Cohort study of all-cause mortality among tobacco users in Mumbai, India

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Introduction Overall mortality rates are higher among cigarette smokers than non-smokers. However, very little is known about the health effects of other forms of tobacco use widely prevalent in India, such as bidi smoking and various forms of smokeless tobacco (e.g. chewing betel-quid). We therefore carried out a cohort study in the city of Mumbai, India, to estimate the relative risks for all-cause mortality among various kinds of tobacco users.

Methods A baseline survey of all individuals aged ⩾35 years using voters' lists as a selection frame was conducted using a house-to-house approach and face-to-face interviews.

Results Active follow-up of 52 568 individuals in the cohort was undertaken 5–6 years after the baseline study, and 97.6% were traced. A total of 4358 deaths were recorded among these individuals. The annual age-adjusted mortality rates were 18.4 per 1000 for men and 12.4 per 1000 for women. For men the mortality rates for smokers were higher than those of non-users of tobacco across all age groups, with the difference being greater for lower age groups (35–54 years). The relative risk was 1.39 for cigarette smokers and 1.78 for bidi smokers, with an apparent dose–response relationship for frequency of smoking. Women were basically smokeless tobacco users, with the relative risk among such users being 1.35 and a suggestion of a dose–response relationship.

Discussion These findings establish bidi smoking as no less hazardous than cigarette smoking and indicate that smokeless tobacco use may also cause higher mortality. Further studies should be carried out to obtain cause-specific mortality rates and relative risks.

Keywords: cause of death; cohort studies; India; smoking, mortality; tobacco, adverse effects; tobacco, smokeless, adverse effects.

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Introduction

Tobacco use is widely regarded as the most preventable cause of death and disease among adults today in the world. WHO has estimated that the excess premature mortality attributable to tobacco use (almost all of it in the form of cigarette smoking) amounts to 4 million deaths per year. Specific estimates are available for industrialized countries; for example, Peto et al. estimated that in developed countries in 1995 there were 2 million smoking-attributable deaths and that the excess mortality rate (per 100 000) among smokers aged 35–69 years was 701 for males and 312 for females (*1*). In China, the current tobacco-attributable mortality has been estimated to be 12% of adult male deaths, which corresponds to 700 000 deaths from tobacco use in the year 2000 (*2*).

India is the second most populous country in the world, and the third largest producer and consumer of tobacco. The country has a long history of tobacco use and a variety of ways of smokeless tobacco use and smoking, of which cigarettes form only a minor part (*3*). It has been clearly established that almost all forms of tobacco use carry serious health consequences (*4*). However, if the death and disease burdens from tobacco use in India are estimated only from cigarette smoking, the results may be a gross underestimation (*5*).

Previous estimates of tobacco-attributable mortality in India were based on the results of cohort studies in rural areas of Ernakulam District, Kerala (*6*), and in Srikakulam District, Andhra Pradesh (*7*). In these studies, cohorts of over 10 000 villagers aged ⩾15 years were followed up over a period of 10 years using a house-to-house approach. Thus accurate estimates of all-cause mortality were obtained, enabling estimates to be made of the relative risks for different kinds of tobacco use. Using conservative figures and employing 1986 mortality data for the whole of India, tobacco-attributable mortality in the country was estimated to amount to 630 000 deaths per year (*8*). Since data on the causes of death were not available, cause-specific mortalities were not calculated.

With a view to obtaining cause-specific tobacco-attributable mortality in India we carried out cohort study in Mumbai (*9*). In this article we report preliminary results on all-cause mortality and the relative risks for various types of tobacco use.

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Methods

Mumbai is a large (population in 1991: 9 925 891), densely populated city (16 461 inhabitants per km^2). It is divided into three sectors: the main city, the suburbs, and extended suburbs. The study was confined to the main city (population: 3 418 089) which is the most densely populated area (48 830 inhabitants per km^2). Since the objective was to estimate adult tobacco-attributable mortality, this cohort study was restricted to individuals aged ⩾35 years.

Baseline survey

The sampling frame used was the electoral rolls, which provided the name, age, sex, and address of all individuals aged ⩾18 years. The rolls were fairly complete since almost everyone aged ⩾18 years is entitled to vote and they are updated before every major election through house-to-house visits.

The electoral rolls were organized by geographical areas. The smallest unit was a polling station, generally having about 1000 but sometimes up to 1500 names of individuals aged ⩾18 years. Polling stations covering areas that largely contained apartment complexes housing upper-middle and rich classes were not selected for the study because the residents did not perceive any material gain from participating and because their security precautions caused access difficulties for the interviewers. These problems became apparent during the pilot phase of the study.

After selecting a polling station, all individuals aged ⩾35 years on the appropriate electoral list were approached by investigators for an interview. About 50% of individuals estimated to be thus eligible were available for the interview. The commonest reasons for nonavailability were that they had changed their address or the interviewers were refused access by security personnel in the building (high socio-economic group). Sometimes individuals not listed on the voters' list were also interviewed and included in the sample when they insisted that they were permanent residents at the address. Such individuals formed about 5% of the sample. Their residence status was confirmed by examining the ration card that is issued by the Mumbai Municipal Corporation. Every household keeps such a card because apart from entitling the holder to certain food items at subsidized prices, it serves as a residence card for access to all city and state government services.

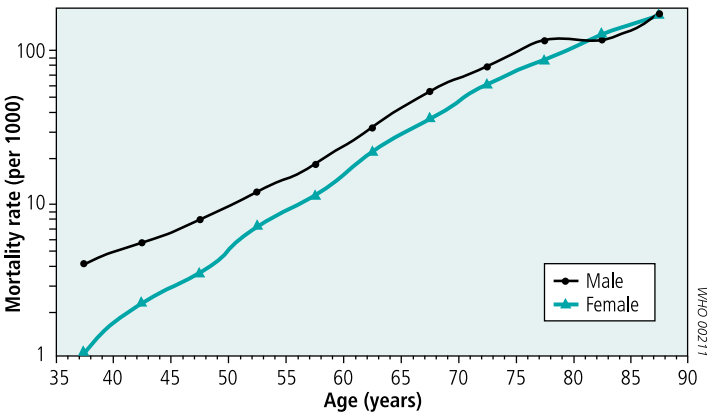
The interviews were conducted between February 1991 and May 1994 by trained investigators using handheld computers (electronic diaries). Details of the survey procedures and baseline characteristics of the cohort have been described elsewhere (*9*).

Table 1. **House-to-house follow-up results in the cohort study, Mumbai, India**

	No. of persons
Attempted contacts	52 568 (100)[a]
Address not located	1096 (2.1)
House demolished	1029 (2.0)
Incomplete address	67 (0.1)
Not identified	71 (0.1)
Invalid information about	122 (0.2)
Death	52 (0.1)
Migration	70 (0.1)
Denominator	51 279 (97.6)
Not contacted (due to migration)	5531 (10.5)
Date of migration not known	136 (0.3)
Contacted	45 748 (87.0)
Reported dead	4358 (8.3)
Date of death not available	237 (0.5)
Reinterviewed	38 836 (73.9)
Not available	2554 (4.9)

[a] Figures in parentheses are percentages

Fig. 1. **Annual mortality rates, by 5-year age intervals, among cohort study men and women, Mumbai**



Follow-up

Active follow-up of the cohort was begun 5–6 years after the initial survey. The field investigators were provided with lists of names and addresses of cohort members and were asked to revisit each person. If the person was alive and available, a face-to-face reinterview was conducted. If the person was reported dead, the date of death was recorded as accurately as feasible. Permanently moving out of the city of Mumbai was considered to be withdrawal from the study, and the date of moving out was noted.

Statistical analysis

Mortality rates were calculated using the person-years method. For this purpose, the person-months of follow-up were calculated first. Exact dates were rounded off to month and year, then the date of the baseline interview was subtracted from the date of withdrawal, i.e. the date of follow-up interview or the date of ascertainment that the person was alive for noninterviewed individuals. For those reported dead, the date of withdrawal was the date of death, and for those reported migrated, the date of migration. In cases where the exact date was not available, an appropriate midpoint was used. The information on age, gender, and details of tobacco use was abstracted

from the baseline data. Finally, the person-months were divided by 12 to obtain person-years.

The numerator for the mortality rate was the number of deaths. For calculating the age-specific mortality rate, the age at death was determined using baseline data. The age-specific mortality rates were plotted on a semi-log scale. The age-adjusted rates were obtained by direct adjustment, weighting by overall age-specific person-years; thus they are meant only for internal comparisons. Relative risks were calculated only from age-adjusted mortality rates.

The tobacco use analysis was restricted to three categories of individuals: those who did not report using tobacco in any smokeless or smoking form; those who reported using smokeless tobacco only; and those who reported smoking (some of whom could be smokeless tobacco users as well). The proportion of past users of tobacco was small, 2.2% among women (almost all smokeless tobacco users) and 4.5% among men (2.8% smokers and 1.7% smokeless tobacco users) (*9*); in the analysis they were combined with current users. In analysing the type of smokeless (or smoking) tobacco use, different categories were kept mutually exclusive. In the analysis of data by frequency of daily use of tobacco, individuals reporting multiple habits were excluded.

Tobacco use

In addition to cigarette smoking, a large variety of tobacco habits are prevalent in Mumbai, with use of bidis being the commonest. These are cheap smoking sticks (4–7.5 cm in length), handmade by rolling a dried, rectangular piece of *temburni* leaf (*Diospyros melanoxylon*) with 0.15–0.25 g of sundried, flaked tobacco into a conical shape and securing it with a thread.

In Mumbai the commonest form of smokeless tobacco is *mishri,* a black powder obtained by roasting and powdering tobacco. It is applied to the gums using a finger and the habit is generally begun by using *mishri* as a dentifrice.

Another common form of smokeless tobacco use that is prevalent in Mumbai, and also throughout India, is the chewing of betel-quid, a combination of betel leaf, areca nut, slaked lime, tobacco, and condiments, according to individual preferences. Other smoking and smokeless tobacco habits common in Mumbai that are also prevalent in many other parts of India have been described elsewhere (*3*).

Results

Table 1 shows the follow-up results for 52 568 individuals up to January 1999. A total of 1096 addresses could not be located, corresponding to 1029 individuals whose residential buildings were demolished and 67 whose address was not complete or specific enough for tracing. Mumbai has many old buildings that are demolished when either they become too dangerous to live in or to pave the way for development. Additionally, 71 individuals could not be identified. The follow-up information was invalid for 122 persons. Of these, 52 were reported dead and 70 had migrated, but their dates of death or of migration turned out to be earlier than the date of the interview in the baseline survey. These 1289 (2.4%) persons were excluded from both the numerator and the denominator of the mortality rates. Of the remaining 51 279 persons who

Table 2. **Person-years of follow-up and number of deaths in the cohort study, Mumbai**

	Men	Women	Total
No. of persons	20 322	30 957	51 279
No. of person-years	113 463	179 905	293 368
No. of deaths	2278	2080	4358
Crude mortality rate (per 1000 per year)	20.1	11.6	14.9
Age-adjusted mortality rate (per 1000 per year)	18.4	12.4	14.9

Table 3. **Person-years, annual mortality rates, and relative risks, by tobacco use, among cohort study women and men, Mumbai**

	No tobacco use	Smokeless tobacco[a]	Smoking
Women			
No. of person-years	64 414	114 980	511
No. of deaths	492	1575	13
Annual mortality rate (per 1000)	7.6	13.7	25.4
Crude	9.9	13.4	12.7
Age-adjusted			
Relative risk	1.0	1.35	1.28
Men			
No of person-years	27 236	57 890	28 338
No. of deaths	438	1096	744
Annual mortality rate (per 1000)	16.1	18.9	26.3
Crude	14.6	17.8	23.8
Age-adjusted			
Relative risk	1.0	1.22	1.63

[a] Non-smokers only.

Fig. 2. **Age-specific mortality rates among male smokers and non-users of tobacco, cohort study, Mumbai**

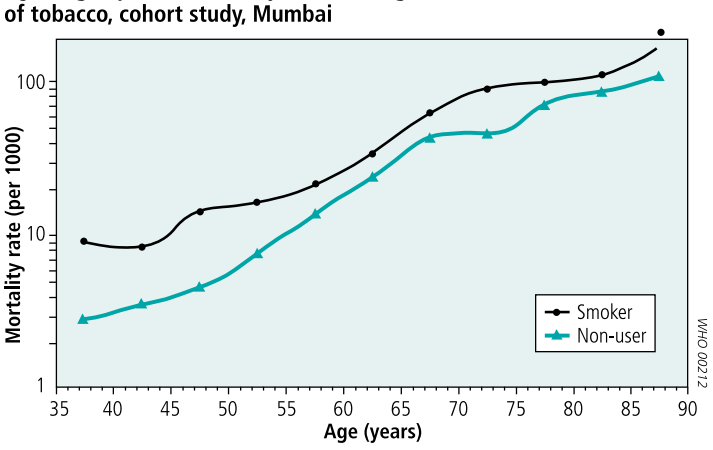


Fig. 3. **Age-specific mortality rates among a) male and b) female smokeless tobacco users and non-users of tobacco**

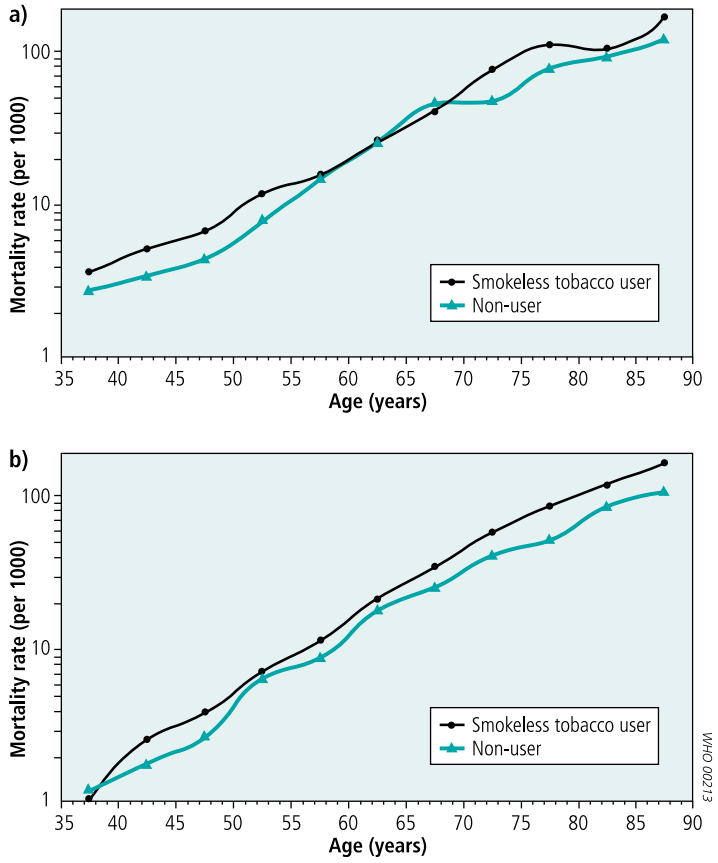


Table 4. **Mortality rates and age-adjusted relative risks by type and frequency of smoking habit among cohort study men, Mumbai**

	Person-years	Mortality rate[a]	Age-adjusted mortality rate[a]	Age-adjusted relative risk
Bidis	13 545	32.4	26.0	1.78
Cigarettes	13 329	19.2	20.3	1.39
Bidis + cigarettes	1163	33.5	32.5	2.23
Other	281	35.8	31.1	2.13
Bidi frequency (per day)				
1–5 times	2578	28.7	23.7	1.62
⩾6 times	10 967	33.3	27.1	1.86
Cigarette frequency (per day)				
1–5 times	6056	15.7	19.1	1.31
⩾6 times	7275	22.1	21.7	1.49
No tobacco use	27 236	16.1	14.6	1.00

[a] Per 1000 per annum.

contributed to the denominator, 5531 could not be contacted since they had migrated, mostly outside the study area. Attempts were made to determine the dates of migration (since this corresponded to the date of withdrawal from the study). The dates of migration of 136 individuals could not be determined, and for these, the midpoint date was used.

Of the 45 748 study persons, 4358 were reported to be dead; the dates of death for 237 of these individuals could not be ascertained and for these the midpoint was used. During follow-up 38 836 persons were reinterviewed, the remaining 2554 being unavailable despite multiple visits.

Table 2 shows the number of person-years and mortality rates by sex. A total of 293 368 person-years were observed. As in the original cohort, the male:female ratio, both in terms of the number of individuals as well as person-years, was about 2:3. More deaths were noted among men than women (2278 vs. 2080), and the crude mortality rate for men was nearly twice that for women (20.1 vs. 11.6 per 1000 per annum). After adjusting for age, the mortality rate among men was about 50% higher than that for women (18.4 vs. 12.4 per 1000 per annum).

Fig. 1 shows age-specific mortality rates for men and women. The rates for males were higher for all age groups, but the difference decreased with age.

Table 3 shows the mortality rates, by tobacco use, for men and women. The prevalence of smoking among women was very low, and only a few person-years (511) and deaths (13) were observed among women smokers. Among men smokers, the age-adjusted mortality rate (based on 744 deaths) was 23.8 per 1000 per annum, whereas the rate among non-users of tobacco (438 deaths) was 14.6 per 1000 per annum, giving a highly significant relative risk of 1.63. Smokeless tobacco use was very high among men and women, the age-adjusted relative risk for men (1096 deaths) being 1.22 and for women (1575 deaths) 1.35.

Fig. 2 shows the age-specific mortality rates among male smokers and non-users of tobacco. The rates among smokers were higher at all ages, but surprisingly the difference was higher for lower-age groups (35–54 years).

Fig. 3a and Fig. 3b show for men and women, respectively, the age-specific mortality rates among smokeless tobacco users compared with non-users of tobacco. For women the mortality rates among smokeless tobacco users were higher in all age groups except the lowest (35–39 years). Among men, except in the age range 55–65 years, mortality rates were higher among smokeless tobacco users.

Table 4 shows the mortality rates among men for the two major types of smoking habits prevalent in Mumbai: cigarettes and bidis. The age-adjusted relative risk was 1.39 for cigarettes and 1.78 for bidis. The daily frequency of smoking was divided into two classes: 1–5 times and ⩾6 times. A clear dose–response relationship was apparent for bidis as well as cigarettes.

Table 5 shows the mortality rates by the type of smokeless tobacco use among women and men. For women the most popular types were *mishri* and *mishri* + others, which had relative risks of 1.24 and 1.49, respectively. For men, the most popular type was *mishri* + others, which had a relative risk of 1.29.

Table 6 shows the mortality rates by frequency of use of the two major types of smokeless tobacco use (*mishri* and betel-quid) by men and women. The daily frequency of use was not very high (1–5 times and ⩾6 times, except for male *mishri* users, for whom they were 1–2 times and ⩾3 times). Despite this low frequency of use, a dose–response relationship was discernible.

Discussion

A high relative risk of overall mortality for cigarette smokers compared with non-smokers has been reported from every cohort study from all parts of the world. The present study, which shows a relative risk of mortality of 1.39 for cigarette smokers, demonstrates that Indians are no different in this respect. The excess mortality among male smokers in the 35–69-year age group in the present study was 880 per 100 000. For developed countries the excess mortality among males has been estimated to be 701 per 100 000 (*1*). Although the daily frequency of cigarette smoking in our cohort was low (median, 5 cigarettes (*9*)) and the two frequency classes were 1–5 times and ⩾6 times, a dose–response relationship was quite apparent, the two relative risks being 1.31 and 1.49.

The predominant form of tobacco use practised in India is bidi smoking. Because Mumbai is a large city, in our cohort use of bidis and cigarettes was equally common, but in the country as a whole, bidis are 8–10 times more commonly smoked than cigarettes. Bidi smoking is also practised in neighbouring countries, and there are recent reports of its availability and popularity also in the USA, especially among youth. The results on bidi smoking are therefore more relevant for India, but interesting also for many other countries.

Bidi smoking exhibited a high relative risk (1.78) that was not entirely unexpected. In a previous cohort study in Ernakulam District, Kerala State, male smokers (90% of them bidi smokers) had an age-adjusted relative risk of overall mortality of 1.5 (*6*). In another cohort study from Pune District, Maharashtra, the relative risk of overall mortality for bidi smokers compared with tobacco chewers was 1.6 (*10*). Although a bidi contains a much smaller amount of tobacco (0.2 g) than a cigarette (1 g), it produces a comparable or higher amount of tar and nicotine (*4*).

A more disturbing finding is the higher difference in age-specific mortality rates among smokers in the lower age groups. Thus, the relative risk for the age group 35–54 years was 2.4. Although the daily frequency of smoking was slightly higher among this age group (⩾6 times reported by 82% of 35–54-year-olds vs. 78% of ⩾55-year-olds), this did not account for the difference. Another disturbing finding is the high relative risk (1.62) even at a low level of exposure among bidi smokers (1–5 bidis per day).

The findings for smokeless tobacco use are slightly more difficult to interpret, but are less equivocal for women. Except for the lowest age group (35–39 years), the age-specific mortality rates for women were always higher among smokeless tobacco users than

Table 5. **Mortality rates and age-adjusted relative risks, by type of smokeless tobacco habit, among cohort study women and men, Mumbai**

	Person-years	Mortality rate[a]	Age-adjusted mortality rate[a]	Age-adjusted relative risk
Women				
Mishri	56 515	8.6	12.3	1.24
Mishri + others	42 192	20.1	14.8	1.49
Betel quid	10 805	14.3	11.8	1.19
Other tobacco	1821	20.9	16.0	1.62
Areca nut	2343	15.8	12.6	1.27
No tobacco use	64 414	7.6	9.9	1.00
Men				
Mishri	9965	15.1	15.5	1.06
Mishri + others	24 425	20.5	18.9	1.29
Betel quid	12 681	18.8	16.2	1.11
Other tobacco	7911	17.9	18.4	1.26
Areca nut	709	12.7	14.8	1.01
No tobacco use	27 236	16.1	14.6	1.00

[a] Per 1000 per annum.

Table 6. **Mortality rates and age-adjusted relative risks, by daily frequency of smokeless tobacco use, among cohort study women and men, Mumbai**

	Person-years	Mortality rate[a]	Age-adjusted mortality rate[a]	Age-adjusted relative risk
Women				
Mishri use (per day)				
1–5 times	54 223	8.7	12.3	1.24
⩾6 times	2786	7.2	14.8	1.49
Betel-quid use (per day)				
1–5 times	8609	13.4	10.9	1.10
⩾6 times	2887	15.6	14.8	1.49
No tobacco use	64 414	7.6	9.9	1.00
Men				
Mishri use (per day)				
1–2 times	9118	14.9	15.7	1.08
3–4 times	907	16.5	16.5	1.13
Betel-quid use (per day)				
1–5 times	8893	18.1	15.4	1.05
⩾6 times	3882	20.1	16.9	1.16
No tobacco use	27 236	16.1	14.6	1.00

[a] Per 1000 per annum.

non-users, with the difference being greater among older age groups (⩾65 years). Among men, the age-specific mortality rate for was same for smokeless tobacco users and non-users for the age group 60–64 years, slightly lower for the 65–69-year age group who used smokeless tobacco, with, as for cigarette smoking, the difference being greater for younger age groups (35–54 years). In the earlier study in Kerala (*6*), the relative risk for male smokeless users was 1.2 (not significant), and among women smokeless tobacco users it was 1.3 (significant). For both men and women, certain categories of smokeless tobacco use exhibited quite high relative risks, increasing with the frequency of use. Excess mortality among female smokeless tobacco users aged 35–69 years in the present study was 260 per 100 000 compared with 312 per 100 000 among women smokers in developed countries (*1*). It is therefore highly likely that smokeless tobacco use may also cause a higher overall mortality.

Our results have important public health implications. To date tobacco-attributable mortality has been calculated as that generally attributable to cigarette smoking. However, our findings demonstrate that the health effects of bidi smoking are at least as important as those of cigarette smoking. In India, where 8–10 times more bidis are smoked than cigarettes, a gross underestimation of the tobacco problem would therefore occur by ignoring bidis. In terms of tobacco control policies, appropriate warning labels on bidi packets and advertisements, and higher taxation on bidis, similar to that on cigarettes, seem highly desirable.

The main objective of this cohort study was to estimate tobacco-attributable mortality, and for that the next step is to determine the relative risks specific to the causes of death. We are currently ascertaining causes of death among the study cohort by examining the death information forms at Mumbai municipal corporation and are in the process of creating a computer database. We are matching cohort records with corporation death records using names and addresses and, to some extent, date of death. There are no standard spellings, however, and names and addresses may be entered in two record sets with different spellings and in a different order. Nevertheless, we are hopeful of achieving an adequate degree of matching that will enable us to calculate cause-specific mortality. ■

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Résumé

Etude de cohorte sur la mortalité générale des consommateurs de tabac à Mumbai (Inde)

Le taux de mortalité générale est plus élevé chez les fumeurs de cigarettes que chez les non-fumeurs. Néanmoins, les effets des autres habitudes tabagiques sur la santé restent méconnus, que ce soit pour les *bidis* (cigarettes locales roulées par le consommateur), ou pour les divers produits sans fumée. C'est pourquoi nous avons entrepris une étude de cohorte dans la ville de Mumbai afin d'estimer les risques relatifs de mortalité générale pour les différents groupes de consommateurs de tabac. Une enquête de référence portant sur toutes les personnes âgées d'au moins 35 ans, choisies dans les listes électorales, a été réalisée de porte en porte et au moyen d'entretiens. Nous avons entrepris le suivi actif de 52 568 personnes de la cohorte 5 à 6 ans après l'enquête en utilisant les mêmes méthodes ; 97,6 % des personnes ont ainsi pu être retrouvées. Nous avons perdu la trace des sujets manquants le plus souvent parce qu'ils avaient quitté leur domicile, devenu trop vétustes ou dangereux et, moins fréquemment, à cause du développement. Nous avons couvert au total 293 368 personnes-année et enregistré 4 358 décès. Les taux annuels de mortalité ajustés selon l'âge étaient de 18,4 ‰ pour les hommes (113 463 personnes-année) et de 12,4 ‰ pour les femmes (179 905 personnes-année). Nous avons pris pour référence les taux annuels de mortalité ajustés selon l'âge chez les personnes ne consommant pas de tabac : 14,6 ‰ pour les hommes (27 236 personnes-année) et 9,9 ‰ pour les femmes (64 414 personnes-année). Il en ressort que pour les hommes, le risque relatif (RR) général du tabagisme est de 1,63 (28 338 personnes-année). Les taux de mortalité, toutes classes d'âge confondues, sont plus élevés chez les fumeurs que chez ceux qui s'abstiennent de consommer du tabac, avec une différence plus grande (RR = 2,4) dans les classes moins âgées (35 à 54 ans). Les produits les plus consommés sont les cigarettes et les *bidis* avec des risques relatifs ajustés selon l'âge de 1,39 (13 545 personnes-année) et de 1,78 (13 545 personnes-année) respectivement. Une relation dose-effet est apparue avec la fréquence des cigarettes fumées chaque jour (1 à 5 fois et ⩾ 6 fois) (RR = 1,31 et RR = 1,49 respectivement), de même que pour les *bidis* (RR = 1,62 et RR = 1,86, respectivement).

Très peu de femmes fumaient (511 personnes-année) : elles consomment essentiellement du tabac sans fumée avec un risque relatif de 1,35 (114 980 personnes-année), les deux principales catégories de produits sans fumée étant le *mishri* seul (sorte de pâte orale, RR = 1,24) ou le *mishri* et d'autres produits (RR = 1,49). Les hommes adeptes du tabac sans fumée consomment surtout le *mishri* et d'autres produits (RR = 1,29). Pour les hommes comme pour les femmes, on a évoqué la possibilité d'une relation dose-effet pour les deux principaux produits sans

fumée, le *mishri* et le bétel. Les résultats établissent que la consommation de *bidis* n'est pas moins dangereuse que celle des cigarettes et indiquent que le tabagisme sans fumée pourrait également entraîner une augmentation de la mortalité générale. La prochaine étape consistera à obtenir les taux de mortalité et les risques relatifs en fonction des causes.

Resumen

Estudio por cohortes de la mortalidad por todas las causas entre los consumidores de tabaco en Mumbai (India)

Las tasas globales de mortalidad son mayores entre los fumadores de cigarrillos que entre los no fumadores. Sin embargo, es muy poco lo que se sabe acerca de los efectos en la salud de otras formas de consumo de tabaco muy extendidas en la India, como son los *bidis* y diversas modalidades de tabaco sin humo. En consecuencia, iniciamos un estudio por cohortes en la ciudad de Mumbai, en la India, para estimar los riesgos relativos de mortalidad por todas las causas entre diversos tipos de consumidores de tabaco. Mediante visitas domiciliarias y entrevistas personales, se llevó a cabo una encuesta de referencia entre todos los individuos $\geqslant$ 35 años identificados a partir de las listas de votantes. Al cabo de 5-6 años de esa encuesta, se emprendió un seguimiento activo de 52 568 individuos de la cohorte empleando los mismos métodos, localizándose al 97,6% de las personas. La razón más común de pérdida de individuos para el seguimiento fue la demolición de su vivienda, por vetustez o peligrosidad, o, con menor frecuencia, el desarrollo. Se abarcó a un total de 293 368 personas-año, y se registraron 4358 defunciones. Las tasas de mortalidad anual ajustadas por la edad fueron de 18,4 por 1000 para los hombres (113 463 personas-año) y 12,4 por 1000 para las mujeres (179 905 personas-año). Se adoptaron como categoría de referencia las tasas de mortalidad ajustadas por la edad observadas en los no fumadores, que fueron de 14,6 por 1000 al año (cifra basada en 27 236 personas-año) entre los hombres y de 9,9 por 1000 al año (cifra basada en 64 414 personas-año) entre las mujeres. En los hombres, el riesgo relativo (RR) global atribuible al tabaco fue de 1,63 (28 338 personas-año). Las tasas de mortalidad entre los fumadores fueron superiores a las correspondientes a los no fumadores en todos los grupos de edad, y la diferencia fue mayor (RR = 2,4) para los grupos de menor edad (35-54 años). El tabaco se consumía principalmente como cigarrillos y como *bidis*, y los riesgos relativos ajustados por la edad para esas dos modalidades de consumo fueron respectivamente de 1,39 (13 545 personas-año) y 1,78 (13 545 personas-año). Se observó una relación dosis-respuesta al tener en cuenta el número de cigarrillos consumidos al día (1-5 veces y $\geqslant$ 6 veces) (RR = 1,31 y RR = 1,49, respectivamente), así como para esas mismas frecuencias de consumo de *bidis* (RR = 1,62 y RR = 1,86, respectivamente).

Fumaban muy pocas mujeres (511 personas-año). Las que lo hacían consumían fundamentalmente tabaco sin humo, y el riesgo relativo entre ellas (basado en 114 980 personas-año) fue de 1,35. Las dos principales categorías de tabaco sin humo consideradas fueron *mishri* (RR = 1,24) y *mishri* + otros (RR = 1,49). Entre los hombres, la principal categoría de consumo de tabaco sin humo fue *mishri* + otros (RR = 1,29). Parecía insinuarse una relación dosis-respuesta para dos formas importantes de consumo de tabaco sin humo consideradas separadamente: mascada de betel y *mishri*, tanto entre los hombres como entre las mujeres. Los resultados indican que fumar *bidis* no es menos peligroso que fumar cigarrillos, y que el consumo de tabaco sin humo también puede dar lugar a una alta mortalidad por todas las causas. El próximo paso del trabajo consistirá en determinar las tasas de mortalidad y los riesgos relativos por causas específicas.

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