# Cancer in Indian Moslems

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**Moslems are the followers of Islam who, during the time of the Ghaznavid dynasty of Afghanistan, invaded India for the first time. Islam attaches equal importance to material and spiritual aspects of human life. Men and women have equal cultural rights. Marriage is positively enjoined and vigorously encouraged. Circumcision is compulsory before boys attain the age of 7. More than one wife (up to four) is permitted in Islamic Society. Differences in the habits, customs, and ethnic characteristics have all provided important leads for the study of cancer in this community. It is a sign of the times that some of the religious and social customs that were rigidly upheld by the older generations are rapidly giving way to "Modernism." Hence an attempt has been made to examine the differences found in the site-specific cancer risks in the Moslem community in Bombay. Analysis of the data was undertaken by sex- and age-adjusted and age-specific incidence rates. The common sites of cancer were found to vary greatly between the Moslem and non-Moslem populations of Greater Bombay. In Moslem men, the lung appears to be at highest risk, followed by the larynx, esophagus, tongue, and hypopharynx, whereas in non-Moslem men, the esophagus is the commonest site, followed by the lung, larynx, and tongue. In women, breast and cervix cancers, which rank first and second, respectively, in frequency in Moslems, reverse their positions in non-Moslem women.**

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AS A FOCAL POINT of epidemiologic research in cancer, studies relating to the ethnic or national origin of immigrants have been rarely been undertaken in India, except for a few large-scale investigations by Jussawalla *et al.*[1-3] and others[4-6] that have dealt with this factor in relation to the differences in site incidence of cancer among immigrants from various countries. The presence of a differential disease pattern in a particular population group suggests the existence of factors that may be genetic or environmental in nature and may be responsible for an increase or decrease in the occurrence of cancer at a particular site or sites. Further investigations may succeed in isolating other characteristics more closely related to the disease and, finally, a group may be identified that presents the highest risk of cancer at a specific site or sites. It may then be possible to determine the particular characteristics of the high-risk group that could lead to the cellular changes that ultimately result in cancer.

Identification of a specific behavior pattern in a culturally distinct group can prove to be most useful in epidemiologic investigations. This report studies the differences in site incidence of cancer between Indian Moslems and other religious groups living in Greater Bombay and examines the possible relationship between ethnic behavioral background and cancer at various sites.

Moslems can be distinguished by their habits, customs, and socioeconomic status from the members of the other Indian religious groups living in Bombay. They present striking differences in the incidence of cancer at various sites. An appraisal of the situation appeared to be promising in ascertaining whether the apparent differences in cancer incidence could be ascribed to recognizable variations in life-style. We have investigated the site patterns of cancer in this community and defined the magnitude and nature of the differences observed to determine which specific characteristics of this group could account for the differences noted.

When various socioeconomic and demographic characteristics of the populations were compared by religion, it was observed that average age at marriage, percentage of approving induced abortions, percentage of couples accepting family planning methods of contraception, and percentage of literacy were minimal in Moslem women when compared with women belonging to other

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TABLE 1. Socioeconomic and Demographic Characteristics of Population by Religion in Greater Bombay

| Characteristic | Religion | | | | All religions |
|---|---|---|---|---|---|
| | Moslem | Hindu | Christian | Parsi | |
| Average age at marriage | 16.05 | 16.77 | 19.65 | 24.03 | 17.00 |
| Standardized general marital fertility rate | 222.83 | 176.16 | 173.44 | 124.91 | 189.01 |
| Average no. of children ever born per woman | 3.50 | 3.06 | 3.04 | 1.60 | 3.07 |
| Average no. of living children born per wife | 2.95 | 2.65 | 2.80 | 1.43 | 2.68 |
| Percentage approving induced abortions | 10.18 | 16.73 | 12.12 | 70.00 | 15.77 |
| Percentage of couples accepting various methods of contraception | 17.90 | 25.19 | 17.95 | 70.17 | 21.49 |
| Percentage of literacy | 45.98 | 73.15 | 59.55 | 97.96 | 71.23 |

With permission from Rele JR, Kanitkar T. Fertility and Family Planning in Greater Bombay. Bombay: Popular Prakashan, 1980.[19]

religions. However, the general marital fertility rate and the average number of children ever born to women were found to be lowest for Moslem women (Table 1).

### Historical Background

Moslems are the followers of Islam. The first principle of Islam is "tauhid," signifying unity or "Oneness of God," with whom no other deity can be associated. To a Moslem, God, or Allah, is not only the creator, but also the master of all. "Zakah," another basic tenet of Islam, is a payment toward the community funds; this is obligatory for every Moslem who has attained the minimum prescribed limits of well-being and prosperity. The meaning of the term is "growing" and "purifying one's self." After Zakah, the next obligatory duty incumbent on every Moslem is fasting during the month of Ramadan. The Hajj is the last of the obligatory practices. It means travel toward God. It is incumbent on every adult Moslem man or woman to go once in his or her lifetime to Mecca to perform the Hajj, in accordance with the Will of God.

In 632 AD, Prophet Muhammad, the founder of Islam, died. During the 23 preceeding years, he had toiled successfully for establishing the new religion, as well as for the creation of a State which, beginning as a tiny city-state in Medine, embraced within a short span of 10 years the whole of the Arabian peninsula, together with certain southern parts of Palestine and Iraq. He left behind a community of several hundred thousand followers, who had the fullest faith and conviction in his doctrines and were fully capable of continuing the work he had begun.

The Ghaznavid dynasty of Afghanistan invaded India for the first time. Soon other dynasties followed, which contented themselves with conquering the north of the country. Then came the Khaljis, who pushed their conquests further south. The Great Mugals (1526–1858) firmly established the Moslem hold on India. For a long time, they ruled over almost the entire vast subcontinent, and have come to be regarded as some of the great rulers of the world. Their central authority began to weaken by the activities of their provincial governors by the 18th Century. In 1858, the British annexed 60% of the country for the British crown, the rest being divided among indigenous states, some of which had a Moslem majority, and were able to preserve the Indo-Moslem culture. In 1947, when India got its freedom, Pakistan was carved out from it. However, all Moslems did not migrate to Pakistan, the majority opting to stay in India. With 11.2% of its population Moslem (about 80 million in all), India has the second largest Moslem population in the world (after Indonesia).

### Area and Population of Greater Bombay

Greater Bombay is a cosmopolitan city which, by 1981, had reached a population level of 8.2 million, drawn in sizable numbers from every state in the Indian Union. Today, this urban centre is representative of a cross-section of the heterogenous peoples of the country. Hindus, Moslems, Christians, and Parsis constitute 68.8%, 14.1%, 6.3%, and 1.1%, respectively, of the total population of the metropolis. This densely populated center on the west coast of India covers an area of 437.7 $km^2$ and is situated between latitudes 18°54′ and 19°16′ North and longitudes 70°47′ and 73°00′ East.

### Material and Methods

The basic data utilized for this study were obtained from the Bombay Cancer Registry, which restricts its coverage to confirmed residents of Bombay. Any person who had lived in the city for 1 or more years before diagnosis is considered a resident. During the period under review (1973–1978), 27,893 new cancer cases were registered, of whom 4248 were Moslems (2609 men, 1639 women).

The Indian Census Board does not publish the data available, by age and sex breakdown for various religious

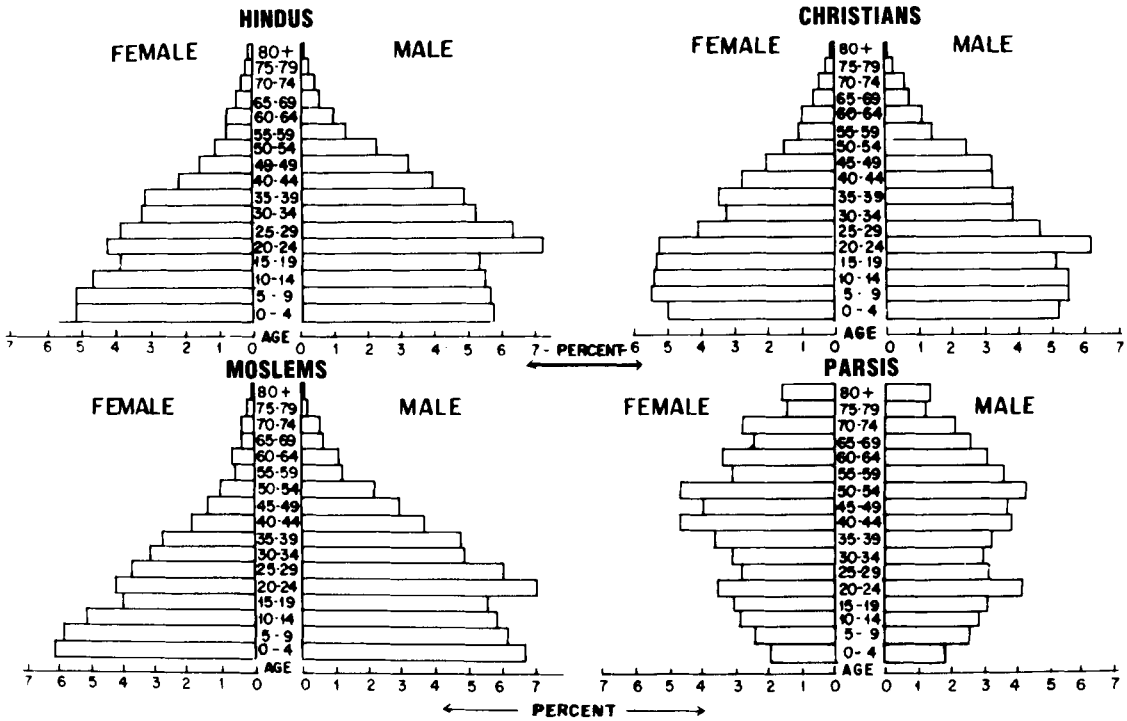


FIG. 1. Percent of cancer patients compared to total population for various religions in greater Bombay.

groups. Such data is, however, preserved on tape for the Greater Bombay region by the census office in Maharashtra State. By special request these population details by age and sex for the various religious groups (20% sample) were supplied to us by the Census Department. Using these figures and the data from the 1961 and 1971 Census reports, the population figures for Bombay were estimated for the period under review by assuming an exponential rate of growth for each age group, sex, and religion. Since our definition of a resident differs from the criteria used in the population census, our population estimates were further corrected by eliminating all migrants who had resided for less than 1 year in Bombay. This estimated population figure and the world standard population suggested by the International Agency for Research on Cancer (IARC)[7] were then utilized for computing the age-adjusted and crude incidence rates (Fig. 1).

For testing the difference between age-adjusted incidence rates of Moslems and non-Moslems at major sites, a simplified statistical procedure was employed, based on the assumption that cancer cases are found in the general population according to the "Poisson" distribution. Furthermore, it was also assumed that when the observed number was more than five, the situation could approximate a normal distribution. Thus, for example, if the age-adjusted rates in the Moslem (Madj I) and Non-Moslem groups (Madj II), are to be compared and their difference tested for statistical significance, it has been assumed that the difference (D) (D = Madj I − Madj II) is normally distributed with a standard deviation (SD),

$$SD = \sqrt{\frac{(\text{Madj I})^2}{f_1} + \frac{(\text{Madj II})^2}{f_2}}$$

when $f_1$ and $f_2$ denote the number of new cases of specific types of cancers in the two populations.

## Findings

### *Incidence Rates*

The crude incidence by sex for Moslem and Non-Moslem populations indicate that women in both groups have a somewhat equal incidence (Moslem, 65.9; non-Moslem, 68.6) but that Moslem men exceed by nearly 16% (77.6) the incidence rate of non-Moslem men (65.9).

These figures should not be used as indicators of the relative risk, since crude rates also reflect the age composition of the population and the Moslem and non-Moslem differences in incidence rates are mainly based on populations having a different age composition. Incidence rates, adjusted to the age distribution of the world population taken as a composite whole, indicate that Moslems have a considerably higher incidence of

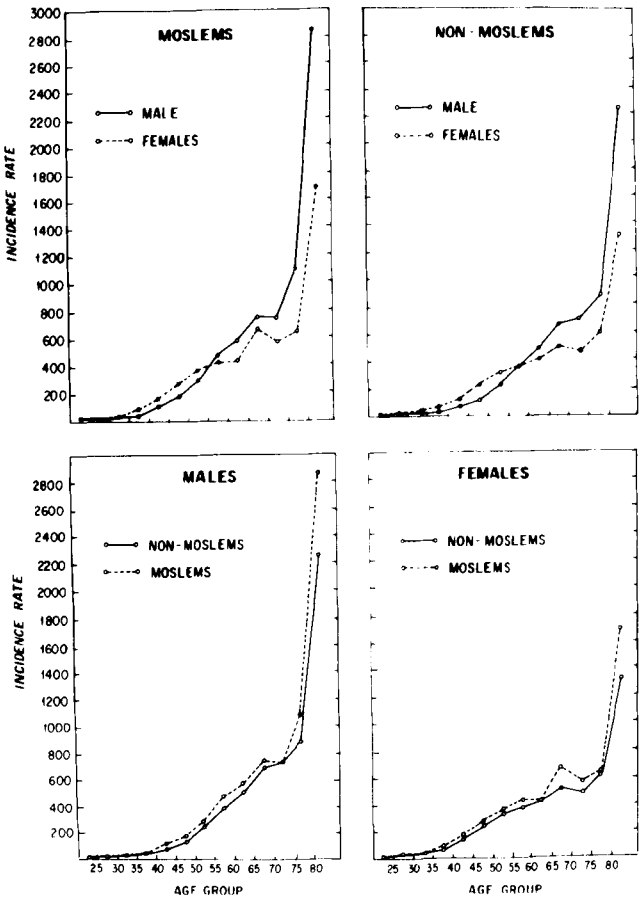


FIG. 2. Average age-specific incidence rates for Moslems and non-Moslems by sex in greater Bombay, 1973–1978.

cancer than non-Moslems in both sexes (19% in men; 13% in women).

This overall high incidence is probably due to the great prediliction for cancer to arise in the pharynx and respiratory systems in Moslem men and in the pharynx and digestive system in Moslem women.

The sex ratio was found to be more or less the same for both populations (Moslems, 1.11; non-Moslems, 1.12). Male preponderance in Moslems, however, was seen mostly in the regions of the rectum, liver, and lung; female preponderance was noted in the hypopharynx, oropharynx, esophagus, stomach, and larynx. An even sex ratio was observed in both populations for tongue and buccal mucosa cancers.

### *Difference by Age*

In both populations, cancer incidence increases sharply with age. The curves for men and women, however, are quite distinct and different. In both populations, at the younger ages, the incidence is slightly higher in men. The frequent occurrence of breast and genital cancers accounts for the higher incidence between the ages of 20 and 54 in women. In both sexes, Moslems have a higher incidence at almost all ages, when compared with non-Moslems. Again, in both the populations, at about the age of 55, the incidence curves for men and women intersect, the male rates increasing more steeply thereafter, perhaps due to the high incidence of prostatic cancer. (Fig. 2). The age-specific incidence rates by sex for the major sites in Moslems and non-Moslems are presented in Figure 3.

The incidence of cancer of lung, larynx, and hypopharynx is higher in Moslem men than in non-Moslem men at all ages. Exactly the reverse situation is observed for cancers of the prostate and esophagus. In Moslem women, the incidence of the cancer of the cervix is low at all ages. Exactly the reverse situation is observed in cancer of the breast, tongue, and hypopharynx. The incidence of cancer of the ovary was more or less equal at all ages in both population groups (Fig. 3).

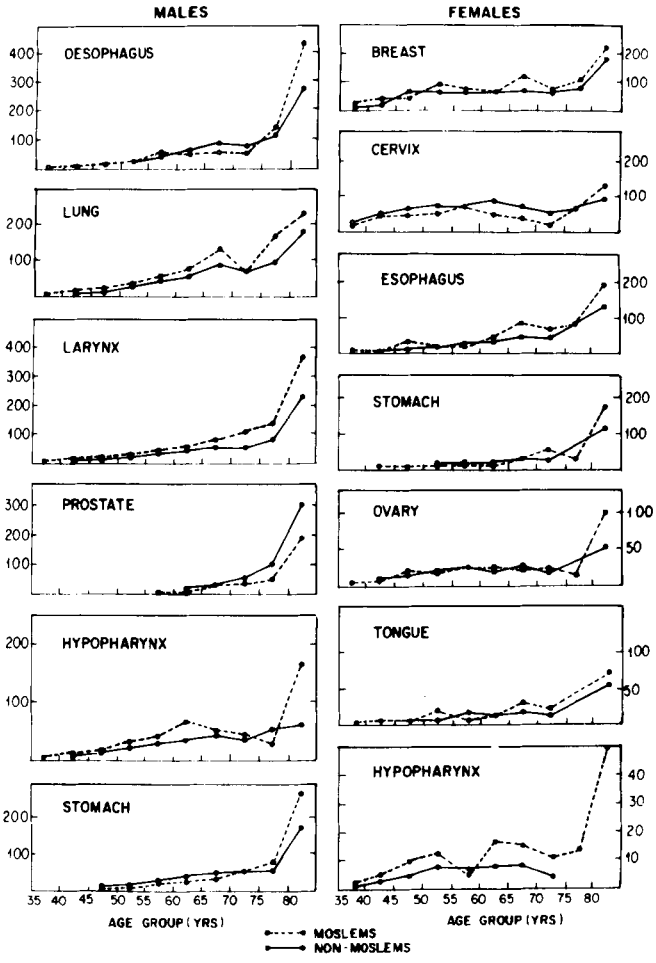


FIG. 3. Age-specific incidence rates for most common sites in Moslems and non-Moslems by sex in greater Bombay, 1973–1978.

TABLE 2. Most Prominent Cancer Sites by Sex in Moslems and Non-Moslems, Greater Bombay, 1973 to 1978

| | | Moslem | | | Non-Moslem | | |
|---|---|---|---|---|---|---|---|
| Rubric | Site | No. of cases | AAR | (%) | No. of cases | AAR | (%) |
| Men | | | | | | | |
| 162 | Lung | 289 | 19.0 | 11.1 | 1218 | 13.8 | 9.2 |
| 161 | Larynx | 242 | 16.9 | 9.3 | 989 | 11.4 | 7.5 |
| 150 | Esophagus | 206 | 15.4 | 7.9 | 1223 | 14.2 | 9.3 |
| 141 | Tongue | 204 | 12.2 | 7.8 | 961 | 9.7 | 7.3 |
| 148 | Hypopharynx | 209 | 12.1 | 8.0 | 829 | 7.9 | 6.3 |
| 157 | Stomach | 121 | 9.1 | 4.6 | 793 | 9.0 | 6.0 |
| 146 | Oropharynx | 122 | 7.0 | 4.7 | 411 | 3.9 | 3.1 |
| 145 | Buccal mucosa | 97 | 5.5 | 3.7 | 467 | 3.9 | 3.5 |
| 188 | Bladder | 69 | 4.9 | 2.6 | 239 | 3.2 | 1.8 |
| 185 | Prostate | 44 | 4.9 | 1.7 | 368 | 7.4 | 2.8 |
| 140–208 | All sites | 2609 | 161.3 | 100.0 | 13194 | 135.7 | 100.0 |
| Women | | | | | | | |
| 174 | Breast | 302 | 25.7 | 18.4 | 1856 | 20.6 | 17.8 |
| 180 | Cervix | 232 | 17.9 | 14.2 | 2132 | 22.4 | 20.4 |
| 150 | Esophagus | 142 | 14.2 | 8.7 | 745 | 9.7 | 7.1 |
| 183 | Ovary | 89 | 7.0 | 5.4 | 620 | 6.8 | 5.9 |
| 151 | Stomach | 60 | 6.6 | 3.7 | 393 | 5.5 | 3.8 |
| 145 | Buccal mucosa | 56 | 4.9 | 3.4 | 327 | 3.9 | 3.1 |
| 141 | Tongue | 46 | 4.7 | 2.8 | 263 | 3.6 | 2.5 |
| 161 | Larynx | 44 | 4.5 | 2.7 | 170 | 2.1 | 1.6 |
| 148 | Hypopharynx | 49 | 4.3 | 3.0 | 187 | 2.0 | 1.8 |
| 153 | Large intestine | 39 | 3.9 | 2.4 | 209 | 3.0 | 2.0 |
| 140–208 | All sites | 1639 | 145.3 | 100.0 | 10451 | 120.7 | 100.0 |

AAR: age-adjusted rate.

*Common Forms of Cancer*

In Moslem men, the lung appears to be at highest risk, followed by the larynx, esophagus, tongue, and hypopharynx, in descending order. In Moslem women, the breast ranks first, followed by the cervix, esophagus, and ovary (Table 2).

The common sites of cancer in the non-Moslem population of Bombay during the same period appear to be quite different from those seen in the Moslem group. In the non-Moslem men, the esophagus is the commonest cancer site, followed by the lung, larynx, and tongue. Lung cancer, which ranks first among Moslems is in second place in non-Moslems. The esophagus, on the other hand, is the third commonest cancer in Moslems, but ranks first in the non-Moslem group. In women, breast and cervix cancers, which rank first and second, respectively, in Moslems, reverse their positions in non-Moslems (Table 2).

The differences between age-adjusted incidence rates of Moslem and non-Moslem populations by sex are presented in Table 3. If all sites are considered together, the difference between the age-adjusted rates in these two populations for both sexes is significant. In men, except for the esophagus and stomach, at all of the prominent sites the differences in the age-adjusted rates

TABLE 3. Testing of Differences Between Age-Adjusted Rates of Moslem and Non-Moslem Populations by Sex, Greater Bombay, 1973–1978

| Rubric | Site | Difference between AAR (D) | Standard deviation (SD) | Test of significance (D/SD) |
|---|---|---|---|---|
| Men | | | | |
| 162 | Lung | +5.2 | 1.63 | 3.19† |
| 161 | Larynx | +5.5 | 1.14 | 4.82† |
| 150 | Esophagus | +1.2 | 1.15 | 1.04$^{NS}$ |
| 141 | Tongue | +2.5 | 0.91 | 2.75† |
| 148 | Hypopharynx | +4.2 | 0.88 | 4.77† |
| 151 | Stomach | +0.1 | 0.89 | 0.11$^{NS}$ |
| 146 | Oropharynx | +3.1 | 0.65 | 4.77† |
| 145 | Buccal mucosa | +1.6 | 0.58 | 2.76† |
| 188 | Bladder | +1.7 | 0.63 | 2.70† |
| 185 | Prostate | −2.5 | 0.83 | 3.01† |
| Women | | | | |
| 174 | Breast | +5.1 | 1.62 | 3.14† |
| 180 | Cervix | −4.5 | 1.27 | 3.54† |
| 150 | Esophagus | +4.5 | 1.24 | 3.63† |
| 183 | Ovary | +0.2 | 0.65 | 0.31$^{NS}$ |
| 151 | Stomach | +1.1 | 0.90 | 1.22$^{NS}$ |
| 145 | Buccal mucosa | +1.0 | 0.69 | 1.45$^{NS}$ |
| 141 | Tongue | +1.1 | 0.73 | 1.51$^{NS}$ |
| 161 | Larynx | +2.4 | 0.70 | 3.43† |
| 148 | Hypopharynx | +2.3 | 0.63 | 3.65† |
| 153 | Large intestine | +0.9 | 0.66 | 1.36$^{NS}$ |

* Significant at 5% level.
† Significant at 1% level.
AAR: age-adjusted rate; NS not significant.

TABLE 4. Age-Adjusted Incidence Rates for Prominent Sites by Religion and Sex, Greater Bombay, 1973–1978

| Rubric | Site | Religion | | | |
|---|---|---|---|---|---|
| | | Moslem | Hindu | Christian | Parsi |
| Men | | | | | |
| 141 | Tongue | 12.2 | 11.7 | 7.4 | 2.0 |
| 145 | Buccal mucosa | 5.5 | 4.5 | 3.2 | 0.6 |
| 146 | Oropharynx | 7.0 | 4.4 | 2.3 | 0.3 |
| 148 | Hypopharynx | 12.1 | 8.9 | 4.9 | 2.3 |
| 150 | Esophagus | 15.4 | 16.6 | 12.3 | 5.1 |
| 151 | Stomach | 9.1 | 9.4 | 16.3 | 5.5 |
| 153 | Large intestine | 2.7 | 3.3 | 3.4 | 7.7 |
| 154 | Rectum | 4.5 | 4.5 | 4.9 | 3.3 |
| 161 | Larynx | 16.9 | 13.1 | 11.1 | 4.7 |
| 162 | Lung | 19.0 | 15.6 | 16.6 | 5.5 |
| 172–173 | Skin | 2.0 | 2.4 | 4.3 | 5.2 |
| 185 | Prostate | 4.9 | 8.1 | 9.2 | 6.9 |
| 186 | Testis | 1.1 | 0.9 | 0.9 | 3.2 |
| 187 | Penis | 0.2 | 2.8 | 2.5 | 0.6 |
| 188 | Bladder | 4.9 | 3.1 | 4.5 | 5.6 |
| 204–207 | Leukemia | 2.9 | 4.2 | 3.0 | 6.9 |
| 140–208 | All sites | 161.3 | 150.9 | 147.0 | 106.7 |
| Women | | | | | |
| 141 | Tongue | 4.7 | 4.3 | 2.9 | 2.2 |
| 145 | Buccal mucosa | 4.9 | 4.7 | 2.1 | 0.6 |
| 146 | Oropharynx | 2.2 | 1.0 | 0.6 | 0.3 |
| 148 | Hypopharynx | 4.3 | 2.4 | 1.2 | 0.2 |
| 150 | Esophagus | 14.2 | 12.6 | 5.3 | 1.8 |
| 151 | Stomach | 6.6 | 6.1 | 9.1 | 5.5 |
| 153 | Large intestine | 3.9 | 3.4 | 4.2 | 4.0 |
| 154 | Rectum | 3.9 | 2.7 | 1.8 | 3.6 |
| 161 | Larynx | 4.5 | 2.6 | 2.3 | 1.5 |
| 162 | Lung | 3.3 | 3.3 | 6.2 | 3.4 |
| 172–173 | Skin | 1.4 | 2.0 | 1.6 | 2.2 |
| 174 | Breast | 25.7 | 20.6 | 31.1 | 43.8 |
| 180 | Cervix | 17.9 | 25.7 | 16.8 | 5.6 |
| 183 | Ovary | 7.0 | 7.2 | 9.3 | 11.4 |
| 188 | Bladder | 0.3 | 0.8 | 1.3 | 3.0 |
| 204–208 | Leukemia | 2.2 | 3.0 | 1.8 | 3.4 |
| 140–208 | All sites | 145.3 | 135.6 | 129.0 | 129.5 |

are significant. Among women, the difference between age-adjusted rates is significant only for the breast, cervix, esophagus, larynx, and hypopharynx.

Age-adjusted incidence rates at selected sites by religion and sex are presented in Table 4. In Greater Bombay, the buccal cavity and pharynx are the most frequent sites affected by cancer, in contrast with the situation observed in various other countries throughout the world.[8] At these sites, male preponderance is quite evident. In this region at almost all sites, Moslems present higher incidence in both sexes. In men, in Moslems as well as in Christians and Hindus, the tongue is the most frequently involved site, followed by the hypopharynx. In women, the tongue is the leading site in Christians only, whereas in Moslems and Hindus it is the buccal mucosa. The incidence of cancers of the buccal cavity and pharynx seems to be very low in the Parsis, in both sexes, when compared with other religious groups.

In Moslems, Christians, and Parsis the incidence of cancers of the digestive organs seems to be more or less equal in men as well as in women, but male preponderance is seen at almost all sites in all of the religious groups. In men, the highest incidence for cancer of the esophagus occurs in Hindus; for the stomach and rectum, Christians; and for the large bowel, Parsis. In women, the highest incidence for esophagus and stomach cancer is observed in Moslems; for the large intestine, Christians; and for the rectum, Parsis. In Moslems and Hindus, in both sexes, the esophagus is the viscus most frequently involved in the gastrointestinal tract, whereas Christians and Parsis seem to be less affected at this site. The incidence of cancer of the stomach was found to be the highest in Christians of both sexes. Cancer of the large

intestine is very rare among Moslem men in comparision with Parsi men. In women, the incidence of cancer of the large bowel was found to be more or less the same in all of the religious groups.

Major differences are noticed in the rate with which cancer occurs in the respiratory organs in the various religious groups in both sexes. In men the lung is most commonly affected in Moslems as well as in Christians, but it ranks sixth in the Parsis and second in the Hindus. The ratio of lung to larynx cancer is greatly in favor of the former in most countries. Except for Moslem women, all of the religious groups in both sexes follow the same standard pattern.

The breast is the most commonly involved cancer site in Moslems, Christians, and Parsis, but it is the second most common cancer site in Hindu women. The highest incidence is noticed in the Parsis, in whom the rate is 2.1, 1.7, and 1.4 times higher than in the Hindus, Moslems, and Christians, respectively. Among the various religions, cancer of the cervix is seen maximally in the Hindus. The rates at this site in Moslem and Christians are only two thirds and for Parsis only one fifth the figure reported for Hindus. Cancer of the ovary is minimal in Moslem women as compared with the other religious groups.

In Moslem men, cancer of the genital organs (grouped together) is the lowest on record at the Bombay Registry. This is primarily due to the near absence of penile cancer and low incidence of prostatic cancer. Cancer of the testis is found maximally in the Parsis. Cancer of the bladder is minimally found in Hindu men and Moslem women, but is common in the Parsis in both sexes. Skin cancer is also found most frequently in the Parsis and is minimal in Moslems of both sexes. The incidence of leukemias is higher in Parsis (both sexes) and is lowest in Moslem men and Christian women.

## Discussion

Table 5 presents cancers in relation to smoking and tobacco chewing habits in the various religious groups in Bombay. The risk of developing oral and pharyngeal cancers is closely associated with tobacco chewing.[9,10] In both sexes, cancers of the tongue, buccal mucosa, oropharynx, and hypopharynx are commonest in Moslems followed, in descending order, by the Hindus, Christians, and Parsis (Table 4). The higher incidence of buccal cancers in the Moslems and Hindus is probably associated with the habit of chewing the betel quid with tobacco and lime and retaining the cud in the buccal sulcus for a long time.[11] Such chewing causes attrition of the gums, leading to malocclusion of the teeth, which then become sharp-edged. Changes are also seen in the periodontal membrane and the underlying bone. This ultimately leads to tilting of the teeth, either toward the buccal mucosa or the tongue, and the sharp edges cause excoriation and ulceration of the adjucent mucosa. This traumatic ulcer is then constantly irritated by the chemical products liberated from the betal chew; together, with poor oral hygiene, this gives rise to cancer. The low incidence of oral and pharyngeal cancer in Parsis and Christians is perhaps related to the fact that they are less addicted to chewing and maintain better oral hygiene (Table 5).

In Bombay, pan chewing also seems to be strongly indicted as a causative factor in esophageal cancer.[12] The high incidence of cancer at this site in Hindus and Moslems is noteworthy. Paymaster *et al.* also found from hospital statistics that Moslems have high frequency rates for cancer of the esophagus.[5] The low incidence of esophageal cancer in the Parsis is perhaps due to the lack of any addiction to chewing (Table 5). In Christians, in both sexes, the stomach is the most common site to be involved in the digestive tract. This situation is also observed in many western populations. This viscus is much less affected in the Parsis, in whom, in both sexes, cancers of colon and rectum are found commonly, as the majority of this group is non-vegetarian.

In both sexes, cancer of the larynx is found maximally in Moslems and, in decreasing order, in Hindus, Christians, and Parsis. The risk of developing laryngeal cancer is greater if the pan chewer is also addicted to smoking (Table 5). It does not seem to matter if the pan is chewed with or without tobacco, the risk being maximal in those addicted to both of these habits.[9] Cancer of the lung is most common in Moslem men and Christian women, and is least common in the Parsis of both sexes. A direct relationship between smoking and lung cancer has been demonstrated by numerous epidemiologists. Recently, Notani and Sanghvi[13] and Jussawalla and Jain,[14] have shown that the risk from lung cancer is maximal among smokers in the Bombay area.

In Table 6, a comparison has been made of demographic characteristics of cervical and breast cancers among the various religious groups in the Greater Bombay population.

The highest incidence of breast cancer is seen in Parsi women, followed, in descending order, by Christian, Moslem, and Hindu women. Paymaster and Sanghvi[4] found from hospital statistics that "almost one half of all cancers in Hindu women occur in the cervix while the breast is affected in only 14 percent. This proportion is reversed in Parsi women in whom the breast is the seat of cancer in 50 percent and the cervix is 19 percent.

TABLE 5. Cancer Occurrence in Relation to Smoking and Tobacco Chewing Habits by Religion, Greater Bombay, 1973–1978

| Primary site | Religion | Chewers only | | Chewers & smokers | | Smokers only | | No habit | | Total cancer cases | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | (%) | No. | (%) | No. | (%) | No. | (%) | No. | (%) |
| Tongue | Moslem | 15 | (11.4) | 41 | (31.0) | 67 | (50.8) | 9 | (6.8) | 132 | (100) |
| | Hindu | 98 | (19.7) | 111 | (22.3) | 247 | (49.7) | 41 | (8.3) | 497 | (100) |
| | Christian | 2 | (4.9) | 5 | (12.2) | 30 | (73.2) | 4 | (9.7) | 41 | (100) |
| | Parsi | 1 | (16.7) | — | — | — | — | 5 | (83.3) | 6 | (100) |
| | Other | 9 | (18.4) | 12 | (24.5) | 24 | (49.0) | 4 | (8.2) | 49 | (100) |
| Total | | 125 | (17.2) | 169 | (23.3) | 368 | (50.8) | 63 | (8.7) | 725 | (100) |
| Buccal mucosa | Moslem | 11 | (18.3) | 18 | (30.0) | 28 | (46.7) | 3 | (5.0) | 60 | (100) |
| | Hindu | 97 | (37.0) | 69 | (26.3) | 77 | (29.4) | 19 | (7.3) | 262 | (100) |
| | Christian | 1 | (4.5) | 2 | (9.1) | 17 | (77.3) | 2 | (9.1) | 22 | (100) |
| | Parsi | — | — | — | — | — | — | 1 | (100.0) | 1 | (100) |
| | Other | 7 | (33.3) | 5 | (23.8) | 9 | (42.9) | — | — | 21 | (100) |
| Total | | 116 | (31.7) | 94 | (25.7) | 131 | (35.8) | 25 | (6.8) | 366 | (100) |
| Oropharynx | Moslem | 15 | (16.3) | 29 | (31.5) | 45 | (48.9) | 3 | (3.3) | 92 | (100) |
| | Hindu | 33 | (14.5) | 59 | (26.0) | 118 | (52.0) | 17 | (7.5) | 227 | (100) |
| | Christian | — | — | 2 | (14.3) | 12 | (85.7) | — | — | 14 | (100) |
| | Parsi | — | — | — | — | — | — | — | — | — | — |
| | Other | 6 | (21.4) | 7 | (25.0) | 13 | (46.4) | 2 | (7.2) | 28 | (100) |
| Total | | 54 | (15.0) | 97 | (26.9) | 188 | (52.0) | 22 | (6.1) | 361 | (100) |
| Hypopharynx | Moslem | 15 | (10.1) | 52 | (35.1) | 62 | (41.9) | 19 | (12.9) | 148 | (100) |
| | Hindu | 126 | (26.0) | 102 | (21.1) | 208 | (43.0) | 48 | (9.9) | 484 | (100) |
| | Christian | 1 | (3.1) | — | — | 28 | (87.5) | 3 | (9.4) | 32 | (100) |
| | Parsi | 2 | (33.3) | — | — | 1 | (16.7) | 3 | (50.0) | 6 | (100) |
| | Other | 19 | (28.8) | 16 | (24.2) | 24 | (36.4) | 7 | (10.6) | 66 | (100) |
| Total | | 163 | (22.1) | 170 | (23.1) | 323 | (43.9) | 80 | (10.9) | 736 | (100) |
| Esophagus | Moslem | 23 | (21.5) | 27 | (25.2) | 44 | (41.1) | 13 | (12.2) | 107 | (100) |
| | Hindu | 116 | (21.0) | 101 | (18.2) | 245 | (44.2) | 92 | (16.6) | 554 | (100) |
| | Christian | — | — | — | — | 52 | (96.3) | 2 | (3.7) | 54 | (100) |
| | Parsi | — | — | — | — | — | — | 6 | (100.0) | 6 | (100) |
| | Other | 7 | (14.3) | 12 | (24.5) | 18 | (36.7) | 12 | (24.5) | 49 | (100) |
| Total | | 146 | (19.0) | 140 | (18.2) | 359 | (46.6) | 125 | (16.2) | 770 | (100) |
| Larynx | Moslem | 20 | (15.8) | 37 | (29.1) | 60 | (47.2) | 10 | (7.9) | 127 | (100) |
| | Hindu | 98 | (22.3) | 87 | (19.8) | 203 | (46.3) | 51 | (11.6) | 439 | (100) |
| | Christian | 1 | (3.3) | 3 | (10.0) | 23 | (76.7) | 3 | (10.0) | 30 | (100) |
| | Parsi | — | — | — | — | — | — | 5 | (100.0) | 5 | (100) |
| | Other | 11 | (24.4) | 9 | (20.0) | 17 | (37.8) | 8 | (17.8) | 45 | (100) |
| Total | | 130 | (20.1) | 136 | (21.1) | 303 | (46.9) | 77 | (11.9) | 646 | (100) |
| Lung | Moslem | 6 | (4.6) | 25 | (19.1) | 92 | (70.2) | 8 | (6.1) | 131 | (100) |
| | Hindu | 46 | (11.3) | 54 | (13.3) | 259 | (63.6) | 48 | (11.8) | 407 | (100) |
| | Christian | 1 | (1.5) | 2 | (3.0) | 56 | (83.6) | 8 | (11.9) | 67 | (100) |
| | Parsi | — | — | — | — | 2 | (50.0) | 2 | (50.0) | 4 | (100) |
| | Other | — | — | 3 | (9.4) | 25 | (78.1) | 4 | (12.5) | 32 | (100) |
| Total | | 53 | (8.3) | 84 | (13.1) | 434 | (67.7) | 70 | (10.9) | 641 | (100) |
| All related sites | Moslem | 105 | (13.2) | 229 | (28.7) | 398 | (49.9) | 65 | (8.2) | 797 | (100) |
| | Hindu | 614 | (21.4) | 579 | (20.2) | 1357 | (47.3) | 316 | (11.1) | 2866 | (100) |
| | Christian | 6 | (2.3) | 14 | (5.4) | 218 | (83.8) | 22 | (8.5) | 260 | (100) |
| | Parsi | 3 | (10.7) | — | — | 3 | (10.7) | 22 | (78.6) | 28 | (100) |
| | Other | 59 | (20.3) | 64 | (22.1) | 130 | (44.8) | 37 | (12.8) | 290 | (100) |
| Total | | 787 | (18.6) | 886 | (20.9) | 2106 | (49.7) | 462 | (10.8) | 4241 | (100) |
| Stomach | Moslem | 6 | (13.6) | 13 | (29.6) | 19 | (43.2) | 6 | (13.6) | 44 | (100) |
| | Hindu | 64 | (22.9) | 34 | (12.1) | 124 | (44.3) | 58 | (20.7) | 280 | (100) |
| | Christian | 2 | (4.7) | 3 | (7.0) | 33 | (76.7) | 5 | (11.6) | 43 | (100) |
| | Parsi | — | — | — | — | — | — | 5 | (100.0) | 5 | (100) |
| | Other | 5 | (23.8) | 6 | (28.6) | 4 | (19.0) | 6 | (28.6) | 21 | (100) |
| Total | | 77 | (19.6) | 56 | (14.2) | 180 | (45.8) | 80 | (20.4) | 393 | (100) |

TABLE 5. (*Continued*)

| Primary site | Religion | Chewers only | | Chewers & smokers | | Smokers only | | No habit | | Total cancer cases | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | (%) | No. | (%) | No. | (%) | No. | (%) | No. | (%) |
| Colon | Moslem | 4 | (23.5) | — | — | 7 | (41.2) | 6 | (35.3) | 17 | (100) |
| | Hindu | 22 | (21.0) | 8 | (7.6) | 36 | (34.3) | 39 | (37.1) | 105 | (100) |
| | Christian | — | — | — | — | 1 | (25.0) | 3 | (75.0) | 4 | (100) |
| | Parsi | 1 | (16.7) | — | — | 2 | (33.3) | 3 | (50.0) | 6 | (100) |
| | Other | 2 | (16.7) | 3 | (25.0) | 2 | (16.7) | 5 | (41.6) | 12 | (100) |
| Total | | 29 | (20.2) | 11 | (7.6) | 48 | (33.3) | 56 | (38.9) | 144 | (100) |
| Rectum | Moslem | 10 | (24.4) | 10 | (24.4) | 14 | (34.1) | 7 | (17.1) | 41 | (100) |
| | Hindu | 36 | (24.7) | 19 | (13.0) | 34 | (23.3) | 57 | (39.0) | 146 | (100) |
| | Christian | — | — | 1 | (5.9) | 9 | (52.9) | 7 | (41.2) | 17 | (100) |
| | Parsi | — | — | — | — | — | — | 4 | (100.0) | 4 | (100) |
| | Other | 7 | (53.8) | 1 | (7.7) | 1 | (7.7) | 4 | (30.8) | 13 | (100) |
| Total | | 53 | (24.0) | 31 | (14.0) | 58 | (26.2) | 79 | (35.7) | 221 | (100) |
| Pancreas | Moslem | — | — | 2 | (33.3) | 4 | (66.7) | — | — | 6 | (100) |
| | Hindu | 16 | (33.3) | 6 | (12.5) | 15 | (31.3) | 11 | (22.9) | 48 | (100) |
| | Christian | — | — | — | — | 3 | (60.0) | 2 | (40.0) | 5 | (100) |
| | Parsi | 1 | (20.0) | — | — | — | — | 4 | (80.0) | 5 | (100) |
| | Other | 1 | (100.0) | — | — | — | — | — | — | 1 | (100) |
| Total | | 18 | (27.7) | 8 | (12.3) | 22 | (33.8) | 17 | (26.2) | 65 | (100) |
| All not related sites | Moslem | 20 | (18.5) | 25 | (23.2) | 44 | (40.7) | 19 | (17.6) | 108 | (100) |
| | Hindu | 138 | (23.8) | 67 | (11.6) | 209 | (36.1) | 165 | (28.5) | 579 | (100) |
| | Christian | 2 | (2.9) | 4 | (5.8) | 46 | (66.7) | 17 | (24.6) | 69 | (100) |
| | Parsi | 2 | (10.0) | — | — | 2 | (10.0) | 16 | (80.0) | 20 | (100) |
| | Other | 15 | (31.9) | 10 | (21.3) | 7 | (14.9) | 15 | (31.9) | 47 | (100) |
| Total | | 177 | (21.5) | 106 | (12.9) | 308 | (37.4) | 232 | (28.2) | 823 | (100) |

Moslem women have a low but even distribution of cancer of the cervix (21 percent) and the breast (20 percent)." It has been repeatedly observed that the incidence of breast cancer is higher in unmarried women. Our findings also show that women with breast cancer have a low parity and that age at first pregnancy is an important risk factor (Table 6). The estimated risk for women who deliver for the first time at age 30 or older is nearly double that in women who have had their first child before age 20.[15,16] More women seem to remain unmarried in the Parsi and Christian communities than in the Moslem and Hindu groups. The average age at marriage is also higher among the Parsi and Christian women, and over the years, increasingly larger numbers

TABLE 6. Comparison of Demographic Characteristics Related to Cervical and Breast Cancers by Religion, Greater Bombay, 1973–1978

| Characteristic | Cervix | | | | Breast | | | |
|---|---|---|---|---|---|---|---|---|
| | Moslem | Hindu | Christian | Parsi | Moslem | Hindu | Christian | Parsi |
| Proportion of unmarried women to total population | 0 | 0.60 | 5.80 | 16.60 | 5.00 | 5.10 | 6.30 | 18.90 |
| Average age at marriage | 15.11 | 14.68 | 18.70 | 21.30 | 17.56 | 15.11 | 22.31 | 24.10 |
| Average age at first pregnancy | 18.80 | 18.09 | 21.20 | 23.50 | 20.79 | 20.20 | 24.91 | 25.71 |
| Average age at last pregnancy | 30.36 | 29.56 | 32.82 | 34.50 | 30.03 | 29.18 | 31.31 | 32.50 |
| Average no. of pregnancies | 5.40 | 5.89 | 4.90 | 4.62 | 4.62 | 5.24 | 4.10 | 4.08 |
| Average spacing of pregnancies (yr) | 3.40 | 3.10 | 3.42 | 4.08 | 3.52 | 3.20 | 3.80 | 4.12 |

of women have begun to marry at an older age. These social factors may have a bearing on the high incidence of breast cancer in Parsi and Christian women.

It has been established that cancer of the cervix is predominantly a disease of married women, especially occurring in those who marry at an early age and bear a large number of children.[17] Whatever influence marital status, sexual activity, and child bearing may have on the development of cervical cancer, the suspect factors begin to exert their action at a much earlier age. The low risk of cervix cancer in Parsi women as compared with women from other religious groups may be due to the older age at marriage and at first pregnancy, broad spacing of pregnancies, and fewer pregnancies (Table 6).

Most countries presenting a high incidence of cervical cancer also seem to have a high cervix to corpus ratio. Hindu, Moslem, and Christian women follow this universal pattern, whereas Parsis by contrast present a "low incidence and a lower ratio." The high cervix corpus ratio in Hindu, Moslem, and Christian women in Bombay in fact reflects the low rate of cancer of the corpus uteri rather than a high rate of cervical cancer.

The incidence of skin cancer is higher in the Parsis and lower in Moslems, as Parsis have a relatively fairer complexion. The higher incidence of this cancer in Parsis who have less cutaneous pigmentation is probably due to the carcinogenic action of sunlight (ultraviolet) and the relative absence of skin pigmentation in a tropical country such as India.[18] The higher incidence of bladder cancer in Moslems and Christians may be attributed to their smoking habits.

The cancer rates in Moslems for sites involving the male genital organs (grouped together) are lower than the figures reported for the other three religious groups. In all of the religious groups cancer of the prostate is predominant. The incidence of penile cancer is almost nil in Moslems, perhaps due to the practice of circumcision. It is also rare in the Parsis, perhaps due to the better hygiene practiced by members of this group.

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