Mortality risk among tobacco users in a rural population of southern India: Evidence from a cohort study

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ABSTRACT

Background. Tobacco has long been identified as one of the most hazardous risk factors detrimental to health. To plan and implement anti-tobacco activities in any community, it is necessary to understand the risk it poses in that setting. We assessed the risk of mortality associated with tobacco use in a rural community of Kerala.

Methods. This cohort study (PROLIFE) was done in Varkkala, a rural development block of Thiruvananthapuram district of Kerala. Adults aged 20 years and above were included. Age-adjusted mortality rates were computed for both users and non-users of tobacco. The risk of mortality was plotted using Kaplan–Meier curves. Cox regression was used to compute the age-adjusted hazard ratio of mortality among tobacco users.

Results. More than one-fourth of the study population used tobacco. The age-adjusted mortality rates were higher among tobacco users. The major causes of death among both users and non-users of tobacco were similar. The incidence proportion of death among all causes of death was higher for tobacco users. The hazard of mortality was significantly more among tobacco users, with the age-adjusted hazard ratio being 1.225 (1.140–1.315).

Conclusion. The mortality risk due to tobacco use is high irrespective of the cause of death.

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INTRODUCTION

The role of tobacco as an important determinant of ill-health around the globe has been proven beyond doubt. According to the WHO, the use of tobacco results in over 5 million deaths per year globally, and recent trends suggest this could exceed 8 million deaths by 2030.[1,2] India is one of the largest consumers as well as producers of tobacco and has almost 275 million users currently for any form of tobacco use.[2] Among adults (age 15 years and above), over one-third (35%) of the population uses tobacco products, with 48% of men and 20% of women using some form of tobacco.[2] Nearly 800 000–900 000 people die every year in India due to diseases related to the use of tobacco.[2,3]

The easy availability of tobacco with its wide range of products in varying prices suits the needs of various socioeconomic, demographic and cultural sectors of the Indian population.[4] Furthermore, the weak links in law enforcement makes the use of tobacco products widely prevalent in India. According to the Global Adult Tobacco Survey conducted in the year 2009–10, 34% of adults in India and 21% in the state of Kerala used tobacco in any form.[5] There is also evidence from Kerala of a very high prevalence of tobacco use (>40%) among adult men.[6] Tobacco use is rampant in the state even among schoolchildren, and the age of initiation of its use is as early as 10.7 years.[7]

Many studies have estimated the burden of tobacco use in India. However, the implications of this high use of tobacco, both in terms of morbidity and mortality, have not been well studied. Evidence from such studies would guide policy-makers and strengthen the anti-tobacco drive. We aimed to assess the mortality risk due to tobacco use in a rural community of Kerala.

METHODS

This study was done in Varkkala, a rural development block of Thiruvananthapuram district, Kerala, India. The baseline information of the cohort has been reported elsewhere and is known as the Population Registry of Lifestyle Diseases (PROLIFE) cohort.[6] The total population of the study setting during 2001 was 161 942 individuals from 33 379 households located in the jurisdiction of seven *panchayats* (local self-governments), according to the original report. From this population, an adult cohort was built by including people aged 20 years and above. Relevant information was obtained from a total of 77 751 subjects including 33 698 (43.3%) men. The age–sex structure of the population, divisions of socioeconomic classes and morbidity profile has been reported previously.[6] The baseline population were followed up every year using trained volunteers for a period of 6 years.

A structured questionnaire was used for data collection and the volunteers visited the households allotted to them. The members of the household, preferably the head of the household, were the informants. People outside the households such as neighbours and local leaders were used as informants on a few occasions especially in case of emigration. Apart from the sociodemographic variables, the questionnaire used for follow-up included questions on behaviours such as tobacco use, alcohol consumption and physical activity as well as history of heart disease, diabetes mellitus and hypertension (self-reported). In case of death, separate verbal autopsies were conducted by trained health workers. The cause of death was ascertained by physicians from the verbal autopsy reports prepared by health workers.

Statistical analysis

Tobacco use was considered the main exposure variable. Death due to any cause during the follow-up period was the primary

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outcome variable. Sociodemographic variables have been compared between the general population and tobacco users. Mean (SD) and proportions have been used to summarize continuous and categorical variables, respectively. The incidence proportion of various causes of death among tobacco users has been compared to that of non-users. Death rates for each age group were computed. The mortality hazard for tobacco users as compared to non-users was tested using the log rank test. The Kaplan–Meier test was done to obtain the hazard plot. The age-adjusted mortality risk was estimated using Cox regression. Analysis was done using SPSS software version 16.

Ethical considerations

The tool for data collection was an interviewer-administered questionnaire which did not include physical examination, any *in vivo* procedures or drawing of blood. A written informed consent was obtained from the head of the family of each household. Community consent was obtained from the democratic leader of the *panchayat*. The study protocol was approved by the research committee and institutional ethical committee of Health Action by People, Thiruvananthapuram.

RESULTS

A total of 77 751 individuals were followed up for a period of 6 years; 20 467 individuals (26.3%) were users of tobacco in one form or the other. The users of tobacco were found to be slightly older than the general population. Men predominated among users of all forms of tobacco. The educational and economic status of tobacco users, though comparable with that of the general population, was low (Table I).

The number of deaths in the cohort during the follow-up period was 3453 (4.4%). However, among the 20 467 tobacco users, 1187 (5.8%) died, of which 943 (79.4%) were men. Figure 1 shows the age-specific mortality rate of tobacco users compared with non-users. The age-adjusted mortality rate was higher among tobacco users across all age groups. The mortality was found to increase as age progressed. The difference between mortality rates was highest in the age group of 60–69 years (0.83/100 person-years). Beyond this the death rates dropped in both categories and the difference also narrowed. Coronary artery disease, respiratory illness, cancers and stroke were the major causes of death in this study population (Table II). The causes were the same among users of tobacco but the incidence proportion of all the causes of death were more among them as compared with non-users of tobacco. A cause-wise analysis of data revealed that the risk of death due to coronary artery disease was 1.64 (1.08–2.49) times more among tobacco users even after adjusting for age. The risk due to other major causes of death such as cancer and stroke was also higher among tobacco users, though not statistically significant.

Figure 2 shows that the risk for mortality among tobacco users was significantly more than that for non-users ($p<0.001$). The unadjusted hazard ratio for death among tobacco users was 1.466 (1.369–1.570). After Cox regression analysis, the age-adjusted hazard ratio was 1.225 (1.140–1.315).

TABLE I. Sociodemographic variables of the population as compared with tobacco users

Variable	Study population (*n*=77 751)	Tobacco users (*n*=20 467)
Mean (SD) age	41.91 (16.04)	47.29 (15.68)
Gender		
Men	33 698 (43.3)	17 158 (83.8)
Women	44 053 (56.7)	3309 (16.2)
Education		
<5 years	20 097 (26.7)	7709 (37.7)
5–10 years	40 722 (54)	10 249 (50.1)
11–12 years	7480 (9.9)	964 (4.7)
Degree	4987 (6.6)	469 (2.3)
Professional degree	1666 (2.2)	211 (1.0)
Higher education	415 (0.6)	45 (0.2)
Marital status		
Bachelor/spinster	11 023 (14.4)	2283 (11.2)
Married	56 822 (74.2)	15 833 (77.4)
Separated	1179 (1.5)	258 (1.3)
Divorced	411 (0.5)	81 (0.4)
Widower/widow	7107 (9.3)	1514 (7.4)
Socioeconomic status		
Low	33 063 (42.5)	11 178 (54.6)
High	41 159 (52.9)	8372 (40.9)

DISCUSSION

In our cohort, more than one-fourth of the study participants used some form of tobacco. The pattern differs across the country due to ethnic, cultural and socioeconomic differences.[8] A recent study from the Andaman and Nicobar islands of India showed that the prevalence of tobacco use was as high as 50%.[9] The study also noticed a high prevalence of its use, especially tobacco chewing among women. The overall prevalence of tobacco use and especially among men in our study is comparable with the rest of the country. However, the prevalence among women is much less. The age of initiation of tobacco use in our cohort is comparable to those reported in other studies.[9,10] It is evident that tobacco use is initiated at school. This highlights the importance of initiating anti-tobacco activities right from school.

The description of the socioeconomic profile of participants in our study shows that people with lower level of education and lower socioeconomic strata largely represent the cohort of tobacco users. As compared to the general population of the state, tobacco use is more among the low socioeconomic strata.[11] The complex interaction between socioeconomic factors and tobacco has been studied previously. Those belonging to lower levels of education and economic status are more prone to both the behaviour and its adverse outcomes.[12,13] One such study established the relationship between lower education in mothers and perinatal complications which operated through the high level of exposure to tobacco.[12] Another study documented that both the behaviour of smoking

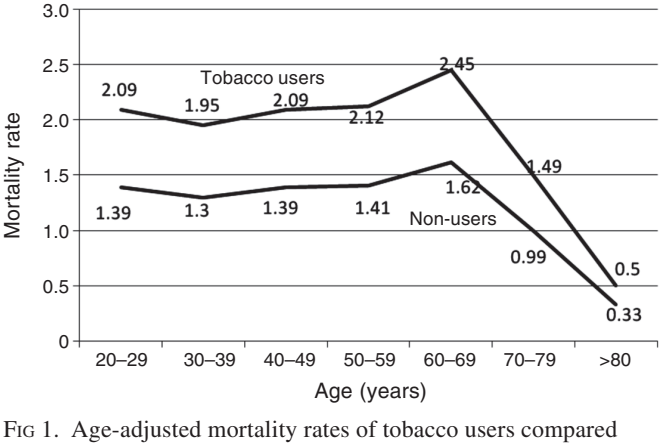

FIG 1. Age-adjusted mortality rates of tobacco users compared with non-users (per 100 person-years)

TABLE II. Causes and incidence proportions of death among tobacco users as compared with non-users

Cause of death	Number of deaths among tobacco users	Number of deaths among non-users	Incidence proportion among 100 tobacco users (*n*=20 467)	Incidence proportion among 100 non-tobacco users (*n*=57 284)
Coronary artery disease	485	493	2.37	0.86
Chronic obstructive pulmonary disease	268	222	1.30	0.39
Cancer	156	183	0.76	0.31
Stroke	134	256	0.66	0.44
Infections	93	77	0.45	0.13
Injuries	143	168	0.69	0.29
Renal disease	40	52	0.19	0.09
Hepatic disease	28	23	0.14	0.04
Old age	107	203	0.52	0.35

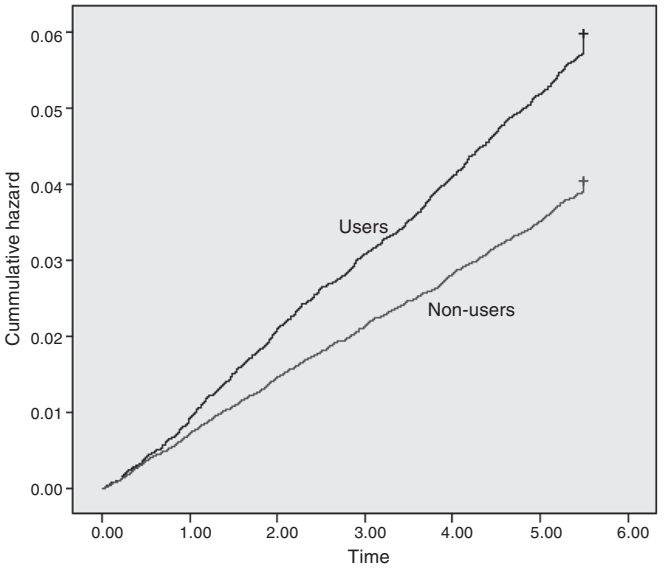

FIG. 2. Hazard of mortality among tobacco users compared with non-users

and average number of cigarettes smoked was associated significantly with the socioeconomic status and education of the people to quit smoking.[13] The anti-tobacco initiatives undertaken by the government should therefore focus on the lower social classes for its effective implementation.[14] The lack of awareness could be a reason for the high burden of tobacco use in India. Evidence suggests that awareness regarding the ill-effects of tobacco use is poor among its users in India.[15] Strategies to create awareness about the ill-effects of tobacco still have a role in 'stop tobacco' activities in India.

The ratios for mortality were high among users of tobacco in our study, even after adjusting for confounders such as age. The relation between tobacco and death has been well documented and is known. Few estimates show that the mortality burden accounted for by tobacco is more than 5000 times that due to international terrorism.[16] Also, the mortality burden due to tobacco is increasing in Third World countries, and these countries are least equipped to face the new challenge due to the prevailing socioeconomic and political settings.[17] A study from Tamil Nadu has shown that smokers have almost double the risk for all-cause mortality compared to non-smokers and the causes of death reported are comparable to those in our study.[18] However, the Tamil Nadu study showed a high burden of deaths due to infectious diseases especially tuberculosis. Deaths due to infectious diseases in our study population are fewer possibly because of the better health status of the participants at the community level. An important finding from our study is that the causes of death among tobacco users and non-users were similar. However, the relative risk of death due to coronary artery disease, chronic obstructive pulmonary disease and cancers were high among the users of tobacco in our study. As these are the leading killer diseases in the community, the risk ratio of death due to these causes in turn reflect the overall mortality burden of the population.

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