Cancer in the Philippines


PHILIPPINE CANCER SOCIETY - MANILA CANCER REGISTRY
DEPARTMENT OF HEALTH – RIZAL CANCER REGISTRY
UNIVERSITY OF THE PHILIPPINES MANILA – SURGERY RESEARCH UNIT
FINNISH CANCER REGISTRY

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This monograph presents the second part of the fourth volume of the analysis of the incidence of cancer in the populations of Metro Manila and Rizal Province, in the Republic of the Philippines. The analysis made use of databases from two population-based cancer registries, namely the Department of Health-Rizal Cancer Registry and the Philippine Cancer Society-Manila Cancer Registry. Presented here are cancer incidence trends from 1980 to 2002, which were determined using joinpoint regression and time-space maps.
INTRODUCTION

This is the second part of the fourth volume of the Cancer in the Philippines series, and it presents cancer incidence trends for Metro Manila and Rizal Province from 1980 to 2002.

Cancer incidence has been reported for the Metro Manila and Rizal Province areas in the Cancer in the Philippines monographs\textsuperscript{1-4} and, Philippine Cancer Facts and Estimates\textsuperscript{5-9} of the Philippine Cancer Society (PCS) as well as the Cancer Incidence in Five Continents series of the International Agency for Research on Cancer (IARC)\textsuperscript{10}. However, trends have only been described in general detail and with less imprecise methods than what are currently available.

Incidence trends reflect changing exposures to cancer risk factors and, if present, the effects of interventions or programs aimed to control or minimize such exposures. They provide information on the effects of risk factors, and help monitor and evaluate cancer control programs.

METHODS

Data Gathering

Case finding, abstracting, data management and quality control have been described in detail in Cancer in the Philippines Vol. IV Part 1.\textsuperscript{4}

Data Analysis

Data analysis was done in three phases: 1) computation of age-standardized rates (ASR); 2) determining trends and annual percent change in ASRs using joinpoint regression; 3) illustrating and describing spatio-temporal trends as maps.

Computation of Age-standardized Rates

The computation of incidence rates was based on the number of new cases registered by the DOH-RCR and the PCS-MCR from 1 January 1980 to 31 December 2002. ASRs were computed for each year of study. Data were summarized and grouped into 5-year age groups and the age-standardized rates were computed using the World Standard Population. The ASRs in Part 1 were computed using an earlier version of the dataset while the ASRs for the spatial maps in Part 2 were computed using an updated version of the dataset.

Joinpoint Regression

Joinpoint regression analysis\textsuperscript{11} was done to determine changes in the trend, using the joinpoint software\textsuperscript{12} downloaded from the website of the Surveillance Research program of the USA National Cancer Institute.
This method gives a more proper description of the patterns than linear regression and is useful in monitoring changes in cancer incidence.

The joinpoint regression determines a series of lines that are connected by a joinpoint, which indicates a statistically significant change in the trend. Trends were assessed by identifying the best-fitting points where a significant change in the slope occurred. The analysis began with the minimum number of joinpoints, a zero, representing a straight line. The presence of additional joinpoints was assessed and these were retained if they denoted a significant change in the trend.

The estimated annual percentage change (APC) was computed for each of the periods to describe the linear trends. The annual percentage change assumed that the rates changed at a constant percentage of the rate of the preceding year.

The following model was used to compute for the annual percentage change.

\[
\log(R_y) = b_0 + b_1y \quad \text{where} \quad \log(R_y) \text{ is the natural log of the rate in year } y
\]

The APC from year \( y \) to year \( y + 1 \) is:

\[
\text{APC from year } y \text{ to year } y + 1 = \left( \frac{R_{y+1} - R_y}{R_y} \right) \times 100
\]

\[
= \left( \frac{e^{b_0 + b_1(y+1)} - e^{b_0 + b_1(y)}}{e^{b_0 + b_1(y)}} \right) \times 100
\]

\[
= (e^{b_1} - 1) \times 100
\]

Cancer Maps

To produce maps on cancer incidence, ASRs (World Standard Population) were calculated for each municipality for 7-year periods 1980-1986, 1988-1994 and 1996-2002. For a given municipality, the observations were assigned to geographical central points; other geographical data needed in the map production included geographical data such as coordinates of national borders (using Alber’s equal area projection). Three administrative regions were located in two separate geographical locations. For these regions, the incidence rate was also located to two separate map coordinates with weights to correspond to sizes of populations living in those regions.

We used the mapping method developed by the Finnish Cancer Registry. For six major cities with more than 100,000 inhabitants per sex, the rates were presented as coloured circles on the maps. The radius of the circle indicates the size of the population and the colour the ASR. The rates for the remaining municipalities were smoothed to decrease visibility of change variation. For each 2km by 2km grid, a weighted average of the ASRs of the neighbouring municipalities within a 60 km radius was calculated to define the colour of that grid. The rates were directly weighted with the population size of the municipality and inversely weighted in relation to the distance. Each step on the colour scale of the maps corresponded to a 10% increase in the ASR.
Figure 1A shows the names of the six major cities presented as coloured circles on the time-space maps.

Figure 1A. Cities and municipalities in the time-space maps, Metro Manila and Rizal Province.

Figure 1B shows the names of all the cities and municipalities. Rizal Province is composed of Angono, Antipolo, Baras, Binangonan, Cainta, Cardona, Jala-jala, Montalban, Morong, Pillila, San Mateo, Tanay, Taytay and Teresa. The rest are in Metro Manila.

Figure 1B. Cities and municipalities in Metro Manila and Rizal Province.
Declining cancer incidence trends were observed in some sites, particularly in the infection-related cancers (stomach, liver, and cervix). On the other hand, incidence trends for cancers related to modern lifestyle continued to increase. Such increase might be attributed to the rapid urbanization and the consequent adoption of unhealthy lifestyle factors that included smoking, unhealthy diet, alcohol consumption, and low physical activity.14,15

3.1 All Sites

Incidence for all cancer types combined among men increased greatly from 1980 to 1983 (APC = 6.1; 95% CI= 2.0, 10.3) (Figure 2). The incidence continued to increase but at a lower rate (APC = 0.9; 95% CI= 0.4, 1.4) from 1983 to 1995. The incidence of cancer in males decreased from 1995 to 2002 (APC = -1.9; 95% CI= -2.9, -0.9). Overall cancer in males increased by an average of 0.7% per annum (95% CI= 0.1, 1.3).

![Figure 2. Joinpoint regression plot for all cancer sites, males, Metro Manila and Rizal Province, 1980-2002.](image)

In females (Figure 3), overall cancer incidence increased greatly from 1980 to 1983 (APC = 5.1; 95% CI= 0.5, 9.8) followed by a stable incidence period from 1983 to 2002 (APC = 0.1; 95% CI= -0.1, 0.4). There had been an annual increase of 0.8% in overall cancer in females (95% CI= 0.2, 1.4).
3.2 Oral Cancer

The incidence of oral cavity cancer in males declined slightly from 1980 to 1997 (APC = -1.3%, 95% CI = -2.4, -0.2) and more strongly from 1997 to 2002 (APC = -9.8%, 95% CI = -16.1, -3.0) (Figure 4). At the start of the study period, Quezon City had the highest incidence (Figure 5). As time went by, the incidence of oral cavity cancer continued to decrease but the ASR in Manila and Quezon City remained higher compared with the other areas. From 1980 to 2002, oral cancer incidence in males decreased by an average of 3.3% per year (95% CI = -5.0, -1.6).
Similarly, the incidence of oral cavity cancer in females declined slightly from 1980 to 1992 (APC = -1.8%, 95% CI = -3.6, -0.0) and decreased more from 1992 to 2002 (APC = -6.8%, 95% CI = -9.1, -4.6) (Figure 6). The cities of Manila and Quezon consistently had higher incidence than the other sites for the duration of the study period. A marked reduction was observed in the incidence of oral cancer in the city of Marikina from 1980 to 2002 (Figure 7). From 1980 to 2002 oral cancer incidence decreased at an average of 4.1% per year (95% CI = -5.4, -2.8). However, more observation is needed to see if the decrease can be sustained.
3.3 Stomach Cancer

The incidence of stomach cancer among males has declined consistently in the past couple of decades (Figure 8). At the start of the study period, markedly higher rates were observed in Metro Manila than in Rizal Province (Figure 9). The rates for the cities of Metro Manila appeared to decline with time. On the other hand, fluctuating but decreasing rates for Rizal Province could be observed. Manila and Quezon City registered the highest ASRs throughout the study period. From 1980 to 2002, stomach cancer incidence in males decreased by an average of 2.7% per year (95% CI= -3.5, -1.9).
Similarly, Figure 10 showed that the incidence of stomach cancer had also declined in the past couple of decades in females. The incidence of stomach cancer among females in Rizal Province as a whole was consistently lower than the incidence in Metro Manila (Figure 11). From 1980 to 2002, stomach cancer incidence in females decreased by an average of 2.3% per year (95% CI= -2.9, -1.7).
These decreasing trends could be due to a decline in *Helicobacter pylori* colonization of the stomach. One reason for this could be changes in food preservation, from salting or smoking to refrigeration, with almost 90% of households using refrigeration as the main food storage method. Another reason could be increased antibiotic treatment for other diseases, that also inadvertently affected *H. pylori* prevalence.

### 3.4 Colon Cancer

Between 1980 and 2002, the incidence of colon cancer had continued to rise in **males**, with an annual average increase of 3% (95% CI = 2.3, 3.7) (**Figure 12**). The spatial maps showed that the continuous increases observed in the ASRs of colon cancer appeared to spread from Metro Manila to Rizal Province (**Figure 13**). In Metro Manila, throughout the study period, the highest ASRs could be found in the cities of Manila and Quezon City, while the lowest incidence was in Caloocan. The incidence was consistently higher in the urban areas of Metro Manila with the exception of Caloocan.
Increases were also noted in the incidence of colon cancer in females, 14% (95% CI= 0.6, 29.9) in 1980-1983 and 2.1% (95% CI= 1.3, 2.9) in 1983-2002 (Figure 14). The spatial trend for females (Figure 15) was very much similar to the trend seen in men. From 1980 to 2002, the incidence of colon cancer increased at an average of 3.7% per year (95% CI= 1.9, 5.5).
The observed trends could partly be attributed to the insufficiency\textsuperscript{18} and continuing downward trend\textsuperscript{19,20} in the consumption of fruits and vegetables. This was coupled with the constant increase in the intake of protein and energy rich foods.\textsuperscript{21} The 7\textsuperscript{th} National Nutrition and Health Survey (NNHeS 2008) of the Food and Nutrition Research Institute (FNRI) reported that overweight/obesity had increased from 24.0\% in 2003 to 26.6\% in 2008\textsuperscript{22}. The prevalence among adults of hypertension and diabetes were 25.3\% and 4.8\% respectively compared to 17.4\% and 4.6\% in the 2003 NNHeS.

3.5 Rectum Cancer

In males, the incidence of rectum cancer annually increased by 8.2\% (95\% CI= 2.0, 14.9) during 1980-1985 but decreased by 8.5\% (95\% CI= -29.9, 19.5) during 1985-1988 (Figure 16). This was then followed by a 2.1\% (95\% CI= 0.8, 3.4) increase from 1988 up to 2002. The spatial maps showed increasing incidence both in Metro Manila and the adjoining province of Rizal (Figure 17). Overall, the incidence of rectum cancer in males increased at an average of 1.9\% per year (95\% CI= -1.7, 5.7).
The incidence of rectum cancer has also been steadily increasing in females, with an annual average increase of 1.2% (95% CI = 0.7, 1.8) (Figure 18). High incidence of rectum cancer in females was concentrated mainly in Quezon City and the City of Manila but was spreading to Rizal Province. However, urban dominance remained and marked differences in the incidence rates between Metro Manila and Rizal Province can still be noticed (Figure 19).
As with colon cancer, the increasing trend could partly be due to the insufficiency and continuing downward trend in the consumption of fruits and vegetables and continuous increase in the intake of protein and energy rich foods.

### 3.6 Lung Cancer

Lung cancer incidence among males had increased by 6.6% (95% CI = -3.5, 17.8) from 1980 to 1984 and by 0.9% (95% CI = -1.5, 3.4) from 1984 to 1995 but had been decreasing since 1995 by an average rate of 3.5% per year (95% CI = -7.5, 0.7) (Figure 20). The spatial maps show that lung cancer ASRs in males appeared to have peaked within the periods 1988-1994 and declined afterwards. The differences in the incidence between the cities of Metro Manila and Rizal Province were decreasing (Figure 21). From 1980 to 2002, the incidence of lung cancer in males increased by an average of 0.5% per year (95% CI = -1.8, 2.9).
Among females the trend was increasing by 3% per year from 1980 to 1989 (95% CI = -0.1, 6.2) but decreased by 1% per year from 1989 to 2002 (95% CI = -2.7, 0.7) (Figure 22). Slow increases in the ASRs were observed until the period 1988-1994, after which a decline was noted (Figure 23). The highest incidence was observed in Quezon City for the entire study period. As time went by, the differences in incidence between Rizal Province and the semi-urban cities of Manila decreased. In females, the incidence of lung cancer increased by an average of 0.6% per year (95% CI = -0.9, 2.1).
These trends were consistent with reported tobacco consumption, which had been decreasing for males. A similar decrease was seen among females. The first Philippine Global Adult Tobacco Survey showed that although more than 90% were aware that smoking causes serious illness, 28.3% were current tobacco smokers, and 48.8% were exposed to cigarette smoke in their homes. Similar to cancer of the oral cavity, more observation is needed to see if the decrease can be sustained.

3.7 Liver Cancer

In males, an annual decrease of 0.1% (95% CI = -0.6, 0.5) in the period 1980-2000, and a sharp decrease of 11.5% per year (95% CI = -26.8, 7.0) in 2000-2002 were observed (Figure 24). While the incidence of liver cancer in Rizal Province was essentially stable, a fluctuation was noted in Metro Manila (Figure 25). Overall, the incidence of liver cancer in males decreased by an average of 1.2% per year (95% CI = -2.8, 0.5).
In females, an average annual decrease of 0.8% (95% CI= -1.4, -0.2) was seen (Figure 26). The ASRs of liver cancer in females in Rizal Province declined over time and this decline appeared to be spreading towards the cities of Metro Manila (Figure 27).
While reduction in liver cancer incidence was seen, the decrease was small. The prevalence of Hepatitis B had started to decrease since the 1980s, and this could continually contribute to the slow decline in liver cancer incidence. The decrease in incidence by 2002 may be partly attributed to increasing vaccination that started in the 1980s in both private and public sectors. Viral infections that cause chronic active hepatitis, such as Hepatitis B and Hepatitis C viruses, are likely to be responsible for most cases of primary liver cancer in the Philippines. **Hepatitis B virus (HBV)** infection is still the most prevalent. Infants and young children who get the infection and become carriers are at highest risk of liver cancer. HBV vaccines have been available in the country since 1984. The Department of Health had included HBV vaccination as part of the Expanded Program of Immunization (EPI) in 1992 but funding had been inconsistent. Most of those who have their children vaccinated against HBV are private individuals who can afford to pay for the vaccine. Moreover, alcohol consumption remained high and continued to increase. More study is needed to explain the trends observed and to see if the decrease can be sustained.

### 3.8 Breast Cancer

Breast cancer incidence was high in the Metro Manila and Rizal areas, and continued to rise with an annual average increase of 0.9% (95% CI= 0.5, 1.2) ([Figure 28](#)). Urban dominance was noticed but continuing increases in the incidence was observed for the entire study site. Towards the end of the study period, the differences in the incidence between the urban and semi-urban areas of Metro Manila and Rizal Province had been continuously decreasing ([Figure 29](#)).

Figure 29. Incidence of female breast cancer by time periods, Metro Manila and Rizal Province, 1980-2002.
Increase in breast cancer incidence could be highly due to various lifestyle factors such as diet, physical inactivity and alcohol drinking. Consumption of energy and protein rich foods was high, and was reflected by the high and increasing proportion of the population who were overweight and obese. Furthermore, 57.0% of women were reported to be physically inactive. Alcohol consumption among women was reported to be moderate but was increasing.

The prevalence of oral contraceptive use and hormone replacement therapy can likewise have an effect on breast cancer incidence. However, there are no estimates available for this population, and more research is needed to determine the actual roles of these factors into breast cancer risk in the Philippines.

A study done in the Philippines found that the risk of Filipino women who had never been pregnant was 5 times that of women with ≥5 pregnancies, while those whose age at first birth was ≥30 years had 3.3 times higher risk than women whose age at first birth was <20 years. The significantly highest rates were seen only in the seven cities of Metro Manila where large-scale housing developments had occurred starting in the 1950's. This had resulted in large scale internal migration of middle and high income families from all over the country, families who could have been already more susceptible to lifestyle changes, including reproductive behavior. As economic development has consistently been associated with a fall in birth rates, it is expected that breast cancer incidence will continue to rise.

3.9 Cervical Cancer

The incidence of cervical cancer was rising until 1984, with an annual increase of 5.5% (95% CI= 0.6, 10.6). Since then, it had decreased by a rate of 1.6% per year (95% CI= -2.0, -1.1) (Figure 30). Declining incidence was observed in all of the study regions, with the highest reduction noticed in the city of Pasay (Figure 31). From 1980 to 2002, the incidence of cancer of the cervix decreased by an average of 0.3% per year (95% CI= -1.2, 0.6).
Although a decrease in cervical cancer incidence was evident, reasons for that are not clear. Pap smear screening was available in the country, but effective coverage was low (around 10%, lower than the average effective coverage of 18.5% in developing countries) and might have only slightly influenced cervical cancer incidence. The increased use of condoms, mainly attributed to the massive anti-HIV campaigns in the 1990s, might be a contributory factor, but male condom use among partners of currently married women remained low as well as condom use among females in the general population. The vaccine for HPV infection was only recently introduced, and could not have an effect on the trends presented here. More study is needed to determine the reasons for continued decrease in cervical cancer incidence.

### 3.10 Prostate Cancer

Between 1980 and 2002, the incidence of prostate cancer was increasing by a rate of 2.5% per year (95% CI= 1.8, 3.2) (Figure 32). The spatial maps show that continuous increases could be noted in the incidence of prostate cancer for all study sites, with the highest incidence registered at Quezon City for the entire duration of the study period. The increase in incidence was slowly spreading from Metro Manila to Rizal Province. The difference in the incidence between the semi-urban areas of Metro Manila and Rizal Province diminished with time (Figure 33).
Current evidence on the etiology of prostate cancer is very limited, and the roles of various risk factors, such as tobacco smoking, alcohol drinking, diet and hormones, are still under debate. While increasing evidence point to the absence of an association of smoking and alcohol drinking with prostate cancer risk, more definitive results remain elusive. Incidence of diagnosed prostate cancer cases in the developed countries has been very strongly related to frequency of PSA tests done among asymptomatic men or on autopsies rates. There had been no PSA population screening in the Philippines. There is also no data on prostate cancer autopsy rates.
3.11 Thyroid Cancer

The incidence of thyroid cancer in **males** has been almost stable, with an annual average *increase* of 0.4% (95% CI = -0.7, 1.6) (**Figure 34**). High incidence of thyroid cancer in males was concentrated in Metro Manila but was spreading to Rizal Province. The difference in the incidence rates between Metro Manila and Rizal Province diminished with time (**Figure 35**).

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**Figure 34. Joinpoint regression plot for thyroid cancer, males, Metro Manila and Rizal province, 1980-2002.**

**Figure 35. Incidence of thyroid cancer by time periods, males, Metro Manila and Rizal Province, 1980-2002.**
In females, the incidence of thyroid cancer has been increasing with an APC of 1.6% (95% CI= 1.0, 2.3) (Figure 36) and the incidence rate now is almost four-fold as compared with the rate among males. Highest incidence rates of thyroid cancer among women were observed in Metro Manila with Rizal Province slowly becoming a high incidence zone (Figure 37).

![Figure 36. Joinpoint regression plot for thyroid cancer, females, Metro Manila and Rizal province, 1980-2002.](image)

![Figure 37. Incidence of thyroid cancer by time periods, females, Metro Manila and Rizal Province, 1980-2002.](image)
While a small increase in the incidence of thyroid cancer was seen for both sexes, its etiology in the Philippine population needs further investigation. Ionizing radiation, which is the main established risk factor for the disease is uncommon in the country. The prevalence of familial benign thyroid disease, which is another known risk factor, is unknown, but is unlikely to be high. A recent study showed that 63.4% of cases with nodular goiter in PGH had iodine deficiency and a higher proportion of malignant thyroid nodules was found among those with iodine deficiency (55.8%) than those who were iodine sufficient (40.0%)%. Differences in diagnostic activity may also explain temporal and spatial variation.

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Appendix

Contributors

Victoria M. Medina is currently working on her Master of Science in Epidemiology from the College of Public Health, University of the Philippines Manila. Vicky’s thesis is on the burden of disease of breast cancer and has co-authored several publications with the registry.

Adriano V. Laudico is a surgical oncologist and Professor Emeritus of Surgery at the University of the Philippines Manila. He was the former head of the Department of Health-Rizal Cancer Registry, and currently heads the Philippine Cancer Society-Manila Cancer Registry. He was a Past President of the Philippine College of Surgeons, and the Founding President of the Surgical Oncology Society of the Philippines. Yago was also a Short Term Consultant on Cancer of the World Health Organization Western Pacific Region to several counties in Southeast Asia and the Pacific.

Maria Theresa M. Redaniel finished her PhD at the Ruprecht-Karls-Universität Heidelberg, Germany, working on cancer survival comparisons in the Philippines and the US. Her association with the Philippine Cancer Society-Manila Cancer Registry started with her Masteral thesis which was on population-based survival of cervix cancer, and has subsequently co-authored several publications with the registry. Tere is currently working in the School of Social and Community Medicine, University of Bristol, UK.

Maria Rica Mirasol-Lumague is a general surgeon, and is the current head of the Department of Health – Rizal Cancer Society. Rica is the Chief Training Officer of Rizal Medical Center, where she also supervises the Tumor Clinic. She underwent training on Cancer Registration Methods and Cancer Epidemiology at the International Agency for Research on Cancer in Lyon, France.

Cynthia A. Mapua holds a Master of Science in Epidemiology from the College of Public Health, University of the Philippines Manila, and is at present working for a Doctor of Public Health in Epidemiology at the same institution. Her association with the Philippine Cancer Society – Manila Cancer Registry began with her Masteral thesis which was on population-based survival of breast cancer. Cyndi had undergone training on cancer registration methods and cancer epidemiology at the International Agency for Research on Cancer in Lyon, France. Cyndi is currently a Scientist/Epidemiologist at the Center for Biostatistics and Molecular Epidemiology, Research and Biotechnology Division, St. Luke’s Medical Center.

Toni Patama holds a degree of Master of Science (Environmental Sciences) from the University of Kuopio and specializes on geographical information systems and spatial epidemiology. Toni is currently an Assistant Researcher at the Finnish Cancer Registry.

Eero Pukkala obtained his M.A. from the University of Helsinki, and his Ph.D. from the University of Tampere. He is currently Director of Statistics and an epidemiologist at the Finnish Cancer Registry, Institute for Statistical and Epidemiological Cancer Research, Helsinki. Eero is also Professor of Public Health and Epidemiology at Tampere School of Public Health, University of Tampere, chairman of the national Epidemiological Society and leader of several national and international research programs.
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