Extrapolated trend of Cancer incidences in North eastern states of India

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Abstract:

The ICMR annual report of 2004-2005 reveals a very high incidence of cancer of all sites in general and tobacco and pesticides related cancer in particular North East region of India. According to the report by Rajesh Dikshit, et.al March 28, 2012 of the center of Global health research, Canada, across states, a 30 year old man in the North East has the highest chance(11.2%) of dying from cancer before 70 years of age. The same report also reveals that this chance of dying is highest(6.0%) for North east women.

Due to the magnitude of the disease in the region, it becomes important to make some forecasting study about the intensity of cancer incidences in the future. The present projections based on the extrapolation of trends of age adjusted cancer incidence rate, over time by least squares linear regression model assuming that trends in risk behavior will remain stable and the continuation of the past trend into the future.

The states that were selected for the present study are those where data are available for maximum number of years in the past. Based on the reports of Indian Council of Medical Research on population based cancer registries, Mizoram, Manipur, Sikkim and the districts of Kamrup and Dibrugarh in Assam are the regions of North East where the data are available from the year 2002 to 2010.

Based on the findings, it becomes clear that the incidences of cancer for all sites can significantly increase in some regions, moderately increase in the others and even decrease in few regions of North East India through the year 2016.

Keywords: North east India; Age adjusted incidences rate; extrapolation trends; ordinary least squares linear regression model.

1. Introduction

Cancer is a group of diseases that impose a heavy burden on the public health and pose a challenge to science. While the century-long trend of increasing cancer mortality in this country was reversed in the mid-1990s, cancer remains the second leading cause of death(Howe, *et al*, 2006), the toll on human suffering is profound, and its economic costs to society are substantial(Brown, *et al*, 2001). Furthermore, cancer presents an intellectually complex set of problems because of multiple sites and causation, inadequately understood biology, and myriad intervention strategies. Impressive progress has been made against cancer, but not solely because of new knowledge about its genetics and molecular biology or new therapeutic approaches. Progress has also followed in the footsteps of understanding the social and behavioral determinants of cancer (Hiatt and Breen, 2008). Recent times have seen an increase in the incidence of cancer and this is mainly attributed to urbanization, industrialization, lifestyle changes, population growth and increased life span.

2. Need of Study

Cancer is a group of diseases with similar characteristics, which can occur in all living cells in the body and different cancer types have different natural history. The myth that cancer affects people mostly in the developed countries is being broken by the fact that, of the 10 million new cancer cases seen each year worldwide, nearly 5.5 million are in the less developed countries. Cancer is the second most common cause of death in the developed world and a similar trend has emerged in the developing countries too (Stewart and Kleihues, 2003).

Cancer prevalence in India is estimated to be around 2.5 million, with over 8,00,000 new cases and 5,50,000 deaths occurring each year due to this disease. More than 70% of the cases report for diagnostic and treatment services in the advanced stages of the disease, which has lead to a poor survival and high mortality rate(Dinshaw, *et al*, 1999). The burden of cancer is increasing worldwide despite advances in diagnosis and treatment. Globally, the burden of new cancer cases in 2000 was estimated to be around 10.1 million, developing world contributing to 53% of this load. Rising longevity, alterations in life styles and progressive control of communicable diseases has led to emergence of cancer and non-communicable diseases as an important health problem in India and other developing countries (Murthy *et al*,

2008). *The ICMR annual report of 2004-2005 reveals a very high incidence of cancer of all sites in general and tobacco and pesticides related cancer in particular North East region of India*. According to the report by Dikshit, *et.al* March 28, 2012 of the center of Global health research, Canada, *across states, a 30 year old man in the North East has the highest chance(11.2%) of dying from cancer before 70 years of age. The same report also reveals that this chance of dying is highest(6.0%) for North east women.*

The three year report of the Population based cancer registries 2006-2008 of the Indian Council of Medical Research, reveals that among males, *five of ten North East registry areas show a higher Age adjusted incidence rate(AAR) compared to Delhi which has the highest AAR(124.3 per 100,000) among older PBCRs.* Aizawl district with AAR of 249.5 per 100,000 has approximately twice the AAR of Delhi. Mizoram state as a whole also shows higher AAR(176.5) followed by Kamrup urban district(AAR of 161.6) of Assam and Mizoram state excluding Aizawl district(AAR of 137.6). Among the newer registries, Thiruvananthapuram had higher AAR(121.7) compared to Kollam(AAR of 113.7) and Barshi expanded registry(AAR of 40.8). Among females, *two of the ten registries areas in the North East registries showed higher AAR*(Aizawl district 210.0 and Mizoram state 152.8) compared to Bangalore which has the highest AAR(139.1) among the older and newer PBCRs

In recent years cancer cases and death have risen alarmingly in the state of Meghalaya and data shows that the cancer incidences in the state have risen as 518 cases in 2005, 759 cases in 2006, 865 cases in 2008, 888 in 2009, 1007 in 2010 and 348 cases till Mar 2011. In the state of Nagaland the AAR incidences rate for the year 2009-2010 is 97.5 for males and 54.4 for females

The increasing trend of cancer incidence has forced the cancer patient to be focused more on treatment than on prevention. Due to the magnitude of the disease in the region, it becomes important to make some forecasting study about the intensity of cancer incidences in the future. Health specialists, planners and policy makers need information on the future cancer burden in their jurisdiction to assist in planning and policy formulation. Accurate information allows them to prioritize prevention activities, to allocate health services, and to evaluate the impact of certain interventions or treatments. Thus accurate projections of the future cancer

burden are essential. The present forecasting study becomes more important as there are some literature on cancer projection for other states of the country, but the same is absent for North East India.

3. Data and Methodology

An age-adjusted rate is a weighted average of the age-specific (crude) rates, where the weights are the proportions of persons in the corresponding age groups of a standard population. The potential confounding effect of age is reduced when comparing age-adjusted rates computed using the same standard population (Boyle and Parkin, 1991). Thus AAR is considered an appropriate indicator for the present study in highlighting the levels and trends of cancer incidence among some of the North eastern states.

Cancer burden is usually measured by four indicators: incidence, mortality, prevalence and survival. Recently, many developed countries have provided cancer incidence and mortality projections, including short-term projections (usually less than 5 years ahead) and/or long-term projections (around 25 years ahead) (e.g. Møller, Fekjxr & Hakulinen et al, 2002; Møller, Fairley & Coupland et al, 2007; Canadian Cancer Society, Statistics Canada, Provincial / Territorial Cancer Registries & Public Health Agency of Canada, 2009; AIHW, 2012 and Murthy et al,2008).

In the present study, statistical regression modeling of past trends is used for incidence projections, as the techniques allows projected cancer incidence and mortality trends to be estimated by extrapolating time trends from observed rates. The present projections based on the extrapolation of trends in cancer incidence over time assume that trends in risk behavior will remain stable and the continuation of the past trend into the future. However, incidence rates of specific cancers are affected by a number of factors, such as lifestyle changes, screening and early detection as a consequent only short term projection is attempted in the present study on account of the restrictive assumption.

An ordinary least squares linear regression model is utilized using age adjusted incidence rate of the most recent available trend of the study region. Due to the underlying assumptions, The model used in the present study is extrapolated only up to the near future to the year 2016.

The states that were selected for the present study are those where data are available for maximum number of years in the past. Based on the reports of Indian Council of Medical Research on population based cancer registries, Mizoram, Manipur, Sikkim and the districts of Kamrup and Dibrugarh in Assam are the regions of North East where the data are available from the year 2002 to 2010.

4. Findings and Discussions

Figure 1 and Figure 2 and Table reveals that the age adjusted rate of the incidence of cancer for all sites is highest for Mizoram state followed by Kamrup district of Assam state through the years of observations from 2004 to 2010 for both males and females.

Based on the past trends of the age adjusted rare of the incidences of cancer during 2003 to 2010 and assuming that no significant factors exists to change the rate through 2016, figure 3 reveals that the AAR for Mizoram state is higher for males and the extrapolated trend of the linear least regression depicts that the rate can increase to 215 by the year 2016. The similar analysis reveals that AAR of the incidences of cancer for all sites can increase to 170 for females by 2016.

Sikkim is the only state in the study to show that AAR(all sites) is higher for females compared to their males counterparts during the study period(Fig 4). AAR in both cases is showing tendencies of decreasing as reveals by the extrapolation of regression line of best fit. AAR can reach 80.5 for males and 85 for females by the year 2016. The figure also depicts that the rate of decline of AAR is faster among females.

Marginal differences are being depicted in the trends of AAR from 2003 to 2010 as obtained from the reports of the population based cancer registries for Manipur. The regression coefficients in the line of best fits show significant differences in the beta coefficients of males and females. The Table and Fig 5 reveals that the slope of the line in the former is positive and the later is negative, which lead to an increasing trend of AAR for males through 2016 and the rate might touch 87 where the same is declining for females to 68.5.

In Dibrugarh district of Assam state, AAR is showing trends of increasing for both males and females(Figure 6), and the rate at which AAR is rising is more in case of males. The extrapolated regression line of fits reveals that by the year 2016, the AAR for all cancer sites will be 118.5 for males and 81 for females.

Kamrup district of Assam is showing a high prevalence of cancer incidences which is only second to Mizoram. The trends of AAR(Figure 7) is decreasing for females where as it is increasing for males. The regression models shows that AAR for males would reach 182 and that of females would reach 134 by the year 2016.

International comparison of Cancer Incidences

The present study also attempts to provide a glimpse of the magnitude of cancer incidences when compared to others regions at an international level. At an international level, the only reliable data for cancer incidences is obtained from International agency for research on cancer through its publication *Cancer Incidence in Five Continents* (2007) which has become the recognized reference source on the incidence of cancer in populations around the world. The ninth volume has a wider coverage than before presenting data from around the year 2000 (ideally the period 1998–2002) not only for entire populations but also for sub-populations living in the same geographic area. Around the same period, the only data available in the country for North East region is the first report of the six population based cancer registries (PBCRs) of the North Eastern region is for the two year period 1 Jan 2003 to 31 December 2004 and publish in 2006 by National cancer registry programme of the Indian council of medical research. The registries are located in four states namely, Assam, Manipur, Mizoram and Sikkim.

Data from the two reports shows that develop countries are showing a very high incidences of cancer cases with respect to all anatomical sites as shown in figure 7. In the Indian continent have in recent times witness an increase in the incidence of cancer which can be mainly attributed to urbanization, industrialization, lifestyle changes, population growth and increased life span. Aizawl district of Mizoram state (AAR: 277.2 in males and 231.5 in

females) and being the main district of the state recorded the highest AAR (all sites) reported as yet from the Indian sub continent. Kamrup urban district (AAR: 177.2 in males and 154.1 in females) of Assam state follows closely in having such high incidence rates.

5. Summary

Based on the findings, it becomes clear that the incidences of cancer for all sites can significantly increase in the state of Mizoram and Diburgarh district of Assam state for both males and females through the year 2016. There can be a moderate rise of cancer incidences for males in the state of Manipur and Kamrup district of Assam. A decrease of cancer incidences for females can be witness in the state of Manipur, Kamrup district of Assam. Sikkim is the only state which can witness a declining trend in cancer incidences through the year 2016.

The above findings suggests that high AAR of the incidences of cancer will continue to persist for Mizoram, the two districts of Assam. It is envisaged from the findings of the study that in years to come cancer morbidity and hence cancer mortality would rise and therefore strengthen /augmenting the existing diagnostic/ management facilities along with primary prevention of tobacco related cancers should be initiated as early as possible. Prevention of cancers through reduction of tobacco use should be an important strategy of National cancer Control Programme of India. Cancer screening facilities should also be initiated so that leading cancer sites can be detected at early stages or at pre-cancerous stage. The district cancer control programme, which has been initiated with the objectives of providing health education, early case detection, and prevention and pain relief measures, has not resulted in substantial and productive activity. High numbers of cancers indicate need for augmented research efforts to identify effective screening tools. Incorporating screening activities into peripheral health infrastructure would effectively change the shift of clinical staging to left when less extensive surgical procedures could be attempted. Establishment of adequate treatment guidelines that can effectively be carried out at different levels (district hospitals, teaching hospitals, specialized hospitals etc.) would also help in reduction of mortality due to cancer. Over the next decades it is expected that there will be a substantial increase in the prevalence of cancers because of increasing longevity, greater exposure to environmental carcinogens due to

industrialization, pollution, use of fossil fuels, wide variety of chemical agents in the industry, agriculture and continued use of tobacco Murthy et al (2008). In short, reduction of cancer morbidity by 2020 would be an unrealistic goal, unless drastic measures are taken for its holistic control. Reduction of mortality through early detection/ down staging could still be expected to a limited extent. The present estimates highlight that existing treatment facilities are woefully inadequate to combat this deadly disease.

6. Conclusion

In conclusion, cancer is becoming an important public health issue and to tackle it would need immediate and major inputs from various agencies. The absolute number of cancer patients is increasing rapidly due to growth in size of the population The existing treatment facilities for cancer control in-terms of radiotherapy and financial allocation are woefully inadequate to take care of even the present load. In the North Eastern region, where more than 80% of the patients report to cancer care facilities in advanced stages of disease and where there are geographic disparities in treatment facilities, it is only natural that a lot of patients will be in incurable stages and that nothing more than measures to

improve the quality of life of such patients and their families can be done. The only way to fight this scourge under such circumstances is to have pragmatic programmed and policies based on currently available scientific information and sound public health principles. The programmed should necessarily have components for education and containing training for health care workers. Primary prevention is the real hope for reducing lung cancer morbidity and mortality. Public education and training of the health care workers also form important components of this programmed. Alternative methods of screening through visual inspection of cervix, clinical examination of breast and oral self examination can be more helpful.

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Figure 1: Age-Adjusted incidence (per 100,000) for all sites of cancer, between 2003 to 2010 for Males.

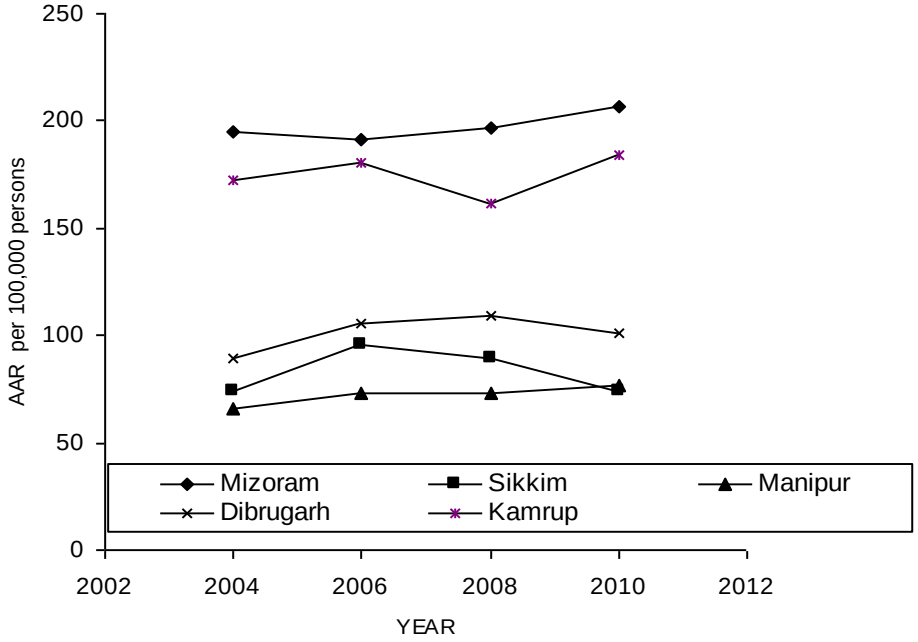


Figure 2: Age-Adjusted incidence rate(per 100,000) for all sites of cancer, between 2003 to 2010 for Females.

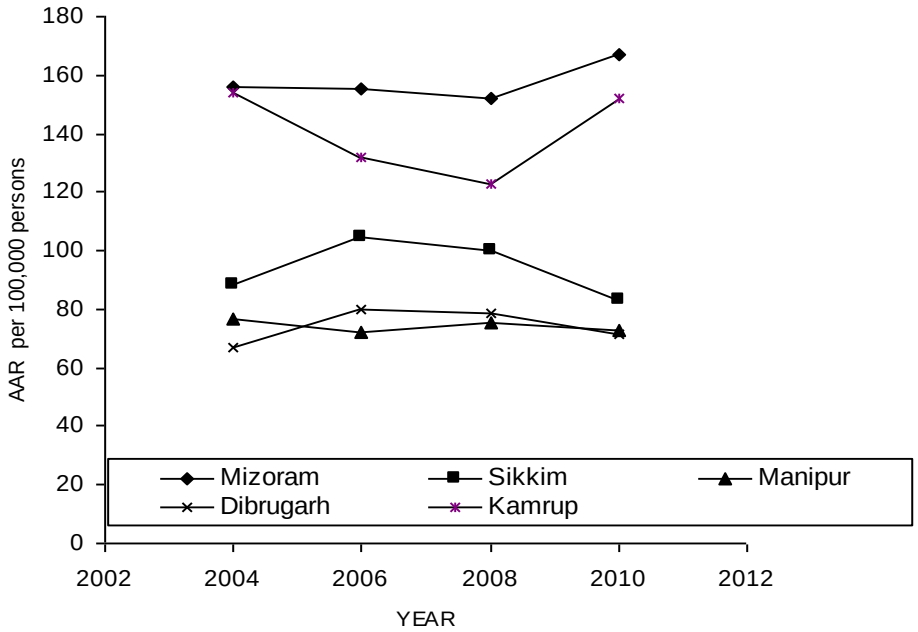


Figure 3: Extrapolated Age-Adjusted incidence rate(per 100,000) for all sites of cancer, up to 2016 for Mizoram.

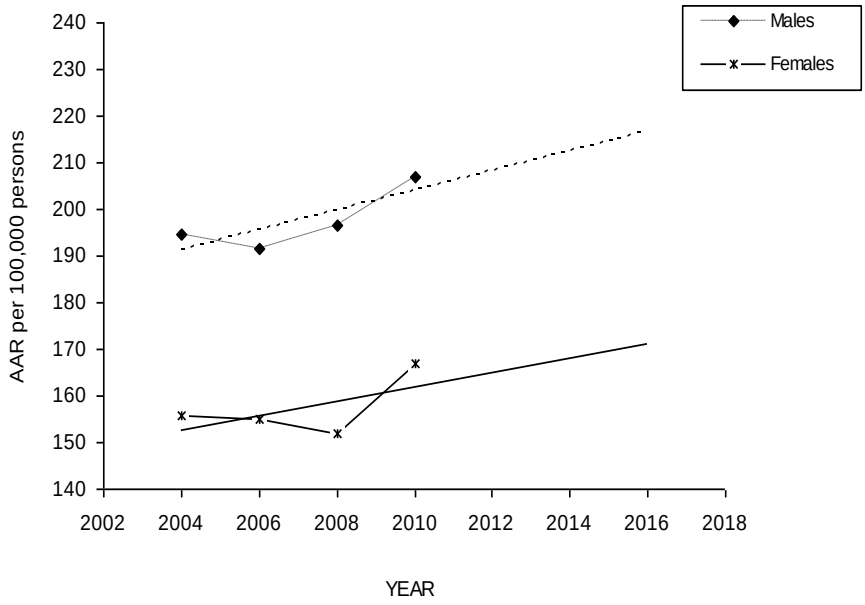


Figure 4: Extrapolated Age-Adjusted incidence rate(per 100,000) for all sites of cancer, up to 2016 for Sikkim state.

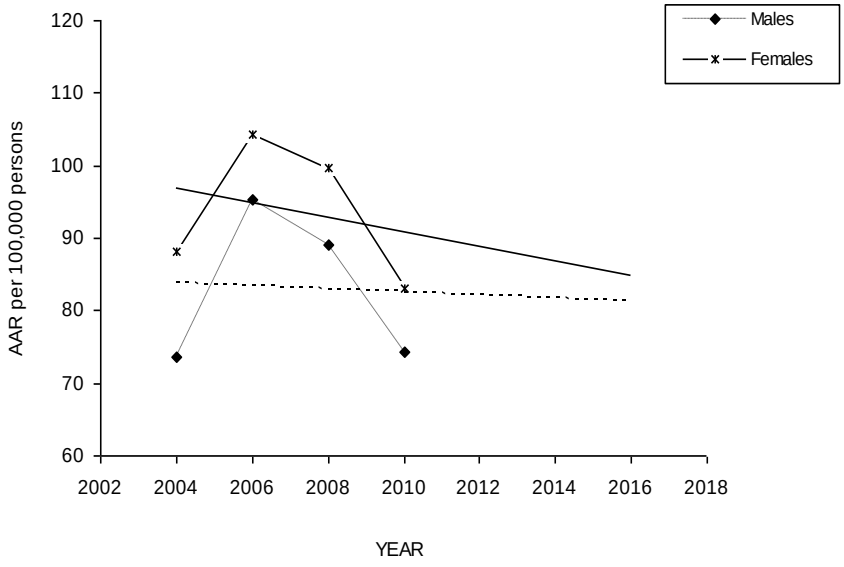


Figure 5: Extrapolated Age-Adjusted incidence rate(per 100,000) for all sites of cancer, up to 2016 for Manipur state.

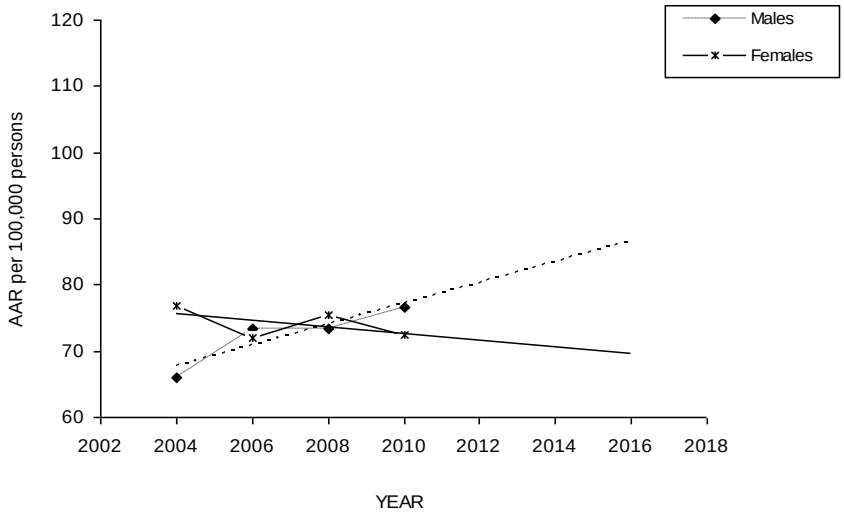


Figure 6: Extrapolated Age-Adjusted incidence rate(per 100,000) for all sites of cancer, up to 2016 for Dibrugarh district of Assam state.

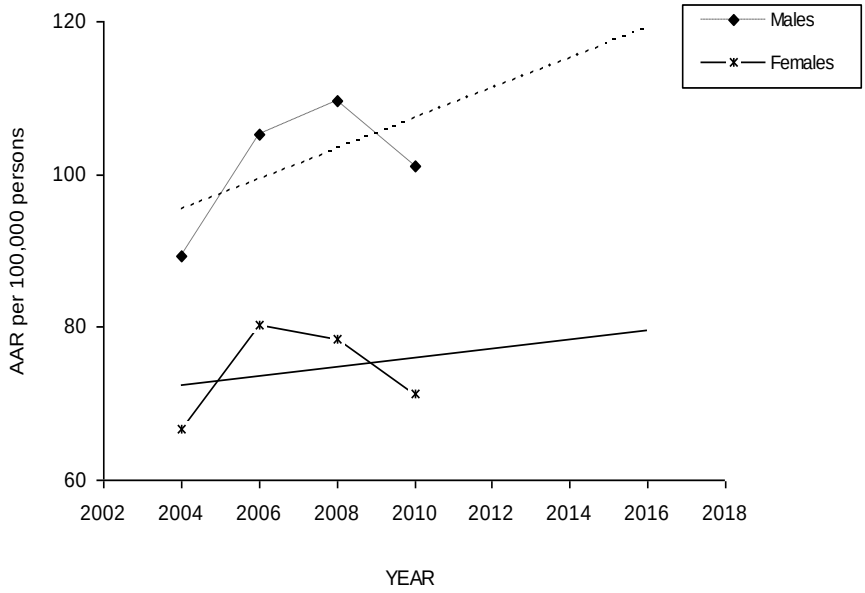


Figure 7: Extrapolated Age-Adjusted incidence rate(per 100,000) for all sites of cancer, up to 2016 for Kamrup district of Assam state.

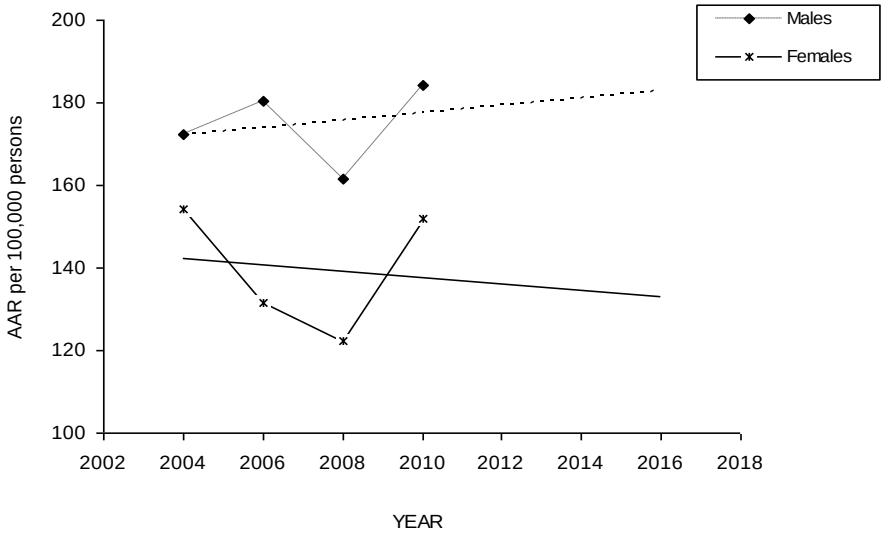
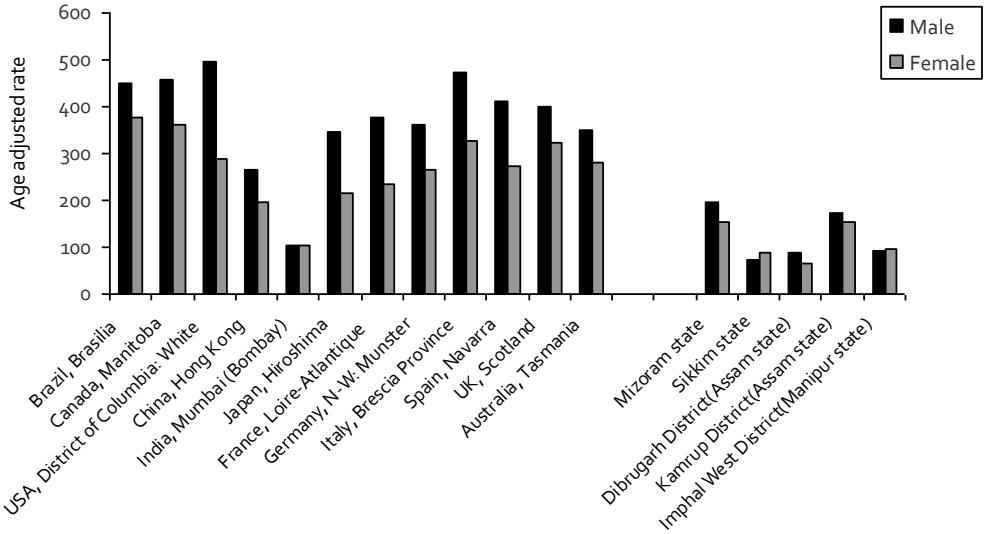


Figure 7. Age-Adjusted incidence (per 100,000) for all sites of cancer, between 1998 to 2004.



Source: 1**.** Cancer Incidence in Five Continents.(2007). IARC Scientific Publications, Lyon, France.

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Table : Extrapolated linear regression analysis of AAR(incidences rate) of all sites through the year 2016 for some North Eastern States.

States	AAR				Projected AAR			Constant	β coefficients
	2004	2006	2008	2010	2012	2014	2016		
Mizoram									
Males	194.5	191.5	176.5	207.0	205	211	215	-4085	2.12
Females	155.7	155	152	166.8	164	168	170	-2874	1.51
Sikkim									
Males	74.3	89	95.4	73.6	83.5	82	80.5	514	-0.215
Females	83.3	99.8	104.3	88.2	89.5	87	85	2080	-0.99
Manipur									
Males	66.04	73.4	76.5	76.9	80	84	87	-3103	1.58
Females	76.9	72.1	75.3	72.5	71.5	70	68.5	1061	-0.492
Dibrugarh (Assam)									
Males	89.4	105.2	109.6	101.1	111	114	118.5	-3862	1.97
Females	66.8	80.2	78.5	71.3	78	79.5	81	-1109	0.59
Kamrup (Assam)									
Males	172.2	180.5	161.6	184.4	179	180.5	182	-1601	0.885
Females	154.1	131.6	122.5	152	137	136	134	1685	-0.77

Source: Population based cancer registry, National Cancer Registry Program, ICMR, India.