RESEARCH COMMUNICATION

Cancer Incidence Trends in Thailand, 1989-2000

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Abstract

Through 2004, five cancer registries in Thailand have collected data for more than ten years. Three-year cancer incidence in Thailand covering the years 1989-1997 has been regularly reported in three volumes of 'Cancer in Thailand'. Since the data for the last decade of the 20th century have been collected, the trends in incidence of some cancer sites were analyzed. Data sources were registry data from Chiang Mai, Lampang, Khon Kaen, Bangkok, and Songkhla, which are representative of the four major geographic regions of Thailand. The data drawn in 2002 covered the years 1989 to 1997 for Bangkok, the other four registries drew data from 1989 to 2000. The population denominators were estimated from the two censuses in 1990 and 2000. Only cancers of the liver, lung, colon-rectum, female breast, uterine cervix, and all cancer sites were analyzed since cancers of these sites may have major public health impacts. Age-specific incidence rates of different 5-year age groups were projected through the period 2007-2009 using a linear regression model if the rates were increasing, and a log-linear model to prevent prediction of a negative rate if the rates were decreasing. During the past decade, colorectal and breast cancers showed a statistical significant increasing trend, while the trend was generally stable for cancer of other sites. The number of new cancer cases of all sites is expected to be approximately 125,000 by the year 2008, compared with 81,000 in 1999. However, the accuracy of projections depends very much on the quality of the cancer registries' data. The Bangkok registry significantly improved case ascertainment in recent years, while the Chiang Mai registry had a consistent drop in incidence of cancer at many sites. In-depth investigation of some cancer sites and age period cohort modeling are required for better understanding of cancer trends in Thailand.

Key Words: Cancer registry data - time trends - Thailand

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Introduction

Through 2004, four cancer registries in Thailand have been operating for over ten years. Although the Lampang registry has not completed ten years of activity, it retrospectively collected the data from 1989. Three-year cancer incidence in Thailand, covering the years 1989-1997, has been reported in three publications since 1993 (Vatanasapt et al., 1993; Deerasamee et al., 1999; Sriplung et al., 2003), as well as in published literature (Vatanasapt et al., 1995; Deerasamee et al., 2001; Sriplung et al., 2005). In the third volume of Cancer in Thailand, the incidence rates of cancer during 1998-2000 from Chiang Mai, Lampang, Khon Kaen, and Songkhla were also shown. This enables projection of national cancer trends beyond the year 2000 from cancer incidence in the past decade.

There have been many changes in environmental and life-style factors in the Thai population. The momentum of change has been moving from the capital, Bangkok, to big cities such as Chiang Mai, Khon Kaen, and Hat Yai, and eventually to suburban and rural areas. Although people in rural areas of Thailand are still resistant to such changes, they are gradually being forced to adopt modern ways of life through the introduction of manufactured products, transportation, communication, and mass media. The influence of radio and television programming is enormous. People are forced to move into big cities for better jobs and opportunities. Changes in these factors in the past decades have affected cancer incidence in recent years. While it is not possible at the moment to project cancer incidence providing changes in prevalence rates of exposure factors, a trend can be estimated by using changes in incidence rate of cancer in the recent past. The objectives of this study were to model the trends in incidence of some important cancers in Thailand during the decade of the 1990s and to project the incidence rates and number of cancer cases in Thailand during the first decade of the 21st century.

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Materials and Methods

Data Sources:

Cancer incidence rates during 1995-1997 and 1998-2000 were reported in Cancer in Thailand vol. III (Sriplung et al., 2003), which omitted Bangkok's 1998-2000 incidence rates. The age-standardized incidence rates (ASR) in the first two three-year periods of 1989-1991 and 1992-1994 were recalculated using population denominators estimated from the 1990 and 2000 censuses (National Statistical Office, 1992; National Statistical Office, 2002), as well as cases drawn from cancer registry databases in 2002. The rates are slightly different from those published in the two previous volumes of Cancer in Thailand (Vatanasapt et al., 1993; Deerasamee et al., 1999) in two ways. One is the fact that cancer registry databases are regularly updated by registry staff; another is the change in population denominators used in calculation of the rates. In Cancer in Thailand volume I, the population data available at that time was the population projection from the 1990 census by the National Statistical Office (National Statistical Office, 1992), and in Cancer in Thailand volume II, and the population denominators were from the Population Projections for Thailand 1990-2020 (Human Resources Planning Division, 1995). However, the difference of the recalculated ASRs and those previously reported appears to be very slight.

Only common cancer sites - liver, lung, colon-rectum, cervix uteri, and female breast - were selected for trend projection, due to their public health impact. The trend for all cancer sites was also projected.

Statistical Method:

Age-specific incidence rates of each five-year age group in the periods 2001-2003, 2004-2006, 2007-2009 for all registries, were projected from the rates in the four previous periods, except for the Bangkok registry, where the rates in the period 1998-2000 had to be projected because observed rates were not available. To avoid a negative age-specific incidence rate, a linear regression model was used when the trend was increasing, and a log-linear regression model was applied when a declining trend was evident. ASR and number of new cases for cancer sites were then calculated from the projected age-specific rates.

The population in four regions in Thailand for the years beyond 2000 was projected by five-year age group based on the 1990 and 2000 censuses using a log-linear model. Expected number of cancer cases for the future time periods of 2001-2003, 2004-2006, and 2007-2009 in each region was calculated based on age-specific incidence rates and population in each five-year age group. The incidence rates in Chiang Mai and Lampang were used for the calculation of expected number of cancer cases in the Northern region, Khon Kaen was used to represent the Northeast, Bangkok represented the Central region, and the South was represented by Songkhla. All the numbers were added to calculate the expected numbers of cancer cases for the entire Kingdom of Thailand in the future. The estimated annual percent change (EAPC) in incidence rate of the five cancer sites mentioned above and of all cancer sites was estimated. The p-value of trend was accepted at a level of 0.05.

Results

The actual and projected ASRs in the middle of three-year periods from 1989-2009 and five cancer sites in males and females are shown in Table 1. During 1989-2000, the EAPC in incidence of cancers of the colon, and all sites in males is 5.1%, and 1.3% per year, with p-value < 0.05. In females, cancers of the colon, breast, and all sites have an increasing trend of 5.9%, 6.8%, and 2.2% per year, respectively, with p-value < 0.05. In both sexes, liver cancer shows a steady trend during the last decade. The rate of increase in cancer of all sites is nearly twice as high in females as in males.

Table 2 shows number of cancer cases in the middle of three-year periods from 1989-2009 and five cancer sites in males and females. Trends in number of cancer cases from 1990 to 2008 for the five cancer sites and all sites are shown in Figure 1. The number of cancer cases is increasing in all cancer sites, even those with stable incidence rate, since the

Table 1. Age-standardized Incidence Rates of Cancers in Thailand

	1990	1993	1996	1999[1]	2002[2]	2005[2]	2008[2]
Male							
Colon-rectum	8.4	9.1	10.8	12.7	13.9	15.4	16.9
Liver	37.7	37.8	37.6	36.7	36.9	37.4	38.1
Lung	23.7	24.3	25.9	25.8	27.1	28.4	29.9
All sites	139.9	147.9	149.2	158.8	165.4	174.1	183.5
Female							
Colon-rectum	5.7	6.9	7.3	9.6	10.3	11.7	13.0
Liver	14.1	15.8	16.0	14.3	14.5	14.8	15.1
Lung	10.7	10.8	10.0	10.5	10.9	11.3	11.8
Breast	12.3	13.3	17.2	20.9	23.6	26.7	29.8
Cervix uteri	19.7	19.7	19.5	20.3	20.1	20.6	21.1
All sites	111.4	117.5	125.0	134.9	141.2	151.4	161.2

[1]Estimated based on projected rates of cancer in Bangkok. [2]Projected from statistical model

Table 2. Numbers of Cancer Cases in Thailand

	1990	1993	1996	1999[1]	2002[2]	2005[2]	2008[2]
Male							
Colon-rectum	1,638	1,940	2,529	3,258	3,896	4,711	5,666
Liver	7,463	8,241	9,020	9,571	10,572	11,652	12,928
Lung	4,480	5,079	5,844	6,435	7,412	8,500	9,792
All sites	27,610	32,096	35,405	41,114	46,756	53,482	61,393
Female							
Colon-rectum	1,280	1,679	1,963	2,847	3,365	4,208	5,155
Liver	3,072	3,733	3,669	4,107	4,574	5,128	5,798
Lung	2,295	2,555	2,786	3,038	3,476	3,985	4,560
Breast	2,931	3,516	5,161	6,750	8,321	10,194	12,370
Cervix uteri	4,696	4,665	5,531	6,488	7,026	7,823	8,756
All sites	24,842	28,863	33,298	40,425	47,000	54,910	63,852

[1]Estimated based on projected rates of cancer in Bangkok. [2]Projected from statistical model

population of Thailand is increasing throughout the two decades from 1990 to 2009. By the end of the first decade of the 21st century, over 120,000 new cancer cases of all sites are projected. In both sexes, liver cancer will be the leading cancer and lung cancer ranks second through the next decade. Within this decade, breast, not cervical cancer, is increasing and rapidly becoming the leading cancer among females in Thailand. The rate of increase in number of cases of colorectal and breast cancer is clearly higher that that of the others, although the rate of lung cancer will still be higher than colorectal cancer among Thai men by the end of the first decade of the 21st century. As demonstrated in Table 1, the number of cases of colorectal cancer in both sexes is rapidly increasing and will probably exceed that of lung

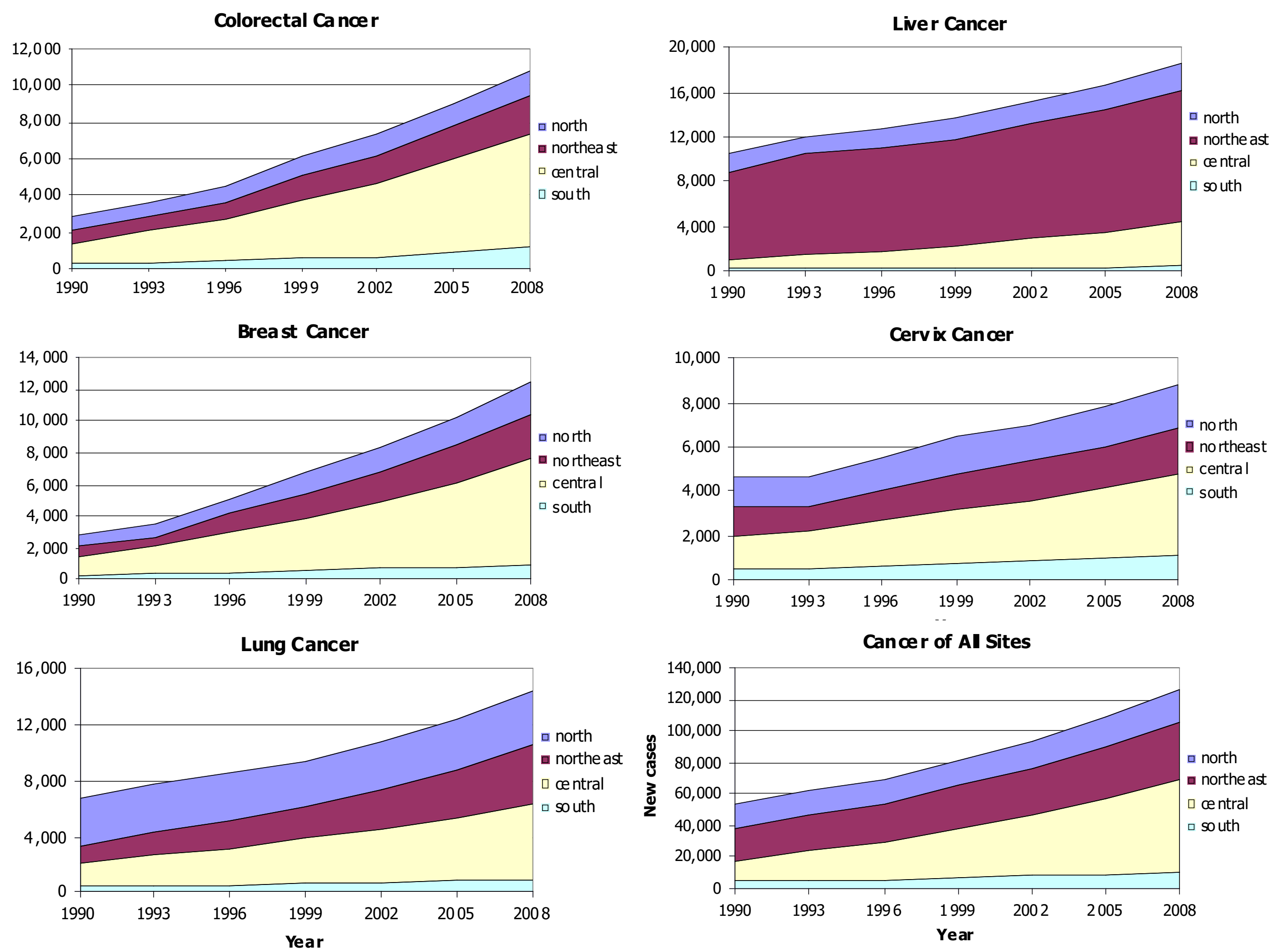

Figure 1 Trends in number of cancer cases for colorectal, liver, lung, cervix, and breast cancers and cancer of all sites.

cancer in the next decade (Figure 1).

Cancer of the colon and rectum is increasing rapidly in both sexes. Over 10,000 new cases are expected in 2008. The largest proportion of cases is in the Central region. The rate of increase ranges from statistical insignificance in some regions to 10.3% per year in the Central region.

While the incidence rate of liver cancer is stable throughout the two decades, the number of cases continuously increases in both sexes, and approximately 20,000 new cases are expected for the whole country in 2008. The largest proportion is expected in the Northeastern region, accounting for approximately 64%, followed by the Central and Northern regions. The incidence of liver cancer in the Northern region is uncertain; EAPC in males range from -6.4%, p-value = 0.02 in Chiang Mai to 5.9% per year, p-value = 0.02 in Lampang. The trend is slightly decreasing in the Northeastern region; EAPC in males = -0.9%, p-value = 0.05, and is increasing in the Central region; EAPC in males = 8.2, p-value < 0.01, and is stable or slightly declining in the Southern region.

Although the highest incidence rate for lung cancer in both sexes is observed in the North, the number of cancer cases in all regions except the South seems to be similar. This is due to the large proportions of population in the Northeastern and Central regions. Approximately 15,000 new cases are expected in 2008. When examining trends within individual regions no significant change is observed (data not shown).

While the number of new cases of cervical cancer is increasing, the incidence rate is generally stable. Over 8,000 new cases are projected for the whole country in 2008. The largest proportion of cases is in the Central region, although the incidence rate is higher in the North than in other regions. There is no significant trend of incidence within any individual geographical region.

The incidence rate of breast cancer is rapidly increasing in Thailand. The 12,000 new cases per year expected in 2008 are greater than that of cervical cancer. The largest proportion is observed in the Central region. The rates of change range from a non-significant increase in some regions to 8.5% per year (p-value < 0.01) in the Central region.

Over 125,000 new cancer cases are projected by the end of the first decade of the 21st century. The consistently low number of new cases in the Southern region is due to the lower incidence rate of cancers and because this region has the smallest proportion of the national population.

Discussion

Reliability of projections depends largely on the quality of data in each registry. The continuously declining trend of most cancer sites in Chiang Mai, and the increasing trend observed in most cancer sites in Lampang, reflects some degree of under-ascertainment of cancer cases in the Chiang Mai registry in later years. The steep increase of incidence in the Bangkok registry can be explained by an improvement of case finding in recent times.

A registry may not be representative of its region. Bangkok is a unique capital city and differs in many respects from other provinces in the Central region. Songkhla is on the Malaysia border and its people are in many ways different from the rest of the Southern region. This is probably also true for Chiang Mai and Khon Kaen, which are the economic centers of the Northern and Northeastern regions, respectively.

It has been demonstrated that it usually takes 4-17 years for cancer registries in the US to complete 99% or more of data collection (Clegg et al, 2002). Thus, the reported incidence in later years may be underestimated to a certain extent, and the trends are downwardly biased.

Despite the probable underlying imprecision and deviation from the average of trend projections mentioned above, data from cancer trends in the present decade is adequately informative for public health policy planning in the near future, especially when caution regarding these probable errors is kept in mind.

Cancer is an increasing health problem in Thailand. Cancers of the colorectum, liver, lung, breast, and cervix uteri are the most common cancers in Thailand (Sriplung et al, 2005) and account for approximately 50% of all cancer cases in both sexes (Table 2). Thus, the trend in incidence of these cancers largely determines the trend in incidence of cancers of all sites. Although liver and lung cancers are still the leading cancers in Thailand, this study demonstrates that colorectal and breast cancers will become increasingly important in the next decade.

There have been upward incidence and/or mortality trends for cancer of the colon and rectum observed in many countries (Adanja et al, 2000; Eilstein et al, 2000; Imamura et al, 2004; Wang et al, 2005). Some studies report different trends in incidence in anatomical subsites of colorectal cancer, suggesting different etiologies in different sites (Rhodes et al, 1977; Nomura et al, 1981; Pillon et al, 1989; Obrand et al, 1998; Takada et al, 2002). However, a report from Minnesota failed to show such the trend (Beard et al, 1995). Improved diagnostic facilities and access to medical care may partly explain the increasing trend of this cancer in Thailand, but a true increase of the disease may also be the cause.

A decline in incidence of HCC can be expected as the two major modes of transmission of HBV, transfusion and sexual contact, are controlled. HBV screening of donated blood in Thailand has been conducted for many years, and the seroprevalence of HBsAg was recently reported at around 5% (Petchclai et al, 1992; Luksamijarulkul et al, 2002). There has been no direct evidence that sexually transmitted HBV infection is declining, but the seroprevalence of HIV-positive pregnant women in Thailand has been declining from over 2% in the mid-1990s to 1.5% by the end of 2003 (UNAIDS, 2002). A large-scale hepatitis B vaccination programme successfully decreased mortality rates for hepatocellular carcinoma in Taiwan (Lee et al, 2003). In Thailand, a very recent evaluation of the vaccination programme in Chiang Mai showed a moderate coverage in Thai children and a drop in protective antibody as children mature. Thus, 1.2% of natural HBV infection was found in the area and some children had never received vaccination (Jutavijittum et al, 2005). This was much lower than the 12% prevalence reported in a study in Kamphaeng Phet, another province in the same region, prior to vaccination (Kozik et al, 2000). Since the national programme was implemented in the early 1990s, a gradual decline in incidence of HCC is anticipated in the second half of this decade. However, in the Southern and Central regions, where the majority of liver cancer cases are HCC, the decline was slight and without statistical significance. .

The trends in incidence of liver cancer in Thailand are largely influenced by a liver fluke, *Opisthorchis viverrini* (OV), and associated cholangiocarcinoma (CCA), which forms a large proportion of liver cancer cases (Sriplung et al, 2003; Sriplung et al, 2005). The declining trend of liver cancer observed in the Northeastern region reflects a degree of success in controlling OV infection in the past. The increasing trend of liver cancer observed in Lampang and Bangkok may indicate an increase in CCA, since people in the Northeastern regions migrate to work in, and carry OV to, other parts of the country where OV control was not intensive or was neglected. This possibility must be promptly investigated.

The success of the anti-smoking campaign in Thailand has reduced the prevalence of cigarette smoking among males aged 25-59 years from around 70% in 1986 to 40% in 2004 (Action on Smoking and Health Foundation/Thailand, 2005). However, the 20-year lag time from decline in prevalence of smoking to reduction in incidence of lung cancer observed in many countries (Heloma et al, 2004) suggests no change in incidence of lung cancer in the past decade. Such a reduction will, however, probably appear in the first or second decades of the 21st century. In addition, there is a trend of decreasing squamous cell carcinoma and rising adenocarcinoma rates reported from many countries (Devesa et al, 2005). Investigation of this issue is difficult for registries in Thailand since percentage of histology verification for lung cancer was low in most registries.

There was no significant change in incidence of cervical cancer in Thailand. Thailand recently initiated a nation-wide cervical cancer screening programme, begun after the period of this analysis, thus the estimates of the rate and number of cases after the year 2000 given in Tables 1 and 2 are likely to be lower than expected. At the start of the screening programme, the incidence rate should be increasing, since cases are detected earlier than they would be by active finding of cases. Subsequently, a steady declining trend develops, such as was the case in Finland (Anttila et al, 1999). A report from Europe showed a decreasing trend of cervical cancer in most European countries, achieved by implementation of successful screening programmes. However, an underlying increasing risk in recent population cohorts was also discovered (Bray et al, 2005). Changing sexual behaviours that lead to HPV infection may underlie such an increase in risk. It would not be surprising if the same phenomenon occurs in Thailand, but until now there is still no evidence of this occurring.

The ASR of female breast cancer in Thailand increased from 12.3 to 20.9 per 105 population from 1990 to 1999, and the rate of increase in breast cancer incidence was 5.2% per year. It has been shown that the ASR of breast cancer among Asian American/Pacific Islanders living in the US was much higher than in the Thai population, at 97.2 per 105 population from 1996 to 2000, but the rate of increase was lower, at 2.1% per year (Ghafoor et al, 2003). The rate of increase in incidence may be decelerated in a population where a mammographic screening programme is implemented for a long period of time, when a significant proportion of breast lesions are detected in an in situ stage. In a previously unscreened population such as Thai women, it is possible that the incidence of breast cancer may accelerate due to increased public awareness of the disease. A study in South Australia demonstrated an increased rate of cancer detection and early stage cancers when a breast self-examination (BSE) programme was implemented (Roder et al, 1982), but another study in a Chinese population in Shanghai failed to achieve early detection of cancer (Thomas et al, 2002). However, the finding in Shanghai does not eliminate the possibility that awareness of breast cancer in general may be related to the increase in incidence of the disease. The trends in stage of breast cancer in the registries should be further investigated.

Methodologically, this analysis took into account only trends across periods in any 5-year age groups. Age-period-cohort modeling usually gives a better prediction and is now widely used in cancer rate prediction, as cohort effect is also taken into account (Esteve et al, 1994; Heuer, 1997), but this requires at least 15 years of data collection. In the near future this method will be applied to cancer registry data in Thailand.

In conclusion, colorectal and breast cancers are increasing in rates and number of cases and will become important cancers in Thailand in the future, while liver, lung, and cervical cancers are predicted to be stable. An organized cervical cancer screening programme initiated just after the periods in this analysis may increase the incidence rates in the near future. Further detailed investigation of some cancer sites and prediction using age period cohort modeling are required for better understanding and precise prediction.

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