RESEARCH COMMUNICATION

Temporal Trends of Cancer Incidence in Vietnam, 1993-2007

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Abstract

Purpose: There is a lack of an overview of overall and site-specific cancer incidence time trends in Vietnam, especially for the period after the year 2000. This paper aims at describing the development of cancer incidence for some cancer sites during 1993-2007. Methods: The Age Standardized Rate (ASR) of cancer incidence data from population based cancer registries of Hanoi, Ho Chi Minh and Cantho cities were used to analyze temporary trends of cancer incidence by site, age and sex group. Results: The ASR of cancer incidence increased from 151.1/10^5 in the period 1993-1998 to 160.0/10^5 in the period 2006-2007 for males and from 106.8/10^5 to 143.9/10^5 for females. By age, the highest ASR was found in the group of 75+ years in males and between 70-74 years in females, with ASRs of 1,109/10^5 and 619/10^5, respectively (2006-2007). Lung remains the most frequent site, followed by stomach and liver in males. In females, the most commonly affected site has shifted from cervix uteri in 1993-1998 to breast in recent years, followed by stomach and lung. Increasing trends were observed in incidence rates of 21 out of 34 cancer sites in males and 27 out of 35 cancer sites in females. Conclusion: Cancer incidences in general have continuously increased during 1993-2007. More efforts should be concentrated on developing and implementing tobacco-related cancer prevention interventions.

Keywords: Cancer - trends - incidence data - Viet Nam

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Introduction

In Vietnam, cancer has been considered as an emerging major public health problem since the 1990s (Ngoan, 2006b). According to previously reported data from Hanoi Cancer Registry, the overall age-standardized rate (ASR) of cancer incidence increased between 1990 and 1996 from 133/10^5 to 166.5/10^5 in males and from 91.7/10^5 to 116.8/10^5 in females (Anh and Duc, 2002). Despite that overall increase, the incidence rate of some cancer sites has not changed or even slightly decreased. For example in the period between 1990 and 2000, lung cancer incidence (ASR) declined in Vietnam from 30.4/10^5 to 30.1/10^5 in males and from 6.7/10^5 to 6.6/10^5 in females, although the magnitude of decrease varies among regions: in the area of Hanoi lung cancer incidence rate decreased from 34.9/10^5 to 33.1/10^5 in males and from 6.3/10^5 to 5.8/10^5 in females whereas in the area of Ho Chi Minh city the reductions were from 24.6/10^5 to 23.7/10^5 in males and from 6.8/10^5 to 5.6/10^5 in females. The reductions in the lung cancer incidence in both males and females have been attributed to the implementation of the National Tobacco Control Program, which started in 1989 (Ngoan, 2006a). Similarly, incidence of penis cancer has significantly decreased, it used to be frequently reported in the early case series within 1950s-1960s, later it was rarely seen (Joyeux and Nguyen, 1950; Luong and Pham, 1964; Anh et al., 1993).

The description of changes in cancer patterns over time is of vital interest in cancer control (Coleman et al., 1993). The study of time trends in cancer incidence is relevant for at least three reasons: to evaluate the population impact of interventions such as diagnostic and therapeutic modalities; to assess the potential influence of risk factors and to estimate needs raised by cancer burden to the public health care system (Doll, 1991; Franceschi et al., 1994; Geddes et al., 1994).

To date, the time trends of cancer incidence have not been studied in detail, with the exception of the reports cited above. There is a lack of an overview of overall and site-specific cancer incidence time trends, especially for the time after year 2000. The aim of this paper is to close this gap by describing the development of cancer incidence for some cancer sites during 1993-2007.

Materials and Methods

Data sources

We used data from population-based cancer registries accessed through the Globocan Database for data from Hanoi Cancer Registry (1993-1997), and Ho Chi Minh City Cancer Registry (1995-1998) (Globocan, 2002).

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The data from Hanoi Cancer Registry and Cantho Cancer Registry for two periods 2001-2004 and 2006-2007 were provided by the National Cancer Institute (NCI). All incidence data were available in the form of ASRs for each primary cancer site.

Hanoi is the capital with the second largest population city in Vietnam (3,289,300 inhabitants) (MOH, 2009). It is located in the central part of former North Vietnam. Ho Chi Minh City is the largest city of Vietnam (6,347,000 inhabitants) (MOH, 2009) and it is located in the center of former South Vietnam. The cancer registries of these two areas were established around 20 years ago (Hanoi registry in 1987 and Ho Chi Minh registry in 1990). Unfortunately, the cancer registry of Ho Chi Minh City ceased in the beginning of 2000s, so data of this registry was available only for 1995-1998. Cantho is located in the South of Vietnam, as the heart of Mekong Delta, about 170 km South of Ho Chi Minh City (1,154,900 inhabitants) (MOH, 2009). Cantho Cancer Registry was established in 2001. Hence, we consider Cantho cancer registry is the best appropriate to replace the registry from Ho Chi Minh City, which was the only one existing in the South.

Methods

Trends in ASRs of cancer incidence were examined by site, sex and age at first cancer diagnosed from a pooled data of two registries in each time period, 1st period 1993-1998 (6 years); 2nd period 2001-2004 (4 years); 3rd period 2006-2007 (2 years).

Cancer site and histology had been coded using the ICD-O first edition; then these codes were converted to ICD-10 for tabulation (which was available in the database). ASR of cancer incidence were age adjusted by the method of direct standardization on the basis of the World Standard Population in 16 categories (0-4, 5-9,..., 75+), and expressed per 10^5 of population (Doll, 1982; Jensen et al., 1991). As the purpose of this study is to provide an estimation of a descriptive epidemiology in cancer over time, so no inference was made on the statistical significance of rates and trends.

Graphic representations were produced with MS Office Excel application. In addition, the linear trend was calculated for those cancers which showed the bigger gradient of increasing or decreasing throughout the three periods.

Results

The ASR of all cancer site incidences both in males and females have been continuously increasing since 1st period (Figure 1), which however is more steep for women. The observed ASR increased from $151.13/10^5$ in the 1st period to $160.00/10^5$ in the 3rd period for males. Between each period, the rising in cancer incidence was moderate (proportion of 3rd /2nd period and 3rd /1st period: 101.7% and 105.8% respectively). For females, overall cancer incidence raised much more steeply as compared to men in the same period of time. Whereas ASR of cancer incidence was $106.75/ 10^5$ in the 1st period raised to $143.88/10^5$ in the 3rd period, steadily converging to the

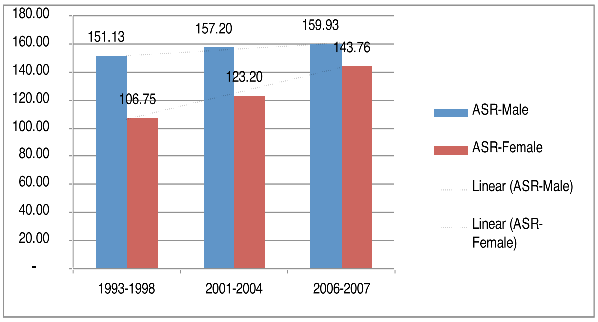
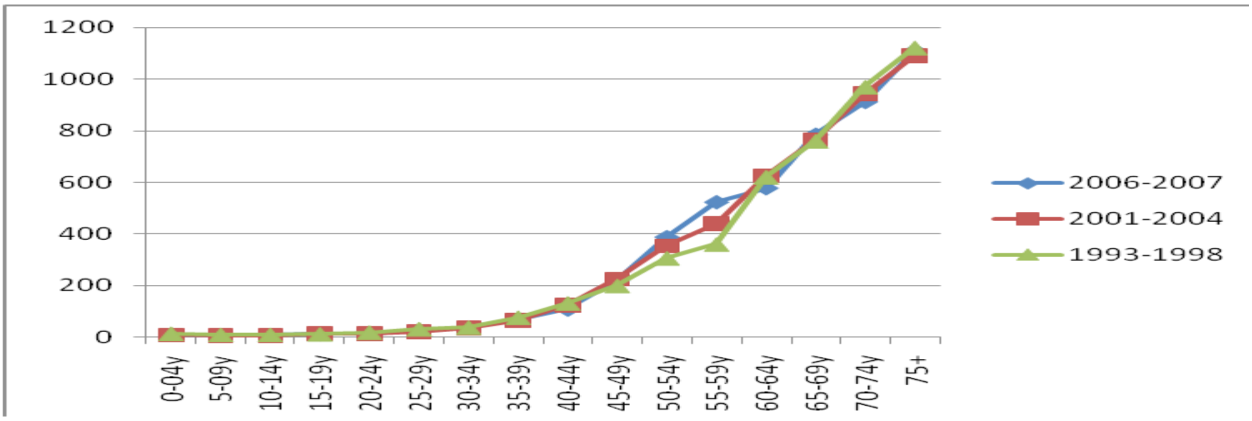
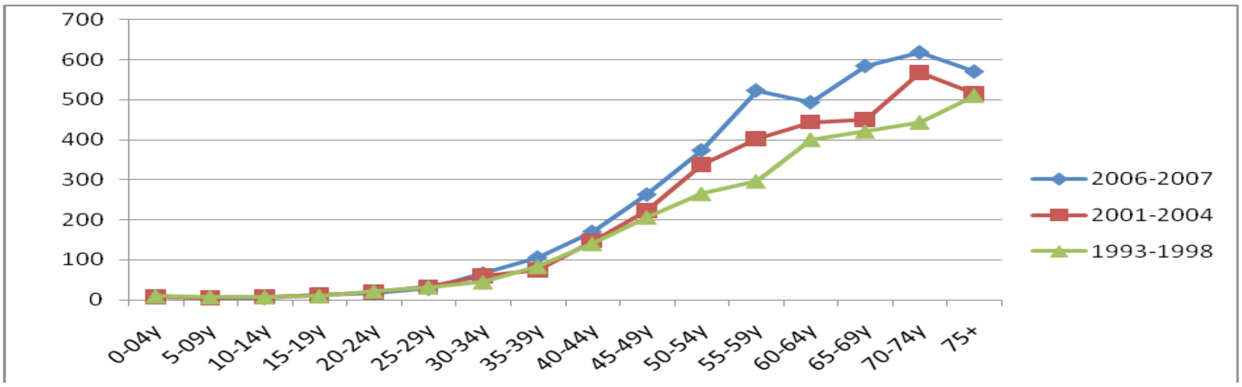


Figure 1. Trends of ASRs of All Site Cancer Combined Incidences by Sex



Age Interval (year)	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-
2006 -2007	10	05	06	11	17	28	67	106	171	264	374	524	494	585	619	571
2001 -2004	07	04	08	11	19	32	60	75	147	222	337	402	443	450	567	515
1993 -1998	09	07	07	09	21	32	44	83	140	207	265	296	401	421	444	511

Figure 2. Trends for All Site Cancer Age Groups at First Diagnosis in Males



Age Interval (year)	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-
2006 -2007	10	05	06	11	17	28	67	106	171	264	374	524	494	585	619	571
2001 -2004	07	04	08	11	19	32	60	75	147	222	337	402	443	450	567	515
1993 -1998	09	07	07	09	21	32	44	83	140	207	265	296	401	421	444	511

Figure 3. Trends of All Site Cancer Age Groups at First Diagnosis in Females

incidence by men (proportion of 3rd /2nd period and 3rd /1st period: 116.7%; 134.8% respectively).

Figures 2 and 3 show the 5 year age interval distributions of ASR of all site cancer incidences at first diagnosis. In males, those 3 slopes (one for each of 3 observed periods) were in parallel and steadily moving upward through out all 3 periods from the first age group to the last group of 75+ years and peaking at the group of 75+ years, with ASR of 1,109/10^5 (of 3rd period).

A similar pattern was observed for women with an increase from the earliest age group to the peak at group of 70-74 years with ASR of 567/10^5, 619/10^5 (in 2nd, 3rd periods), then going down at group of 75+ years with ASR of 515/10^5, 571/10^5 (in 2nd, 3rd periods). As small difference was observed in the 1st period's curb as the trend moved upward without any bump upward to the peak at the last age group of 75+ years.

Table 1 shows the ASR incidence of specific cancer sites for males and females respectively, and gives the rank for the ten most frequent sites in brackets. Despite an increase in overall incidence of cancer among both males and females, the incidence of some cancer sites have considerably decreased.

Among females the ten most frequent cancer sites in the 3rd period were breast, cervix uteri, lung, stomach, colon, thyroid, rectum and anus, liver, ovary etc and leukemia. Those cancer sites account for 74.8% of all cancer site ASR incidences. This proportion has slightly increased since the 1st period (72.1%). For males, in which they were lung, stomach, liver, colon, pharynx, esophagus, rectum and anus, non-Hodgkin lymphoma, leukemia and prostate, the ten accounted for 76.5% of all cancer site ASR incidence. This proportion has stayed rather unchanged compared to the 1st and 2nd periods (76.9%; 75,6%).

For males, although the lung cancer incidence rate has slightly decreased over time (30.67/10^5; 26.95/10^5 and 27.30/10^5 respectively for the 1st, 2nd and 3rd periods), but it has been the most frequently affected site in all observed periods. Stomach and liver cancer represent the 2nd and 3rd rank with ASR incidences of 23.00/10^5, 21.98/10^5 respectively. However the incidence of stomach cancer has slightly increased over time whereas the incidence of liver cancer has slightly decreased. Prostate cancer had not been on the list of 10 most frequent cancer sites in the 1st period but has become the 10th cancer site after almost doubling its incidence from 2.61/10^5 to 4.13/10^5 in the last period. Overall, the incidence of Tobacco-related cancers (lung, oral cavity and pharynx, esophagus, kidney, bladder) (ACS, 2009) has remained unchanged (55.6/ 10^5, 56.5/10^5 in 1st and 3rd periods), although lung cancer incidence has decreased. This decrease has been mainly compensated by a rise in the incidence of esophagus cancer.

For females, the most interesting development is the shifting from cervix uteri as the most frequently affected site in the 1st period to breast cancer in the following periods. Whereas the incidence of cervix uteri cancer slightly decreased from 17.77/10^5 to 16.25/10^5, the incidence of breast cancer has nearly doubled between 1st and 3rd periods (17.32/10^5, 32.80/10^5 respectively). Stomach and lung cancer took the 3rd and 4th places among the most frequent cancer sites. The incidence of pharynx cancer, which was among the 10 most frequent sites in 1st period, has decreased over time and is not any more among the top ten.

Increasing trends in incidence (with positive coefficient) were observed in 21 out of 34 cancer sites in males and 27 out of 35 cancer sites in females (Table 1). Among these, the most rapid growth rates are seen for multiple myeloma, esophagus, other endocrine and prostate in males with a ratio of 3rd: 1st period equal to 3.50:1; 2.34:1; 1.93:1 and 1.58:1 respectively. For females, the steepest increases are observed in multiple myeloma, thyroid, melanoma of skin, colon, breast with the ratio of

Table 1. ASR of Each Site Cancer Incidence of 3 Periods (per 10^5 Populations). Source: Globocan & NCI ***

ICD 10	Label	Females				Males			
		1993 -1998**	2001 -2007*	2006 -2004*	Linear Trend	1993 -1998**	2001 -2004*	2006 -2007*	Linear Trend
C00	Lip	0.36	0.30	0.15	↓↓	0.10	0.15	0.03	↓
C01-02	Tongue	0.94	0.80	1.08	↑	1.57	1.60	1.85	↑
C03-06	Salivary glands	1.23	0.90	0.83	↓↓	1.39	1.80	1.83	↑
C07-08	Mouth	0.37	0.35	0.50	↑	0.65	0.75	0.80	↑
C09-14	Pharynx	3.89(9)	2.90	3.41	↓	10.56(4)	8.75(4)	8.74(5)	↓
C15	Esophagus	0.63	1.05	0.90	↑	3.67(10)	6.30(6)	8.60(6)	↑↑
C16	Stomach	10.66(3)	10.90(3)	10.05(4)	↓	22.86(3)	24.85(2)	23.00(2)	↑
C17	Small intestine	0.11	0.15	0.20	↑	0.11	0.30	0.25	↑
C18	Colon	4.12(7)	5.85(6)	8.50(5)	↑↑	6.49(5)	8.75(5)	10.15(4)	↑
C19-21	Rectum and anus	3.94(8)	4.85(8)	6.26(7)	↑	5.33(6)	6.05(7)	6.78(7)	↑
C22	Liver	5.79(5)	6.20(5)	5.88(8)	↑	23.58(2)	23.60(3)	21.98(3)	↓
C23-24	Gallbladder etc.	0.71	1.15	1.30	↑	1.04	1.15	1.23	↑
C25	Pancreas	1.04	1.60	1.35	↑	1.93	2.20	2.18	↑
C30-31	Nose sinuses etc.	0.52	0.50	0.70	↑	0.88	0.80	0.73	↓↓
C32	Larynx	0.28	0.20	0.43	↑	3.06	2.30	3.00	↓
C33-34	Lung (incl. trachea and bronchus)	7.36(4)	8.55(4)	10.50(3)	↑	30.67(1)	26.95(1)	27.30(1)	↓
C40-41	Bone	0.88	1.05	0.88	↑	1.52	1.45	1.05	↓↓
C43	Melanoma of skin	0.19	0.20	0.40	↑↑	0.27	0.50	0.53	↑
C44	Other skin	2.90	2.80	4.15	↑	3.72(9)	3.45	3.55	↓
C47+C49	Connective tissue	1.10	0.95	1.33	↑	1.55	1.55	1.20	↓
C50	Breast	17.32(2)	24.55(1)	32.80(1)	↑	0.62	0.50	0.63	↑
C60	Penis					1.84	2.15	1.95	↑
C61	Prostate					2.61	2.75	4.13(10)	↑↑
C62	Testis					0.71	0.75	0.55	↓
C51-52 C55, C58	Other female genital organs	2.73	1.50	2.52	↓				
C53	Cervix uteri	17.77(1)	15.15(2)	16.25(2)	↓				
C54	Corpus uteri	2.30	3.15	2.48	↑				
C56-57	Ovary etc.	4.33(6)	5.60(7)	5.55(9)	↑				
C64-66, C68	Kidney etc.	0.53	0.80	0.95	↑	0.93	1.30	1.31	↑
C67	Bladder	0.64	0.85	0.88	↑	3.07	3.60(10)	3.00	↓
C69	Eye	0.29	0.25	0.33	↑	0.40	0.20	0.18	↓↓
C70-72	Brain, central nervous system	0.98	1.45	1.25	↑	1.48	1.70	2.03	↑
C73	Thyroid	2.60	4.55(9)	7.58(6)	↑↑	1.30	1.45	1.80	↑
C74-75	Other endocrine	0.14	0.10	0.26	↑	0.14	0.20	0.26	↑↑
C81	Hodgkin lymphoma	0.41	0.25	0.23	↓↓	1.03	0.60	0.33	↓↓
C82-85, C96	Non-Hodgkin lymphoma	2.54	3.80	3.88	↑	5.25(7)	5.70(8)	5.95(8)	↑
C88+C90	Multiple myeloma	0.17	0.35	0.80	↑↑	0.16	0.35	0.56	↑↑
C91-95	Leukemia	3.18(10)	3.90(10)	4.19(10)	↑	4.21(8)	4.35(9)	5.64(9)	↑
C00-C96	All sites	106.75	123.20	143.88	↑	151.13	157.20	160.00	↑
C00-C96 exp C44	All sites but non-melanoma skin	103.85	120.40	139.70	↑	147.41	153.75	156.48	↑

(1-10) is the order of major ASR of cancer site incidence

3rd: 1st period equal to 4.71:1; 2.92:1; 2.11:1; 2.07:1 and 1.89:1 respectively.

As already mentioned, despite a general trend for increasing cancer incidence both in males and females, 7 out of 35 cancer sites in females and 13 out of 34 cancer sites in males show a decrease in incidence (with negative coefficient) in observed periods. For females, cancer incidence of lip, Hodgkin lymphoma, mouth more steeply decreased with a ratio of 3rd: 1st period equal to 0.42:1; 0.57:1 and 0.68:1 respectively. For males, those are Hodgkin lymphoma, eye, bone, nose sinuses with ratios of 3rd: 1st period equal to 0.32:1; 0.46:1 and 0.69:1 respectively.

Discussion

To our knowledge, this is the first overview on cancer incidence trends in Vietnam during 1993-2007. In this article we provided a descriptive overview of the development of overall and site specific cancer incidence in three periods of time (1993-1998, 2000-2004 and 2006-2007).

The data used have some limitations. First, the incidence rates for whole of Vietnam have been estimated by pooling data from regional cancer registries. The registries pooled (2 in each observation period) covered the biggest cities in both the South and the North, thus they might be not fully representative of the Vietnamese population (together, both registries cover about 10% of the population). There are important socioeconomic differences between those live in urban and rural areas. For example 24.5% of inhabitants living in urban areas share 38.7% of per capital household income and 38.6% of per capital household expenditure (GSO, 2004). Another limitation raises from the fact that one of the registries (Ho Chi Minh city) stopped its activity in the year 2000 and had to be replaced by another one (Cantho city). When studying the cancer incidence patterns over time using population-based cancer registries, it is important to consider the degree of completeness of registration of incident cancer as gaps in registration (for example due to logistic problems, changes in registration routines, etc.) can lead to spurious incidence decreases (Wabinga et al., 2000; Bullard et al., 2000). It is probable that during the first years of operation there was some degree of under-registration in the cancer registries used in this study (Nguyen et al., 1998). As a low rate which derived from over a million person-years of observation, is likely reflect reality if under-registration can be ruled out (Muir et al., 1994). Despite this potential for underestimating cancer incidence in the beginning of registration, the two cancer registries in Hanoi and Ho Chi Minh City have produced the first reliable data on cancer incidence in Vietnam (Anh and Duc, 2002). Despite these limitations, our study allows to identify cancer incidence trends over 3 observed periods during 1993-2007 based on the best available data from Vietnam.

The latest available age-standardized incidence rates of all cancers in Vietnam were $160.00/10^5$ and $143.88/10^5$ in males and females respectively, with standardized males/females rate ratio of 1.11. Overall, an increasing trend was found in both males and females but magnitude of increase was greater in females than in males thus leading to a narrowing of the sex-rate ratio males/females from 1.42 and 1.28 to 1.11 in the 1st, 2nd and 3rd periods respectively. Compared to other countries in Eastern Asia, ASR of all cancer site incidence of Vietnam (in 2006-2007) in males is lower than the average of whole area, China or Japan with $219.4/10^5$; $204.9/10^5$ and $261.4/10^5$ respectively. But in females, it is slightly higher than the whole area and China (136.810^5 and 129.510^5, respectively), and lower than Japan ($167.4/10^5$) (Parkin et al., 2005). Furthermore, the observed incidence of cancer remains clearly below the cancer incidences among Vietnamese people living in California (US) with $360.6/10^5$ and $272.1/10^5$ (in 1997-2001) for males and females respectively (Sandy et al., 2005).

The increasing temporal trend of overall cancer incidence is probably most and foremost explained by the increasing life expectancy in Vietnam. Life expectancy at birth was 65.1 in 1993 and has increased by nearly 8 years to reach 72.84 in 2007 (GSO, 1993; GSO, 2007). Cancer incidence patterns approach those seen in European Union and the United States with heterogeneous patterns across age groups, older adults could drive the increasing cancer incidence with 67% increasing of the cancer incidence attributable to older adults while only 11% to younger adults (Devesa et al., 1987; Verveli et al., 1998; Smith et al., 2009). The increase in health insurance cover rate from 9% of population in 1993 up to 49% in 2007 (Tim, 1995; Ekman et al., 2008) may partly lead to a better access to health services, especially to the higher technology health service such as cancer histology confirmation. In addition, pesticide has been known as significant risk factor to some special cancer sites (Beard et al., 2003; Chrisman et al., 2009). Importantly, its consumption for agricultural work in Vietnam has an increasing tendency during last decades with about 20% to 30% per year, while 70% of the Vietnamese population has work in agriculture fields (Chen, 2006; TN, Agencies).

Cancer trends of the 10 most frequent cancer sites were rather stable during the three observation periods. Among males, lung cancer remained the most frequently affected site during the three observed periods, despite showing a small decrease in incidence. Tobacco-related cancers still have a high incidence and account for around 35.3% of all new cancer cases in males. This is not surprising since Vietnam still ranks among the countries with the highest prevalence rate of male smoking in the world with 56.1% among males aged 25-64 years, even up to 72.8% found in one survey done in 1997 (Jenkins et al., 1997; MOH, 2003; Ngoan, 2006a).

The second most frequently affected site in males is stomach, which is also the 3rd commonest site among women. The reason is not really known, but it is probably related to Helicobacter pylori infection as Vietnam which shows a very high prevalence of 74.6% (Hoang et al., 2005). The incidence of stomach cancer in Vietnam (Nguyen et al., 1998) is plausibly similar to that of other countries with high incidence of Helicobacter pylori infection such as Japan (Yanaoka et al., 2008) and Korea (Lee et al., 2002).

Liver cancer ranks third among the most frequent affected sites in males (ASR $21.98/10^5$ in 2006-2007) and is also one of the 10 most frequent affected sites in females (ASR $5.88/10^5$ in 2006-2007). This finding is probably related to the high prevalence of Hepatitis B Virus (HBV) infection in Vietnam - which in rural areas can be considered endemic. The prevalence of HBV infection among Vietnamese adults has been reported as being between 8.8 and 19.0% (David et al., 2003; Nguyen et al., 2007; Duong et al., 2009). Such high prevalence rates of HBV infection are common in the Southeast Asian area. Despite the high HBV infection prevalence, the incidence of liver cancer in Vietnam is strikingly low compared to other countries in the region, such as the Philippines (ASR $25.6/10^5$ in males; $9.0/10^5$ in females) (Corazon and Edward, 2002), Thailand (ASR $38.1/10^5$ in males; $15.1/10^5$ in females) (Sriplung et al., 2006); and China (ASR $40.0/10^5$ in males; $15.3/10^5$ in females) (Yang et al., 2005).

In females, cervix uteri was the most frequent affected site in 1993-1998, then breast cancer increased faster to occupy the first place of the most frequent affected sites. The increase in breast cancer already observed in previous analysis from Vietnam (Nguyen et al., 1998; Anh and Duc, 2002) is confirmed and sustained when taking into account longer observation periods as we did in our analysis. This shift could be explained by the fact the high incidence of cervix cancer was related to the high rate of HPV infections during the Second Indochinese War in the South of Vietnam which was significantly associated with the development of invasive cervical cancer (Huynh et al., 2004).

The increasing rate of breast cancer in Vietnam is a trend comparable to that of other developing countries, being rapidly emerging as a leading cause of death in women (Parkin et al., 1997). It is also similar to the trend reported for Korea during 1993-2002, the incidence rate was grew from 14.5 in 1993 to $26.2/10^5$ in 2002 (Lee et al., 2007). Besides demographic shifts towards longer life, the increase in breast cancer incidence may be partly explained by changes in other known risk factors such as the age of first pregnancy carried out. Hazel et al. found that women having their first-delivery at the age of 25 years or later had 1.5 times higher risk of developing breast cancer than those who first-delivery before age 25 (95% CI, 1.2-1.95) (Hazel et al., 2005). In Vietnam, the age of first delivery is mostly coherent with the age of first marriage which has increased for both males and females in the period of 1999 to 2006 by 1.3 years in males and 0.5 year in females (Tokyo, 2008). Another possible explanation could be an increase in knowledge and awareness of breast cancer and the introduction of screening mammography service which both could contribute to an increase of breast cancer incidence (Jemal et al., 2007; 2008).

For males, the ASR of all site cancer by age group at first diagnosis of all 3 observed periods (Figure 2) fit each other very well. But for females, the patterns show some changes between the first and third period, especially in the age groups 55-59 years and 70-74 years (Figure 3). This change may partly be due to the above average increase of cancer incidence in females in these age groups during the last period. This assumption should be more concretely studied by a study of some specific cancer site incidence rate by age-group-analysis, in order to find what are the facts that probably explain the increase in the cancer incidence during last decades of Vietnam especially in females.

In conclusion, cancer incidence in Vietnam has continuously increased during 1993-2007. Trends for specific sites show increases in the incidence of specific cancers. According to the data presented here, Vietnam's health decision makers should consider to refine the primary health preventive strategy. More efforts should be concentrated on developing and implementing tobacco-related cancer prevention interventions, in men, as well as in women.

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