

Social Disparities in Tobacco Use in Mumbai, India: The Roles of Occupation, Education, and Gender

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Tobacco use in low-income and middle-income countries is predicted to contribute to an increasing share of the global burden of disease in future decades.¹ Eighty-two percent of the world's 1.1 billion smokers now reside in low- and middle-income countries, where, in contrast to declining consumption in high-income countries, tobacco consumption is on the rise.¹ Indeed, the World Health Organization's Framework Convention on Tobacco Control underscores the importance of tobacco control efforts within developing countries as part of a worldwide strategy to reduce the health, economic, and social consequences of tobacco use.² Addressing this growing public health problem requires attention to increasing social disparities in patterns of tobacco use. Across high-, middle-, and low-income countries, smoking rates are highest among individuals of low socioeconomic position.³

Indicators of socioeconomic position vary across studies; often education, occupation, and income level are used interchangeably to measure socioeconomic position.⁴ It is important, however, to examine multiple indicators of socioeconomic position simultaneously if one is to understand their combined impact and thereby provide more complete descriptions of social inequalities in tobacco use. In particular, insufficient attention has been focused on occupational disparities in tobacco use, given the role of occupation in linking education and income as well as its role as a determinant of health in its own right, through hazardous workplace exposures. Indeed, recent analyses of US data indicate that education does not represent a "stand-in" surrogate for occupation, or vice versa; rather, they reflect distinct social constructs making overlapping as well as independent contributions to patterns of tobacco use.⁵

In this study, we examined social disparities in tobacco use in India, where multiple forms of tobacco consumption complicate at-

Objectives. We assessed social disparities in the prevalence of overall tobacco use, smoking, and smokeless tobacco use in Mumbai, India, by examining occupation-, education-, and gender-specific patterns.

Methods. Data were derived from a cross-sectional survey conducted between 1992 and 1994 as the baseline for the Mumbai Cohort Study (n=81 837).

Results. Odds ratios (ORs) for overall tobacco use according to education level (after adjustment for age and occupation) showed a strong gradient; risks were higher among illiterate participants (male OR=7.38, female OR=20.95) than among college educated participants. After age and education had been controlled, odds of tobacco use were also significant according to occupation; unskilled male workers (OR=1.66), male service workers (OR=1.32), and unemployed individuals (male OR=1.84, female OR=1.95) were more at risk than professionals. The steepest education- and occupation-specific gradients were observed among male bidi smokers and female smokeless tobacco users.

Conclusions. The results of this study indicate that education and occupation have important simultaneous and independent relationships with tobacco use that require attention from policymakers and researchers alike. (*Am J Public Health*. 2005;95:1003–1008. doi:10.2105/AJPH.2004.045039)

tempts to reduce its overall impact on public health. It has been estimated that 65% of men use some form of tobacco, including 35% who smoke, 22% who use smokeless tobacco, and 8% who engage in both forms of tobacco use.^{6,7} About one third of women use at least one form of tobacco, although rates among women vary considerably by region (from approximately 15% to approximately 65%).^{6,7} In general, cigarettes account for an estimated 20% of tobacco consumption; about 50% of tobacco is consumed in the form of *bidis*, that is, traditional, leaf-wrapped unfiltered cigarettes.^{8,9}

In previous studies, different patterns have been observed in the educational gradient in tobacco use depending on the type of tobacco used. Whereas overall tobacco use has been shown to be highest among those with the least education, cigarette smoking rates have been shown to increase with increasing education.¹⁰ In India, because of their low cost, *bidis* are more commonly smoked than cigarettes by individuals of lower socioeconomic position; in turn, cigarettes are more commonly consumed among those with greater

financial resources.^{10,11} (*Bidi* smoking has been shown to pose significant health hazards.^{12–14}) A similar socioeconomic gradient has been observed for the use of smokeless tobacco, including chewing tobacco, snuff, burnt tobacco, powder, and paste.^{7,15}

In general, men in India smoke as well as chew or apply tobacco, whereas women generally chew or apply tobacco, with the exception of the few areas where prevalence rates of smoking among women are high.^{7,16} It is estimated that more than 150 million men and 44 million women in India use tobacco in various forms,¹⁴ and approximately 635 000 deaths in India are attributed to tobacco each year. Tobacco-related cancers constitute about half of the total cancer incidence among men and about 20% among women.⁸

The purpose of this study was to assess educational and occupational differences in the prevalence of tobacco use, including total tobacco use, *bidi* and cigarette smoking, and smokeless tobacco use, in a large sample of residents of Mumbai, India. In addition, we sought to assess the joint effects of occupation and education level on tobacco use after con-

trolling for other key determinants of use (i.e., gender and age).

METHODS

Baseline data for the Mumbai Cohort Study were collected between 1992 and 1994 in Mumbai (Bombay), India.¹⁷ The overall purpose of this prospective cohort study was to assess mortality associated with tobacco use in Mumbai.

Study Population

Mumbai is a large, densely populated city whose population was approximately 12 million people in 2001.¹⁸ The city is divided into 3 sectors: the main city, the suburbs, and the extended suburbs. This study exclusively focused on the main city. The sampling frame comprised the city's electoral rolls, which are updated via house-to-house visits before each major election. From these rolls, assumed to be relatively complete given that almost all adult residents are entitled to vote, data were derived on the name, age, gender, and address of all individuals older than 18 years. The electoral rolls were organized by geographical areas; sampling was based on the smallest unit, the "polling station," which included 1000 to 1500 eligible voters. Selection of polling stations excluded those involving a large proportion of apartment complexes with high levels of security; results of the pilot data collection indicated the need for this exclusion owing to the difficulty of gaining access to such buildings.

At the selected polling stations, all individuals 35 years or older who were listed on the electoral rolls were eligible to be interviewed. The age cutoff of 35 years was selected as a result of the study's overall goal of studying tobacco-attributed mortality. In selected geographical areas, lists were supplemented to include individuals who were not listed on the electoral rolls but whose residence status was confirmed by a "ration card." These cards, issued by the Bombay Municipal Corporation, serve as a proxy for residence cards and permit access to all city and state governmental services; individuals identified in this manner represented approximately 5% of the overall sample.

Of the individuals approached and invited to participate in the study, the nonresponse rate was less than 1%. It was not possible to contact approximately 50% of the individuals included on the lists as a result of incomplete addresses, houses being demolished, changes of residence, and inaccessibility of residences (often owing to security considerations). A total of 99 598 adults (40 071 men and 59 527 women) were recruited and surveyed. In the analyses presented here, we excluded respondents who reported that they were retired ($n=15\,223$) or had missing data for occupation ($n=2\,538$). The final sample comprised 81 837 respondents.

Data Collection

The survey was conducted by trained interviewers within participants' households. Hand-held computers were used to record data at the time of the interview. Interviews were conducted in the local languages, including Hindi and Marathi. No surrogate responses were permitted.

Measures

The primary outcome in the present analyses was tobacco use, categorized as follows: (1) having no habit in either the past or present ("never user"), (2) former user (including smoking and use of smokeless tobacco), (3) current smokeless tobacco user (including betel quid, mishri, and creamy snuff), (4) current cigarette smoker, and (5) current bidi smoker (including other forms of smoked tobacco as well, e.g., chilum and hooka). Smokers who also used smokeless tobacco were classified as smokers in these analyses.

Occupation was assessed according to respondents' self-reports. Following the standard Indian classification system, occupations were coded as follows: skilled workers, unskilled workers, traders, service workers, and professionals.¹⁹ Additional categories included unemployed and housewife. Women were considered as housewives unless they were currently employed or looking for employment. Retirees were excluded from the analyses. Education level was classified as illiterate, primary school (up to 5 years of education), middle school (6–8 years of education), secondary school (9–12 years of education), and college (including both some college and at-

tainment of college degree). Gender and age data were also collected.

Data Analysis

Descriptive statistics were calculated for the overall population as well as for men and women separately. Logistic regression was used in conducting multivariate analyses. The response variable, tobacco use, was converted into a dichotomous variable in which current tobacco users (including users of any form of tobacco) were compared with current nonusers. Multivariate analyses of cigarette and bidi smoking were conducted only among men because of the extremely low prevalence (less than 0.5%) of smoking among women. SPSS statistical software (SPSS Inc, Chicago, Ill) was used in analyzing the data.

RESULTS

Sample Characteristics

Men represented about one third of the sample (Table 1). More than 40% of men were employed in service positions, and one third were unskilled workers, whereas a large majority (88%) of women were classified as housewives. Women were generally less educated than men; 45% of women were illiterate, as compared with 11% of men. In addition, only 5% of women had completed secondary school or college, whereas 16% of men had done so. Overall, about a quarter of the participants were between the ages of 35 and 39 years; more than a third were between 40 and 49 years of age.

Tobacco Use Prevalence: Bivariate Analyses

Patterns of tobacco use differed dramatically according to gender (Table 1). While women were less likely than men to have ever used tobacco (26% vs 41%), they were more likely to currently use smokeless tobacco (57% vs 44%). Smoking prevalence rates were 27% among men and, as mentioned, less than 0.5% among women (thus, data on female smokers are not shown separately in Table 1 or described in subsequent analyses). Among male smokers, 12% were cigarette smokers and 15% were bidi smokers. Overall, 2% of the sample members were

TABLE 1—Tobacco Use, by Gender, Occupation, Education, and Age: Mumbai Cohort Study

	Men						Women ^a			
	Total, No. (%)	Never Users, %	Former Users, %	Current Smokeless Tobacco Users, %	Current Cigarette Smokers, %	Current Bidi Smokers, ^b %	Total, No. (%)	Never Users, %	Former Users, %	Current Smokeless Tobacco Users, %
Occupation										
Professional	422 (1.6)	48.1	6.4	26.3	16.4	2.8	293 (0.5)	72.0	1.4	26.6
Trader	2 620 (9.7)	37.4	3.4	29.2	16.1	13.9	265 (0.5)	43.0	3.0	52.5
Service	11 605 (42.8)	27.6	1.7	48.9	12.3	9.6	1 721 (3.1)	50.2	1.3	48.2
Skilled	2 000 (7.4)	28.2	2.7	38.9	12.5	17.8	336 (0.6)	47.0	6.0	46.7
Unskilled	8 835 (32.6)	21.6	2.4	44.6	11.4	20.1	3 796 (6.9)	35.0	2.3	61.8
Unemployed	1 659 (6.1)	18.5	3.6	47.0	11.4	19.6	131 (0.2)	28.2	2.3	66.4
Housewife	...	...	...	...	...	...	48 154 (88.0)	40.5	2.1	57.1
Education										
None/illiterate	3 090 (11.4)	11.9	1.7	47.0	7.2	32.3	24 678 (45.1)	25.8	2.3	71.3
Primary	10 090 (37.2)	19.5	2.1	49.7	10.8	17.9	19 773 (36.2)	46.2	2.1	51.5
Middle	9 519 (35.1)	31.8	1.8	42.8	14.0	9.6	7 358 (13.5)	60.1	1.9	37.9
Secondary	2 765 (10.2)	33.3	4.4	40.5	15.3	6.5	2 070 (3.8)	74.4	2.3	23.1
College	1 677 (6.2)	53.1	4.4	22.9	17.3	2.4	817 (1.5)	89.1	0.7	10.0
Age, y										
35–39	7 697 (28.4)	30.1	1.5	42.9	13.3	12.1	13 920 (25.4)	51.9	1.0	46.9
40–44	6 447 (23.8)	28.6	1.9	42.8	13.8	13.0	9 530 (17.4)	45.1	1.4	53.2
45–49	4 962 (18.3)	25.0	1.6	46.0	12.3	15.1	8 516 (15.6)	37.7	2.2	59.6
50–54	4 036 (14.9)	23.4	2.8	48.2	11.0	14.6	7 364 (13.5)	34.6	2.3	62.6
55–59	2 554 (9.4)	20.8	3.9	46.6	10.4	18.3	5 300 (9.7)	32.7	2.7	64.2
60–64	780 (2.9)	19.5	6.8	40.5	7.9	25.3	4 783 (8.7)	32.3	3.0	64.1
65–69	384 (1.4)	19.0	6.0	39.1	10.9	25.0	2 609 (4.8)	30.0	4.0	65.5
≥70	281 (1.0)	23.8	8.2	34.9	9.6	23.5	2 674 (4.9)	32.2	5.0	62.1
Total	27 141 (100.0)	26.4	2.3	44.4	12.4	14.5	54 696 (100.0)	40.6	2.1	56.9

^aThis group was not categorized separately, because very few women were smokers (less than 0.5%).

^bIncludes all current smokers who were not exclusively current cigarette smokers.

former tobacco users, an indicator of cessation rates.

Among men as well as women, professionals were least likely to have ever used tobacco, whereas unskilled workers and unemployed individuals were most likely to have done so. Use of smokeless tobacco was more common than smoking across all occupational categories. Rates of smokeless tobacco use among women were highest among unskilled workers, those who were unemployed, and housewives. Among men, smokeless tobacco use was especially prevalent among service and unskilled workers and unemployed individuals. Bidi smoking among men followed a similar pattern, with high prevalence rates among unemployed individuals and unskilled workers. In contrast, cigarette smoking was

most common among professionals and traders. Self-reported rates of former tobacco use ranged from less than 2% to 6%.

There was a strong gradient in tobacco use according to education level. Among both men and women, the rate of smokeless tobacco was highest among the illiterate and lowest among those with a college education. Among men, the prevalence of bidi smoking was highest among those at low levels of education, but the prevalence of cigarette smoking was highest among those at the highest education levels.

Multivariate Analyses

Table 2 presents gender-specific tobacco use odds ratios comparing current tobacco users, current cigarette smokers, current bidi

smokers, and current smokeless tobacco users with individuals reporting no current use of any type of tobacco. Odds ratios according to occupation and education were adjusted for age and the other relevant model variable (i.e., either occupation or education). The reference category for occupation was professional, and the reference category for education was college.

Tobacco use was inversely related to education level across all types of tobacco use. The magnitudes of the odds ratios were especially large among those with no more than a primary school education; in addition, in this subgroup, odds ratios were particularly pronounced among women who used smokeless tobacco and men who were bidi smokers. Relative to participants in the reference edu-

TABLE 2—Adjusted Odds Ratios (and 95% Confidence Intervals) for Various Forms of Tobacco Use (vs No Current Habit), by Education, Occupation, and Gender: Mumbai Cohort Study

	Current Tobacco Users	Current Cigarette Smokers	Current Bidi Smokers ^a	Current Smokeless Tobacco Users
Education				
College	1.00	1.00	1.00	1.00
None/illiterate				
Women	20.95 (16.60, 26.45)	...	...	21.02 (16.63, 26.56)
Men	7.38 (6.36, 8.56)	1.73 (1.39, 2.16)	38.64 (27.38, 54.54)	7.75 (6.55, 9.18)
Primary				
Women	9.12 (7.22, 11.51)	...	...	9.18 (7.27, 11.60)
Men	4.48 (4.00, 5.02)	1.65 (1.41, 1.93)	17.31 (12.46, 24.07)	5.25 (4.59, 6.01)
Middle				
Women	5.45 (4.31, 6.90)	...	...	5.50 (4.34, 6.97)
Men	2.42 (2.16, 2.70)	1.35 (1.16, 1.57)	5.92 (4.26, 8.25)	2.90 (2.54, 3.31)
Secondary				
Women	2.69 (2.09, 3.45)	...	...	2.70 (2.10, 3.48)
Men	2.00 (1.76, 2.27)	1.28 (1.07, 1.53)	3.12 (2.18, 4.46)	2.45 (2.11, 2.85)
Occupation				
Professional	1.00	1.00	1.00	1.00
Skilled				
Women	0.93 (0.64, 1.34)	...	...	0.92 (0.64, 1.34)
Men	1.26 (1.00, 1.58)	1.04 (0.75, 1.43)	2.51 (1.34, 4.71)	1.19 (0.91, 1.56)
Unskilled				
Women	1.26 (0.93, 1.70)	...	...	1.24 (0.92, 1.68)
Men	1.66 (1.34, 2.06)	1.22 (0.91, 1.63)	3.29 (1.77, 6.10)	1.65 (1.29, 2.12)
Trader				
Women	1.05 (0.71, 1.55)	...	...	1.01 (0.68, 1.50)
Men	0.85 (0.68, 1.06)	1.05 (0.77, 1.42)	1.53 (0.82, 2.86)	0.68 (0.52, 0.88)
Service				
Women	1.00 (0.73, 1.36)	...	...	0.99 (0.73, 1.35)
Men	1.32 (1.07, 1.63)	1.08 (0.81, 1.44)	1.39 (0.75, 2.59)	1.48 (1.16, 1.90)
Unemployed				
Women	1.95 (1.18, 3.21)	...	...	1.89 (1.15, 3.12)
Men	1.84 (1.45, 2.33)	1.34 (0.95, 1.87)	3.48 (1.84, 6.58)	1.79 (1.36, 2.36)
Housewife				
Women	1.04 (0.77, 1.39)	...	...	1.03 (0.77, 1.38)
Men	...	...	...	...

^aIncludes all current smokers who were not exclusively current cigarette smokers.

educational category (college), odds ratios for all forms of tobacco use were significantly higher among those in the other educational categories. After adjusting for age and education, we also observed an inverse relationship between cigarette smoking and education (see Table 2).

Although the magnitudes of the relationships were not as large, occupation continued to play an important role in patterns of to-

bacco use when education and age were controlled. In the case of men, odds ratios for smokeless tobacco use remained statistically significant among unskilled workers, service workers, and unemployed individuals, and the odds ratios for bidi smoking remained significant among unemployed individuals and both skilled and unskilled workers. None of the odds ratios for cigarette smoking were significant. After education level had been con-

trolled, male traders were actually less likely to use smokeless tobacco than were professionals, suggesting an interesting interaction between education and occupation. Among women, after control for education level and age, only the odds ratios for those who were unemployed remained statistically significant.

DISCUSSION

The present results demonstrate the important roles of education and occupation in tobacco use patterns in India. Research in the West has consistently documented a strong socioeconomic gradient in tobacco use, with higher rates of use among those of greater social disadvantage.^{4,5,20–22} Indeed, Jarvis and Wardle²³ concluded that, in Western countries, “any marker of disadvantage that can be envisaged and measured, whether personal, material or cultural, is likely to have an independent association with cigarette smoking.” Recent evidence documents the same socioeconomic tobacco use gradient in India; tobacco use has been found to be higher among individuals at lower levels of education,^{10,11,15,24–27} of lower castes,^{15,27} and with lower standards of living.^{27,28} (Other research, however, has failed to reveal an association between tobacco use and socioeconomic position.²⁹)

Education is a powerful correlate of tobacco use patterns.¹⁰ In this study, after adjustment for occupation and age, all forms of tobacco use followed an inverse linear pattern in terms of educational level; similar results have been reported by others.^{11,15,27} Odds ratios were alarmingly high among individuals with no more than a primary school education, particularly, as described earlier, women using smokeless tobacco and men smoking bidis. Of note, when we adjusted only for age (data not shown), the direction of the relationship between education and cigarette smoking among men was reversed relative to the bivariate relationships presented in Table 1. Unlike the use of other forms of tobacco, cigarette smoking was most prevalent among the younger groups within this sample; among male participants, age contributed significantly to both education- and occupation-specific odds of cigarette smoking. These findings underscore the importance of ad-

justing for age in analyses such as those described here.

Our analyses also offer evidence of the independent effects of occupation and education on tobacco use among men; even after control for education, odds ratios for occupation were statistically significant among the most disadvantaged workers in regard to bidi smoking and use of smokeless tobacco. One interesting exception in these occupation-specific results involved the odds of using smokeless tobacco among male traders; although the overall prevalence of smokeless tobacco use was somewhat higher among traders than among professionals, a lower proportion of traders than professionals in each of the various educational groups used smokeless tobacco (data not shown).

Occupation appeared to carry more weight in regard to men's tobacco use than that of women. Because a large proportion of the women in this sample were housewives and 45% were illiterate, it is not surprising that education was a more important indicator of socioeconomic position than current occupation. The "housewife" category provided insufficient information to adequately describe socioeconomic position because it included women living in a range of social and economic circumstances. In addition, education appeared to swamp any influence of occupation among women; for example, the odds of smokeless tobacco use were more than 20 times greater among women who were illiterate than among women with a college education.

Unemployment was a particularly powerful predictor of tobacco use. In the case of all comparisons, even those taking education into account, unemployed individuals were at the highest risk of using tobacco, a relationship that has been reported in other populations as well.^{30–34} In addition, unemployment was most strongly associated with bidi use among men (OR = 3.5). Unemployment is an indicator of increased economic disadvantage and associated stressors such as poor housing conditions, unmet needs for food, and potential lack of social connectedness.^{23,35} Expenditures on tobacco products have been found to represent a significant portion of the daily incomes of Indian residents in low income categories, including unemployed individuals.³⁶

The present findings demonstrate the need, in studies assessing social disparities in tobacco use, to examine occupation and education separately as well as simultaneously. This will allow researchers to gain a more complete understanding of such disparities than might be the case when considering either indicator alone.⁵ Others have noted the importance of considering multiple indicators of socioeconomic position in understanding patterns of tobacco use.^{5,23,37} Education and occupation are likely to operate through differing pathways. Education is one of the most widely used indicators of socioeconomic position, given that it is easy to measure, applicable to individuals both inside and outside the labor force, and stable across the life course. It has consistently been shown to be a strong correlate of tobacco use, both in India and elsewhere.^{5,10,11,15,22,24–26} Nonetheless, it may fail to capture some of the elements of socioeconomic position expressed by occupation; occupation may further indicate one's standing in the community, reveal aspects of the normative environment prevalent within one's occupational "culture," and serve as a marker for the general conditions present at one's workplace.^{5,37}

Several caveats must be noted in interpreting our results. For example, our education and occupation data were based on self-reports. In addition, the complexities of obtaining, recording, and coding occupational data can lead to misclassification.^{37–40} Furthermore, our occupational categories were combined into broad groupings, which could have contributed to biased estimates in terms of the gradients observed. Nonetheless, these groupings provided greater precision than those used in earlier tobacco use research in India; in these studies, occupation was grouped into even more general categories.⁴¹ We collected data at the individual level, not the household level, and thus our data on socioeconomic position may have been incomplete, particularly in the case of women.³⁷ Future studies could include other indicators of socioeconomic position, such as caste or different standard of living measures.

In addition, as described earlier, the present data were collected as part of the initial data collection effort in a prospective cohort study; they were not part of a surveillance

study designed to assess population prevalence rates of tobacco use. The sample was not a random or representative sample of the population. In particular, we excluded individuals who resided in upper-middle-class and upper-class housing complexes that were not accessible as a result of security issues. Thus, the proportions of individuals in different occupational categories might not have been comparable to the proportions in other cities or in India as a whole. Nonetheless, our findings provide important insight into the interrelationships between education, occupation, and tobacco use. Moreover, although the proportions of different occupation types and the prevalence rates of tobacco use may not have been representative of the general population, it is highly unlikely that the interrelationships observed would have been seriously affected by our sampling methods.

Identifying occupation- and education-specific disparities in tobacco use can provide a useful "signpost" indicating inequities that need to be addressed by policymakers and the broader community through allocation of resources.⁴² Our results indicate that tobacco use in India follows a social gradient mirroring that reported for Western countries. If one is to shed light on patterns of disparities, it is important to consider multiple indicators of socioeconomic position, including both education and occupation, as well as gender. Additional research elucidating the differing pathways by which occupation and education may influence tobacco use can inform future policies and other interventions. ■

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This article was accepted September 3, 2004.

Contributors

G. Sorensen conceptualized the analyses presented here and wrote the first draft of the article. P.C. Gupta participated in all aspects of the conceptualization and preparation of the article. M.S. Pednekar conducted all data analyses and participated in the preparation of the article.

Human Participant Protection

This study satisfied all criteria regarding the ethical treatment of human participants, including those formulated by the Indian Council for Medical Research. Participants provided informed consent.

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