and May, except in 2001–02)—were analysed in this study. The probability sample for each wave was based on stratified clusters of households drawn from an initial sampling frame that covers the civilian non-institutionalised population ages 15 and older. The TUS-CPS collects data on individual tobacco use, attitudes toward smoking and clean air laws, and private smoking bans in peoples’ homes and places of work. Primary data collection was conducted by telephone but about 30% of interviews were conducted in-person in the household.

We limited the sample to women ages 18 and older. The sample of female self respondents ages 18 and older who report less than a completed high school education consisted of 75 130 women from a total sample of 777 713.

SES and other respondent characteristics

In this study, educational achievement is the basis for selecting a sample of women of low SES. Osler *et al*⁸ theorise that education as a proxy for knowledge is not the sole

pathway for better health outcomes; protective characteristics also may be derived from education as a proxy for ability to use knowledge and information, and education as a proxy for a broader SES in society and membership in social subcultures. We define low educational attainment as including up to and including some part of a 12th grade education but excluding attainment of a high school degree or GED*.

Other personal characteristics used in the model included race/ethnicity, age, marital status, and region of residence. Race/ethnicity was measured in five categories (white, black, Asian or Pacific Islander, Hispanic, Other). Age was measured as a dichotomous measure of young adults (ages 18–24) and adults (ages 25 and older). Marital status was distinguished by four separate variables for married or not married, which includes married (the reference group), single, widowed/divorced, separated and never married.

Tobacco measures

Individual respondents were first screened for tobacco use with an “ever use” screening measure. Respondents who reported that they had smoked at least 100 cigarettes in their lifetime were asked about their current smoking status. Current smokers were queried about the level of their current use in categorical terms (women who report now smoking every day or some days) and in continuous terms (number of cigarettes per day on average; number of days smoked out of past 30 days). All current smokers, regardless of the

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*General educational development (GED) is a substitute for a high school diploma obtained through passing a test.

Table 1 Characteristics of the sample of low education* women, weighted, 1992–2002				
	1992–93	1995–96	1998–99	2001–02
Number	228552	187141	176452	185568
Race/ethnicity†				
White	60.0 (59.2,60.7)	57.5 (56.7,58.3)	55.4 (54.5,56.2)	52.0 (51.0,52.9)
Black	19.1 (18.5,19.7)	16.8 (16.2,17.4)	16.5 (15.8,17.2)	16.2 (15.5,16.9)
Asian or Pacific Islander	1.8 (1.6,2.0)	2.5 (2.2,2.8)	2.7 (2.4,3.0)	3.1 (2.7,3.4)
Hispanic	18.4 (17.8,19.0)	21.9 (21.2,22.6)	24.3 (23.5,25.1)	27.5 (26.6,28.4)
Other	0.8 (0.7,0.9)	1.4 (1.2,1.6)	1.2 (1.0,1.4)	1.3 (1.1,1.5)
Age group‡				
18–24	14.2 (13.8,14.6)	17.9 (17.3,18.5)	18.1 (17.4,18.8)	18.2 (17.4,19.0)
25+	85.8 (85.4,86.3)	82.2 (81.5,82.8)	81.9 (81.2,82.6)	81.8 (81.0,82.7)
Marital status†				
Married	59.7 (59.5,60.0)	58.4 (58.1,58.6)	56.8 (56.5,57.1)	55.6 (55.3,55.9)
Widowed/divorced	17.2 (17.0,17.3)	17.4 (17.2,17.6)	18.0 (17.8,18.2)	18.1 (17.9,18.3)
Separated	2.8 (2.7,2.8)	2.8 (2.7,2.9)	2.6 (2.5,2.7)	2.4 (2.4,2.5)
Never married	20.3 (20.1,20.5)	21.4 (21.2, 21.6)	22.6 (22.4,22.9)	23.8 (23.6,24.1)
Region†				
Northeast	18.6 (18.1,19.1)	18.5 (17.9,19.1)	18.9 (18.2,19.5)	18.2 (17.5,18.9)
Midwest	20.8 (20.2,21.4)	20.0 (19.4,20.7)	19.5 (18.8,20.2)	18.6 (17.9,19.3)
South	41.7 (41.0,42.4)	41.6 (40.8,42.4)	40.2 (39.3,41.1)	41.3 (40.4,42.3)
West	19.0 (18.4,19.6)	19.8 (19.1,20.5)	21.5 (20.7,22.2)	21.9 (21.1,22.7)
*Low education category is women with education level “less than high school degree or GED”. †Measured as a percentage of the sample with 95% confidence interval reported in parentheses below.				

frequency or quantity defining their smoking behaviour, were included as eligible for this analysis.

State level data: tobacco control policies

Cigarette prices compiled by Orzechowski and Walker²⁸ measured the average state level prices of cigarettes, including generics. We adjusted the price indices of the different waves for inflation using the consumer price index from the Bureau of Labor Statistics (BLS) (<http://www.bls.gov>). We also adjusted for state tax changes and price changes at the national level (using the BLS cigarette price index) that occurred between sample months of the four waves. These data represent a snapshot of the state price and excise tax rate on a pack of cigarettes corresponding with the timing of each survey wave.

Clean air laws were represented by an index of state level clean air regulations informed by CDC, American Lung Association, and NCI data.^{29 30} We initially constructed separate variables for three types of laws: worksite, restaurant, and others (shopping malls, retail stores, enclosed arenas, and public transit). Based on studies of relative impact,³¹ states with “no smoking allowed (100% smoke free)” were counted as 100% of the effect, with “no smoking allowed or designated smoking areas allowed if separately ventilated” as a 50% effect, and with “designated smoking areas required or allowed” as a 25% effect. We used separate indices by type of law, and settled on an aggregate weighted index, with worksite laws weighted by 50%, restaurant laws by 30%, and laws for other public places by 20%. Most of the developments in clean air regulations at the state level occurred after 2001.¹⁹

For media/comprehensive tobacco control campaigns at the state level, we developed an indicator variable. California and Massachusetts were the earliest states to institute comprehensive campaigns and are thus marked “1” for the full duration of the study period. Between 1994 and early 1999, Arizona and Oregon (started in 1995 and 1996 respectively), and Florida and Utah (1997) implemented campaigns. Between late 1999 and 2002, Hawaii, Indiana, Maine, Maryland, Minnesota, Mississippi, New Jersey, New York, Ohio, Vermont, Washington, and Wisconsin instituted programmes. We distinguished Florida, Mississippi, and Utah as having youth programmes rather than programmes targeted to the full population by assigning those states a value of 0.5 instead of 1.0. Programmes started in the earlier years have been described in the surgeon general’s report

Reducing Tobacco Use.¹⁸ For more recent programmes, we considered information in Farrelly *et al*³² and expenditures on tobacco control programmes available through CDC. We included states that spent more than 70% of the CDC goals in 2001 and 2002.

Analysis

Among women, two reference groups were defined by educational attainment: medium education women (high school degree or GED through an undergraduate college degree) and high education women (graduate level education). Low education men, under the same definition used for low education women, comprise a third reference group.

For the analyses, we use Stata 8.2 (StataCorp, 2003, College Station, TX) and individual weights to adjust for the survey design. We present individual level estimates of current smoking prevalence for four different subpopulations based on educational attainment and gender across the four survey waves of data. Logistic models of selected tobacco control policies on current smoking are estimated separately for each subpopulation, adjusting for personal characteristics. We focus our discussion on the models (by subpopulation) of stacked survey waves (all survey wave/years included) but also report where results from individual survey waves vary. The 95% confidence intervals of estimated odds ratios across subpopulations are compared.

RESULTS

Sample characteristics

The distribution of characteristics for the selected samples by education and gender are shown in table 1, over the course of the four survey waves. The proportion of white people among low education women fell from 60.0% (59.2%, 60.7%) to 52.0% (51.0%, 52.9%) over the study period, while the proportion of Hispanic women of low education increased from 18.4% (17.8%, 19.0%) to 27.5% (26.6%, 28.4%). The percentage of women ages 18–24 increased from 14.2% (13.8%, 14.6%) to 18.2% (17.4%, 19.0%). The percentage of married women decreased from 59.7% (59.5%, 60.0%) to 55.6% (55.3%, 55.9%), while the percentage of widowed/divorced and never married increased to make up most of the gap.

Smoking status

Table 2 shows the smoking status of four subpopulations: low, medium, and high education female group, and low

Table 2 National estimates of current smoking prevalence, selected demographic groups, 1992–2002, weighted					
		1992–93	1995–96	1998–99	2001–02
Total population	Number	228552	187141	176452	185568
	Percentage	24.5	23.6	22.1	21.0
	95% CI	(24.3,24.7)	(23.3,23.8)	(21.8,22.3)	(20.7,21.2)
Low education female*	Number	24456	18988	16185	15501
	Percentage	26.6	25.1	23.0	21.4
	95% CI	(25.9,27.2)	(24.4,25.8)	(22.3,23.7)	(20.7,22.2)
Medium education female†	Number	99085	82742	77675	81179
	Percentage	22.4	21.5	20.1	19.3
	95% CI	(22.1,22.7)	(21.2,21.9)	(19.8,20.5)	(19.0,19.6)
High education female‡	Number	7187	6390	6773	7733
	Percentage	9.2	8.8	7.9	7.3
	95% CI	(8.5,10.0)	(8.0,9.6)	(7.2,8.6)	(6.7,8.0)
Low education male*	Number	17474	13102	11830	12244
	Percentage	35.1	33.9	31.8	30.4
	95% CI	(34.3,35.9)	(33.0,34.9)	(30.9,32.8)	(29.5,31.4)
*Low education female/male category is women/men with education level more than high school degree or GED. †Medium education female category is women with education level more than high school degree or GED and less than or equal to bachelors degree. ‡High education female category is women with education level more than bachelors degree.					

education male group. Among these subpopulations, the low education male group report the highest estimated current smoking prevalence throughout the study period, followed by the low education female group. Compared with the total population, current smoking prevalence among the low education female group exceeded national estimates in the earlier years of the study period but has moved closer to the estimated smoking prevalence of the total population in later years. In 1992/93, the estimated prevalence among the low education female group was 26.6% (25.9%, 27.2%) and in the total population was 24.5% (24.3%, 24.7%). By 2001–02, prevalence among the low education female group was 21.4% (20.7%, 22.2%) and in the total population was 21.0% (20.7%, 21.2%). The estimated prevalence for each of the subpopulations differs statistically from the others over time, and the estimated prevalence among the female samples is substantially lower for those with greater reported education.

In keeping with the overall decline in smoking prevalence at the national level over the period, the estimated prevalence of smoking in each of the selected subpopulations is significantly lower in 2001–02 than in 1992–93. The greatest declines, however, are for the low education samples, both female and male. The smoking rate declined 5.2 percentage points among the low education female sample from 26.6% (25.9%, 27.2%) in 1992–93 to 21.4% (20.7%, 22.2%) in 2001–02. The percentage point decline in smoking among the low education male sample was 4.7%, similar in absolute terms but lower in relative terms because of the higher initial smoking rates (35.1%). Smaller reductions are seen for higher education female groups (3.1% in absolute terms for medium education, 1.9% for high education), although both of these groups, especially the high education female group, had lower smoking rates to begin with (9.2% in 1992–93).

Logistic models of current smoking

The following sections describe the results of multiple logistic models with classifications by education, as shown in table 3. In each model, we controlled for age, race/ethnicity, individual marital status, and geographical residence. By race/ethnicity, we found that smoking was highest among the white population and Others (mostly American Indian) for all groups except the high education female group.

Among the comparison populations, higher smoking rates are uniformly estimated for all single (never married, separated, and divorced/widowed) persons than for married persons. This uniformity is not seen among low education female sample, among whom the widowed/divorced have a lower odds of current smoking than the married. For low education women, smoking rates were higher among all areas outside the northeast region of the USA.

Cigarette price and current smoking

Over the period 1992–2002, the likelihood of a low education woman being a current smoker decreased with higher cigarette prices (odds ratio = 0.74; 95% CI: 0.62, 0.89). The odds ratio of 0.74 produces a price elasticity near one, implying that a 10% increase in price would reduce smoking by 10%. This estimate falls in the same range as the parallel odds ratios for the low education male sample (OR = 0.70; 0.58, 0.85) and for medium education female sample (OR = 0.83; 0.76, 0.90). In the stacked model, the price effect for high education female sample is not significant.

Models of separate survey waves show some fluctuation in the role of price over time for these selected subpopulations. Over time, the odds ratio for price on current smoking is less than one for low education female sample in 1992–93 and 2001–02, but insignificant in the intervening survey waves although still negative and falling within overlapping confidence intervals over the full period. The likelihood of smoking given increasing price is negative for the low education male sample in each survey wave except 1998–99, and the confidence interval for the 1998–99 estimate overlaps those of the other survey waves. Women with more than a high school education seem less responsive to price. For the medium education female sample, the odds ratio is less than one only in 2001–02, and the estimates for previous survey waves are statistically different from the 2001–02 estimate based on an examination of the confidence intervals. The odds ratios for the high education female sample are insignificant, with broad confidence intervals. These price results were consistent with and without the clean air and media variables included in the models.

Based on guidance from the literature, we examined two interaction models for the low education female sample. In

Table 3 Logistic regression analysis of smoking status, populations aged 18 years or older, 1992–2002												
	Low education women			Low education men			Medium education women			High education women		
	Odds ratio	95% CI		Odds ratio	95% CI		Odds ratio	95% CI		Odds ratio	95% CI	
Age (ref: 18–24 years)												
25+ years	0.97	0.90	1.04	1.17*	1.08	1.26	1.01	0.97	1.05	1.35	0.77	2.38
Race/ethnicity (ref: White)												
Black	0.63*	0.59	0.67	0.80*	0.75	0.86	0.70*	0.68	0.73	1.02	0.84	1.23
Asian or Pacific Islander	0.19*	0.15	0.24	0.69*	0.58	0.82	0.37*	0.34	0.40	0.52*	0.38	0.73
Hispanic	0.27*	0.25	0.29	0.61*	0.57	0.65	0.53*	0.50	0.56	0.93	0.69	1.26
Other	1.28*	1.08	1.51	1.57*	1.30	1.88	1.62*	1.47	1.79	1.52	0.84	2.74
Marriage status (ref Married)												
Widowed/divorced	0.77*	0.74	0.81	1.35*	1.28	1.43	1.63*	1.60	1.67	2.19*	1.95	2.47
Separated	2.39*	2.19	2.60	2.41*	2.13	2.71	2.92*	2.77	3.08	2.18*	1.55	3.07
Never married	1.53*	1.43	1.63	1.58*	1.47	1.68	1.60*	1.55	1.65	1.92*	1.69	2.17
Region (ref: Northeast)												
Midwest	1.18*	1.11	1.25	1.17*	1.09	1.25	1.07*	1.04	1.10	1.04	0.91	1.20
South	1.16*	1.09	1.23	1.19*	1.12	1.27	0.99	0.96	1.02	1.07	0.93	1.24
West	1.26*	1.17	1.37	1.08	1.00	1.17	0.94*	0.90	0.97	0.95	0.80	1.12
Year (ref: 1993)												
1996	0.92*	0.87	0.97	0.93*	0.87	0.98	0.94*	0.92	0.97	1.00	0.87	1.15
1999	0.91*	0.86	0.97	0.94*	0.88	1.00	0.92*	0.90	0.95	0.85*	0.73	0.99
2002	0.95	0.87	1.04	0.97	0.88	1.06	0.94*	0.90	0.98	0.76*	0.61	0.94
Policies												
Log (Price)	0.74*	0.62	0.89	0.70*	0.58	0.85	0.83*	0.76	0.90	1.21	0.79	1.85
Media	0.86*	0.82	0.96	0.92*	0.86	1.00	0.89*	0.86	0.92	0.93	0.79	1.09
Clean air	0.91	0.80	1.03	0.96	0.84	1.09	0.88*	0.83	0.94	0.83	0.61	1.13

*Significant result (p<0.05).

contrast with expectations, we found no interaction between age and price in this population. However, an interaction for race/ethnicity and cigarette price does appear over the study period. Overall, within the low education female population, we find that African-Americans and those not falling into a named category of race/ethnicity (that is, persons marked "Other," mostly American Indian and Eskimo) seem to be less responsive than the white population to price in terms of modifying their smoking status. By contrast, Asian-American and Hispanic women of low reported education seem to have been more responsive to price than white female subpopulation.

Media and current smoking

Media/comprehensive state campaigns seem to be similar and significant for the low and medium education female samples in the stacked models over the full study period. The likelihood of being a current smoker in a state with a tobacco control media campaign was 14% lower (OR = 0.86; 0.82, 0.96) for low education female sample, 8% lower (OR = 0.92; 0.85, 1.00) for low education male sample, and 11% lower for (OR = 0.89; 0.86, 0.92) for medium education female group. An overall effect of media does not appear for the high education female sample.

In individual survey waves, these results vary somewhat. The association between media and current smoking among low education women appears in 1992–93 and 1995–96 but disappears in subsequent survey waves. Among the medium education female sample, the role of media is consistent until the 2001–02 survey wave. In 1995–96, an odds ratio similar to the reported levels of other groups is estimated for the low income male sample, but the effect is otherwise insignificant in this group. Generally, the association of the media variable and smoking prevalence declines in the more recent survey waves.

Clean air laws and current smoking

Over the period 1992–2002, current smoking among low education women is inversely related to the index of clean air laws with an odds ratio of 0.91 (0.80, 1.03), but is significant only in the medium education female subpopulation, with an odds ratio of 0.88 (0.83, 0.94). These results are borne out by the single survey wave models for each of the other subpopulations. However, only in the 2001/02 model do clean air laws seem to play a part for the medium education female sample, although the confidence intervals around the estimates for each survey wave overlap for this group.

DISCUSSION

Nationally representative estimates of current smoking in four selected subpopulations defined by gender and level of attained education show that smoking prevalence varies across groups and the decline in smoking prevalence was greater for some than others. Women and men of low education report overall higher rates of smoking but also greater declines in smoking prevalence over the period 1992–2002. Interestingly, among the low education female sample over the 1992–2002 period, separated and never married women had higher rates of smoking than married women while divorced/widowed had lower rates, a pattern not found among the comparison groups for whom all single persons had higher rates of smoking than married persons. Speculatively, this could show an economic constraint among divorced and widowed low education women.

The 1992–2002 pattern of a greater decline among women with less education contrasts with data reported for an earlier period. Between 1974 and 1990, the annual decline in smoking prevalence among women was about 4% for those with college degrees and 2.2% or less for women with less

than a college degree.⁷ Although the association with education did not appear in the data for 1990–1995, the 1995 rate of smoking for women with less education was 2.4 times the rate of women with more education while the 1974 differential was narrower (1.4). With the expansion of tobacco control policy efforts in the 1990s, both in variety and in intensity, it is not surprising that trends in different subpopulations might change. In particular, prices increased substantially between 1997 and 2002, the period over which we see the largest declines in prevalence.

Low education women seem particularly responsive to price and media tobacco control efforts. The price of cigarettes seems to play a bigger part in current smoking behaviour for both low education women and men, compared with more highly educated women. This is consistent with other analyses showing a greater price effect for people of lower SES. Over the period 1976–1993, using data from the national health interview survey (NHIS), people of lower income were more likely to change their smoking behaviour in response to price increases than were respondents reporting higher incomes.³³ Tax increases can play an important part in reducing smoking rates among low SES women.

State media/comprehensive campaigns were associated with current smoking behaviour among low and medium education women, but not among women with more than a college education. The role of media may be dissipating over time, perhaps because of a saturation effect from national tobacco control news that may supersede campaigns run at the state level or because more recent campaigns have been less intense than in earlier years. By 2001–2002, the truth campaign was being aired nationally, and secondarily targets 18–24 year olds. To capture this phenomenon, we included a variable interacting the 2001–02 sample with an indicator for 18–24 year olds. The odds ratio was less than one as expected, but insignificant for both the female and male low education samples. Better measures that distinguish the role of media campaigns from other tobacco control programmes and that show campaign intensity (for example, per capita expenditures) and duration may help to improve the ability to distinguish state programme effects. Nevertheless, the results suggest an important role for media campaigns.

The index of clean air laws used in our analyses suggests at most a marginal effect on current smoking. When we added separate variables for restaurant clean air laws and worksite laws, we continued to get weak results. However, when we included a variable from the TUS-CPS marking indoor workers who were subject to a smoking ban, we found that this variable showed significant negative effects for each of the subpopulations studied, except high income women. The lack of stronger effects for the state level clean air index for low education populations may reflect that they are probably less likely to be subject to private worksite smoking bans. Generally, more refined measures of clean air laws that measure local policy variations and enforcement would yield more precise results.

Particularly for low SES populations, another set of policy variables not included in this study warrants closer attention. Data now exist on which cessation services are covered by Medicaid. A report of the various forms of medication and counselling covered by Medicaid notes the disproportionately high smoking prevalence in the population receiving Medicaid coverage.³⁴ Our preliminary analyses in this area yielded challenges with the collinearity of state policy variables, and further work is required.

Race/ethnicity is an important characteristic in modelling smoking behaviour as shown in our analyses and reported elsewhere.¹⁵ We note that categorisation of people into five groups can mask more detail. For example, examining

Asian-Americans as a group masks different rates of smoking for people from different Asian cultures.³⁵ The difference in black-white health outcomes is at least partially accounted for by income differentials, although race does have an effect independent of income, with black-white differentials in health outcome at every level of income.³⁶ Scarinci *et al*⁹ note that the interaction between income and ethnicity is important to examine, and other analyses show a relation between race/ethnicity and price.³³ Looking at cigarette price as the key tobacco control policy theoretically related to income, in preliminary analyses we examined the interaction of race/ethnicity and cigarette price in our low education female sample. We found a consistent trend for African-Americans to be less responsive to price than the white population, although some evidence³³ suggests that Asian-Americans and Hispanics are more responsive to price than the white population. Further work is needed in this area.

In addition to our individual level analysis, we conducted preliminary analyses of the role of tobacco control policies and prevalence of smoking among low education women aggregated to the state level. We also examined the percentage and absolute change in policy values and smoking prevalence between survey years. Overall, these preliminary efforts did not yield significant results for the role of policies, but we would note that the smoking rates at the state level fluctuate substantially from survey wave to survey wave. Small sample sizes at the state level for the population of interest may be introducing a considerable degree of error. Further examination of the data at the state level is warranted.

To gauge more precisely how policies affect smoking rates over time, further analysis might also consider the effect of policies on quantity smoked and cessation. Our preliminary analysis found that the likelihood of being a someday rather than every day smoker was greater for low education men and women and medium education women in states with higher prices. Among every day smokers, the quantity smoked by low education the male and female and medium education female samples was found to be lower in states with stricter clean air laws. Higher prices were also associated with reduced quantity smoked by low education male sample and medium education female sample, but the association was insignificant among the low education female sample.

These analyses may be affected by the way that we specified SES status in terms of education. Multiple characteristics or vectors to represent SES may be preferable.⁸⁻³⁷ Sample selection for our analyses was originally based on education and income characteristics. Because women with minimal education seem to have improved their financial lot over time, combining these two characteristics in an index was not tenable. Because of the higher proportion of respondents with missing data in household income and problems with the measurement of income in the TUS-CPS sample, we chose to focus on the education samples. In models not reported here, we included a control for whether the respondent was also from a low income household (lowest quintile) to control for income within the low

What this paper adds

Using a 10 year span of nationally representative data, we examine the role of tobacco control policies associated with smoking among women of low SES. We describe the prevalence of smoking in the selected population, comparing these data to three reference groups—women of two different higher SES groups and men of low SES—and we assess whether tobacco control policies have a differential effect on the selected population compared with the three reference groups.

education group, and obtained very similar results to the models reported above. Preliminary investigation using household income to define our samples also yielded similar results, but was subject to limitations of the TUS-CPS data in distinguishing income beyond preset categories (as specified in the original data).

A potential concern is that variables that are correlated with lower SES may be omitted in our models. For example, childhood SES may be a more important determinant of adult smoking than own SES in adulthood.⁶ Kiefe *et al*³⁸ found that barriers to accessing health services (for example, no health insurance) were associated with higher rates of smoking initiation, higher prevalence of smoking, and lower rates of cessation, even controlling for four measures of SES (education, family income, unemployment, and marital status). Fagan *et al*³⁵ make the point that in an epidemiological study looking at socioeconomic differences, it would be useful to operationalise a measure of individual stress. Personal occupation as a measure of SES has also been found to play an independent part in smoking status.⁸

Contextual characteristics, such as neighbourhood residence, may be important as well.¹⁰ For example, the degree of material deprivation in a respondent's residential area has been found to be related to current smoking status independently of respondent education and social class.¹¹ Williams *et al*³⁶ find effects of neighbourhood residence, biases in medical care, and life stress resulting from discrimination separate from SES impact on health outcomes. Without a contextual component, analyses at the individual level may miss broader environmental contributions to smoking behaviour and differences across groups.³⁵ One option is to specify measures of education and income aggregated at the postcode (zip code) level, as this approach may capture some community level characteristics that were omitted in our analyses.⁹

Finally, the results are cross sectional and are subject to bias from omitted variables. In particular, those states with strong antismoking sentiments may implement stricter policies, and these sentiments may be the underlying reason for low smoking rates. When we included separate indicator variables for each state to account for state characteristics otherwise not measured (such as the normative antismoking environment), there was a swamping of most of the policy variable effects in the stacked model over the study period 1992–2002. Consequently, state fixed effects were omitted from the model results that we report. However, further attention is merited.

In summary, using nationally representative data, we found that declining trends in smoking over the period 1992–2002 appeared in each of our selected education samples, but that greater relative declines occurred for low education populations. Moreover, evidence showed that compared with better educated women, low education women responded with greater positive effect to certain policy measures, particularly price. Media campaigns also

What is known on this subject

Women with less than a high school education are three times more likely to be current smokers than women with a college education. Some studies of female smoking have examined SES and some studies of tobacco control policies have looked at the impact on women and those of lower SES. Further study is needed, especially regarding women and low SES in conjunction.

were found to be effective. Campaigns targeted to low SES populations may prove even more effective in reducing smoking rates than the general campaigns found in this study. Furthermore, among women who have not completed high school, price plays a different part for different racial/ethnic groups. With higher smoking rates among low education women and the corollary of increased risks of morbidity and mortality, targeting effective policy measures for this group should be a public health mandate. On a positive note, the association between SES and smoking behaviour is not immutable. It does not appear in cohorts born before 1930 (that is, people 75+ years old at this point) despite the strong association in later cohorts.⁸ By helping to counter targeted marketing strategies, personal stressors, and debilitating neighbourhood characteristics, the public health community may make strides in narrowing the SES related smoking gap to the benefit of all.

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