RESEARCH ARTICLE

Retrospective Appraisal of Cancer Patients from Vientiane Capital City, Lao People's Democratic Republic (PDR), Seeking Treatment in Thailand

Kongmany Chaleunvong[1,4], Supot Kamsa-ard[2], Krittika Suwanrungruang[2], Surapon Wiangnon[3]*, Vanphanom Sychareun[4], Phetsamone Alounlangsy[4], Jo Durham[5], Supannee Promthet[1]

Abstract

Background: Recent estimates suggest that in the Lao People's Democratic Republic (Lao PDR) the burden of cancer in terms of DALYs lost is amongst the highest in South East Asia. As such, increasingly cancer is becoming an important public health concern in the country. Lao PDR however has no population-based cancer registry and only one hospital-based registry. Cancer treatment within the country is extremely limited. Patients who can, may travel to neighboring countries for treatment, but little information about this is available in the country. The aim of this study was to estimate some of the otherwise largely unknown parameters of the cancer burden in Lao PDR. Materials and Methods: This is a retrospective, descriptive study based on the records of 847 Lao cancer cases treated with surgery, radiation and chemotherapy at Srinagarind Hospital, Khon Kaen University, in Thailand between 1988 and 2010. Results: The annual rate of registration of Lao cancer cases fluctuated, but showed an increasing trend. Most cancers were diagnosed by histology (65.2%), and a combination of endoscopy and radiology (15.6%). In most cases (70.2%) the stage of cancer at diagnosis could not be determined. In those whose stage could be identified, 54.0% were at the final stage (Stage IV). Among males, the commonest cancer sites were the liver (16.1%), blood (12.3%) and nasopharynx (10.6%). Those in female patients were the cervix (22.2%), breast (14.6%) and blood (8.1%). Conclusions: This study indicates that despite some fluctuations, the number of Lao cancer patients presenting at Srinagarind Hospital, Khon Kaen, gradually increased between 1988 and 2010. The unfavorable pattern of late-stage cancer diagnosis among male and female patients suggests a need for cancer control interventions and the establishment of cancer registration and treatment facilities within Lao PDR.

Keywords: Cancer incidence - cancer burden - cancer treatment - Lao PDR

Asian Pac J Cancer Prev, **14 (9)**, 5435-5440

Introduction

Estimates from the GLOBOCAN (2008) database show the cancer burden is higher in the developing parts of the world than in advanced economies both in terms of incidence (56% of new cancers in 2008 occurred within developing regions) and mortality (63% of cancer deaths were in developing regions) (Ferlay et al., 2010). Further, it is predicted that by 2020, approximately 60% of all new cancer cases will occur in the least developed nations. Compared to advanced economies where early diagnosis and access to systemic therapy is prolonging life, in low and middle-income countries cancer patients typically present and are diagnosed late and as a consequence, mortality rates are high (Gyorki et al., 2012).

Within the Association of Southeast Asian Nations (ASEAN) countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam), more than 700,000 new cases of cancer are estimated to occur annually and this number is expected to rise (Ferlay et al., 2010). Using GLOBOCAN (2008) data and Global Burden of Disease methodology, Kimman et al. (2012) reported the most commonly diagnosed cancers were: lung (98,143), breast (86,842) and liver cancers (74,777). The most common causes of cancer related mortality were lung (85,772), liver (69,115) and colorectal cancers (44,280). In terms of disability adjusted life years (DALYS), the burden of cancer was highest in the lower-middle income countries of Lao PDR, Vietnam and Myanmar (Kimman et al., 2012).

Lao PDR is a low-middle income country in Southeast Asia. The country is in the process of rapid demographic

*[1]Department of Epidemiology, Faculty of Public Health, [2]Cancer Unit, Faculty of Medicine, [3]Department of Pediatrics, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand, [4]University of Health Sciences, Lao PDR, [5]University of Queensland, School of Population Health, Brisbane, Australia *For correspondence: surapon@kku.ac.th*

and epidemiological transitions characterized by the burden of undernutrition and infectious disease alongside overnutrition and a rise in chronic non-communicable diseases including cancer (Dans et al., 2011). As Lao PDR becomes increasingly urbanized and the population has increasing exposure to risk factors for cancer, the future burden is expected to increase. The health system, however, remains orientated primarily towards infectious disease and reliable epidemiological data about the patterns and burden of cancer and related risk factors are scarce (Lua et al., 2011). This poses a major challenge to an already overstretched health system in terms of planning and resource allocation. In recognition of this, Lao PDR is beginning to respond to the current and potential future cancer burden. In June 2008, for example, the Cancer Center was established at the Mittaphab Hospital in the capital, Vientiane. The first hospital-based cancer registry (pathology) in the country was established at the local University of Health Sciences using data from hospitals in Vientiane and was first published in 2010. The only hospitals in the country which can perform some limited cancer surgery are six tertiary level public hospitals in Vientiane. There are no comprehensive diagnostic or cancer treatments available and facilities for chemotherapy and radiotherapy are nonexistent. Most cancer patients do not receive proper treatment and die at home.

Despite the increasing cancer burden in Lao PDR, there are no population-based cancer registries, making it extremely difficult to determine the national cancer burden and prevalence. This lack of data is compounded by the fact that due to the limited capacity to diagnose and treat cancer, patients are known to cross national borders, often to neighboring Thailand, in order to obtain diagnosis and care (Lua et al., 2011). In this study we sought to estimate some of the otherwise largely unknown parameters of the cancer burden in Lao PDR by analysing records from Srinagarind Hospital, Khon Kaen University, in Northeast Thailand. The estimated cancer statistics for the most recent year reported in the present study can provide a useful benchmark for the planning and evaluation of cancer control programmes in the country.

Materials and Methods

This was a retrospective descriptive study of all Lao patients attending Srinagarind Hospital, Khon Kaen University, for cancer treatment during the period 11 March 1988 to 1 December 2010. Secondary data of 847 cancer cases treated with surgery, radiation and chemotherapy were extracted from the Srinagarind Hospital cancer registry. The data comprised sex, age, residence, marital status, religion; date of diagnosis; method of diagnosis; tumor site and type of treatment. The data were analysed using descriptive statistics (frequency distributions, means and standard deviations), linear trend analysis and chi square for determining age and gender differences in method of cancer diagnosis, cancer stage and cancer sites.

Ethical clearance was received from the Ethical Committee of the University of Health Sciences. Permission to use the cancer registry data from the Srinagarind Hospital, Khon Kaen University was also obtained from the local authority. All the data was de-identified, routine in nature and collected with the intent of eventually becoming publicly available, thus individual consent was not required.

Results

Figure 1 shows the number of Lao cancer patients registered at the Srinagarind Hospital, Khon Kaen University by year from 1988-2010. The number of patients increased steadily from eight cases in 1988 to 42 cases in 1994, but fluctuated over the remaining years, sometimes declining from one year to the next. Nevertheless, there was an overall increase in the number of cases over the entire period (R^2=0.677; p<0.001).

Socio-demographic characteristics of cancer patients

The socio-demographic characteristics of the cancer patients are summarised in Table 1. The sex ratio of cancer patients was 0.96, and their mean (SD) age was 45.2 (18.89) years (range <1-93 years). The highest proportion of cancer patients was in the age group 45-49 years (12.2%) and the lowest proportion was among the age group >85 years (0.2%). Most patients (81.7%) were married and almost all were Buddhists (98.6%).

Method of cancer diagnosis and cancer stage

The main recorded method of diagnosis was histology of the primary tumour (65.2%), followed by endoscopy and radiology (15.6%) and blood cytology (6.3%). The results show that there was a statistically significant gender difference in the method of cancer diagnosis, with

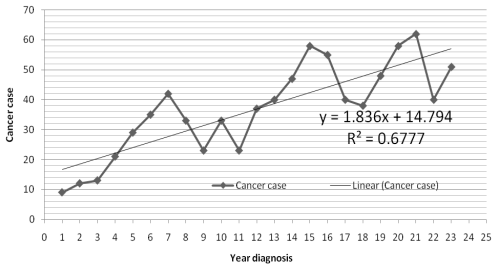

Figure 1. Number of Lao Cancer Patients by Year of Registration at Srinagarind Hospital, Khon Kaen University

Table 1. Socio-demographic Characteristics of the Cancer Patients (n=847)

Characteristic		No.	%
Sex	Male	415	49
	Female	432	51
Age	Mean (SD)	45.2 (18.89)	
Marital status	Single	147	17.4
	Married/widow	692	81.7
	Monk/Nun	7	0.8
	Unknown	1	0.1
Religion	Buddhist	835	98.6
	Christ	5	0.6
	Islam	4	0.5
	Other	2	0.2
	Unknown	1	0.1

specific histology being the primary method of diagnosis for female cancer patients (χ^2=29.602; p<0.001). Table 2 summarizes the methods used in the diagnosis of cancer.

Table 3 shows the stage (where known) at which cancer was diagnosed. For the majority of cases (70.2%) the cancer stage was not recorded, but of those for whom the stage was known, very few were at an early stage (7.5% at stage 0 and 1), and the majority (54.0%) were at the most serious stage (stage IV).

The most common types of treatment received by the patients (Figure 2) were supportive care from family and relatives (27.3%), surgery (26.5%), radiation (23.3%) and chemotherapy (19.5%).

Distribution of cancer sites by socio-demographic characteristic of patients

Among male patients, the most common cancer sites were the liver (16.1%), blood (12.3%) and nasopharynx (10.6%), but there were some age differences. For example, the incidence of liver cancer was relatively higher (24%) in the 45-64 year age group, and the incidence of blood cancer was particularly high (26.2%) in the 0-44 year age group (See Table 4). Among female patients, the most common cancer site was the cervix (22.2%), followed by breast (14.6%) and blood (8.1%). The incidence of cervical cancer and breast cancer were highest in the 45-64 years age group (32.4%), while the highest proportion of blood cancer (13.1%) was in the 0-44 year's age group. Tables 4 show the distribution of cancer sites by sex and age group.

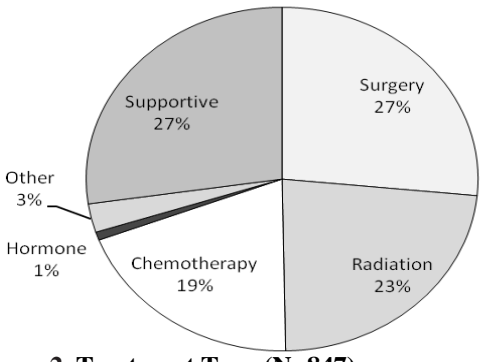

Figure 2. Treatment Type (N=847)

Table 2. Methods of Diagnosis of the Cancer Patients from 1988-2010

Variables	Male		Female		Total	
	N=415	%	N=432	%	N=847	%
Method of diagnosis					X^2=29.602; p<0.001	
History and physical examination	21	5.1	21	4.9	42	5
Endoscopy and radiology	85	20.5	47	10.9	132	15.6
Surgery and autopsy (no history)	12	2.9	24	5.5	36	4.2
Biochemical/immunological tests	18	4.3	6	1.4	24	2.8
Blood cytology	31	7.5	22	5.1	53	6.3
History of metastasis	3	0.7	5	1.2	8	0.9
Histology of primary tumor	245	59	307	71	552	65.2

Table 3. Cancer Stage

Cancer stage at diagnosis	Male N=97	%	Female N=155	%	Total N=252	%
Staging					X^2=34.092; p≤0.001	
0	0	0	3	1.9	3	1.2
I	1	1	15	9.7	16	6.3
II	7	7.2	40	25.8	47	18.7
III	16	16.5	34	21.9	50	19.8
IV	73	75.3	63	40.7	136	54

Table 4. Cancer Sites from 1988-2010 by Sex and Age Group

	Male Age group					Female Age group				
	0-44 N=168 %	45-64 N=171 %	≥65 N=76 %	Total N=415 n	%	0-44 N=199 %	45-64 N=185 %	≥65 N=48 %	Total N=432 n	%
Liver	8.9	24	14.7	67	16.1	7	6.5	10.4	31	7.2
Blood	26.2	2.3	4	51	12.3	13.1	2.7	8.3	35	8.1
Nasopharynx	12.5	9.9	7.9	44	10.6	5	2.7	2.1	16	3.7
Bronchus	4.8	11.7	11.8	37	8.9	3	2.7	4.2	13	3
Lymph node	6.5	7.6	6.6	29	7	5	4.9	8.3	23	5.3
Skin	3.6	3.5	9.2	19	4.6	-	-	-	-	-
Glottis	1.2	4.7	9.2	17	4.1	-	-	-	-	-
Brain	7.7	0	0	13	3.1	-	-	-	-	-
Stomach	0	4.7	1.3	9	2.2	-	-	-	-	-
Colon	1.8	2.3	1.3	8	1.9	-	-	-	-	-
Eye	4.8	0	0	8	1.9				9	2.1
Cervix	-	-	-	-	-	14.1	32.4	16.7	96	22.2
Ovary	-	-	-	-	-	4.5	4.3	2.1	18	4.2
Nasopharynx	-	-	-	-	-	5	2.7	2.1	16	3.7
Thyroid	-	-	-	-	-	5.5	2.2	2.1	16	3.7

Discussion

Lao PDR does not have a population-based cancer register and the cancer burden in the country is largely unknown. To estimate cancer incidence and cancer mortality in 2008 for Lao PDR, the IARC used data from China and Thailand (IARC, 2008). Furthermore, treatment facilities remain underdeveloped and cancer patients in Lao PDR seek treatment in neighbouring countries, such as Thailand (Lua et al., 2011). This study represents the first attempt to analyze the secondary data of cancer patients receiving treatment in Thailand. The patient data came from the cancer registry of Srinagarind Hospital; a tertiary-level, University-based hospital in Northeast Thailand. This hospital is easy to access from Vientiane, the capital of Lao PDR, where most of the patients came from and is known for its quality of its care.

The present study shows an increasing trend in the number of Lao cancer patients from Vientiane registered at the Srinagarind Hospital over a recent period of more than 20 years suggesting a steady rise in the number of cases. This is consistent with the rising cancer rate in countries globally. For example, between 1994 and 2003 in Ireland, the average annual increase in the incidence of cancer was 2.7% (2.5% for males and 2.8% for females) (National Cancer Registry Ireland, 2006). In France, cancer incidence had increased by 63% over a 20-year period with 170,000 new cases in 1980 rising to 278,000 in 2000 (Remontet et al., 2003). Similarly, in less developed contexts the incidence of cancer has also increased. In Sri Lanka for example, the cancer incidence rose from 10,925 in 2001 to 13,372 in 2005 (Cancer Registry, 2009). Using actual data for the period 1989-2000 and basing predictions on data from nine registries for the period 1998-2000, Sriplung et al. (2006) estimated that in

Thailand the number of cancer cases would increase from 45,873 cases in 1990 to 102,665 cases in 2008 (Sriplung et al., 2006). In Nepal, it was estimated that cancer cases would increase by 90% between 2000 and 2015 (Sathian et al., 2010). The increasing trend of cancer cases is also consistent with that seen in other ASEAN countries (Ferlay et al., 2010; Kimman et al., 2012). While the present study suggests a steady rise in Lao cancer cases, there have been marked variations in the annual number of Lao patients attending Srinagarind Hospital for cancer treatment. One possible explanation for this is that patients' choice of treatment centre outside Lao PDR has increased over time. Alternative cancer treatment centres are now available in other places in Thailand (for example, Udon Thani which is closer to Lao PDR than Khon Kaen) and in other neighboring countries such as Cambodia and Vietnam. Travel to these countries has also been facilitated in recent years by a relaxation of travel restrictions.

The mean (SD) age of the cancer patients in the present study was 45.2 (18.891) years, which is similar to that reported in other studies conducted in South East Asia (McDonald et al., 2008). However, some authors have found a higher mean age of cancer patients (Hertz et al., 2005). In the present study, the commonest method of diagnosis was by histology of the primary tumor (65.2%). This is consistent with previous studies (Mutuma et al., 2006; Tracey et al., 2010). For example, Attasara found that in 2008, 88.7% of males and 87.7% of females cancers were diagnosed by histology, and basis of diagnosis for all cases registered 2000-2002 was 86% histology verification respectively. In our study however, there was a statistically significant gender difference in the method of cancer diagnosis, with specific histology being the primary method of diagnosis for female cancer patients. This might be explained by the low awareness of cancer among female patients and their health seeking behavior. The second most frequent method of diagnosis in our study was by endoscopy and radiology, a finding which was also similarly reported elsewhere (Attasara, 2005).

According to the World Health Rankings Live Longer Live Better in 2011, liver cancer in Lao PDR was estimated to account for 1,155 (2.77%) of the total deaths. The age adjusted death rate was 35.14 per 100,000 population, which is the fourth highest death rate for this disease globally. In this study, the leading cancer site in the male patients was the liver (16.1%). This is consistent with the type of cancer found to have the highest incidence (45-50% of all cancers) in the northeastern region of Thailand (Nakhon Phanom, Udon Thani and Khon Kaen provinces) which borders Lao PDR and has a similar lifestyle and culture (Hertz et al., 2005). Using epidemiological data from GLOBOCAN (2008). Kimman et al. (2012) also found high rates of liver cancer. In a study of mortality data from 2007-2008 in Lao PDR, Lua et al. (2011) found liver cancer to be the most frequent cause of cancer related mortality (52.2 per 100,000). In our study, blood cancer was the second leading type of male cancer, which is different from the findings of a Sri Lankan study which reported that crude rate of blood cancer was 2.9% (Cancer Registry, 2009). Among female patients, the most common cancer site was the cervix (22.2%). This finding is consistent with WHO estimates for Lao PDR (WHO/ICO, 2010). Kimman et al. (2012) also reported high cervical cancer incidence rates in Lao PDR. This finding is in contrast to the northeastern region of Thailand, however, where the most common cancer for females between 1998 and 2000 was liver cancer (24.2-32.4% of all cancers) (Attasara, 2005; Sriplung et al., 2006). Liver cancer was also reported to be the leading cause of mortality from cancer in the Lao PDR in the Lua et al. (2011) study. In the aforementioned study in Thailand, cervical cancer was the second most common cancer (Attasara, 2005). For female patients, the second common cancer site was the breast. Within the ASEAN region, breast cancer has been identified as the most frequently diagnosed cancer and the leading cause of cancer mortality (Kimman et al., 2012). Our study also revealed that over half (54.0% of total, 75.3% males and 40.7% females) of the patients were at the last stage of cancer. These figures are much higher than those for patients at stage IV of colon and rectum cancer (19.9%) and oral cavity cancer (6.5%) reported in Thailand (Kamnerdsupaphon et al. 2008). Studies in other lower-middle income countries, however, have reported that most patients present at an advanced stage of disease (Gyorki et al., 2012). Reasons for delayed presentation typically include low levels of awareness, lack of access to health care, lack of early detection, and use of alternative health care models. The diagnosis of advanced cancer is usually difficult for patients and their family and can cause anxiety and uncertainty. However, even if treatment is no longer able to cure or stop the growth of cancer there are alternatives for care, such as treatments which slow tumor growth and manage pain and other symptoms of cancers. Understanding the stage of cancer helps patients and doctors to develop a personalized treatment plan, which takes into account individual needs, goals, and preferences. The present study found that the stage of cancer could not be identified in a high proportion of the patients (70.2%) so that for many this source of guidance in the development of a treatment plan was not available. This finding was in contrast to studies carried out in advanced countries. In New Zealand, for example, Stevens et al. (2008) found much fewer cases of unknown staging (25.2% unknown in all sex), and in the United States too, Utah residents diagnosed between 1996-2000 the stage of disease at diagnosis of liver and intrahepatic bile duct was reported as unknown in 37.5% (Utah Cancer Registry and Utah Department of Health, 2012).

Cancer control includes a range of interventions and treatment selection should be based on life expectancy and expected benefit for the patients. In advanced economies, a combination of early detection and therapy has contributed to a constant decline in cancer mortality rates since the 1980s (McDonald et al., 2008). Some tumors may be cured with anticancer therapy, even at an advanced stage, and quality of life can be improved or maintained. This study suggested that the most common types of treatment were surgery and supportive care from families and relatives. However, the previous studied in the Northern Thailand (Kamnerdsupaphon et al., 2008) found that the most common primary treatment was surgery (43.1%) followed by chemotherapy, and radiation therapy (19.7% and 14.8%

respectively). The main determinant of outcomes is largely due to access comprehensive health systems whereas in low and lower middle income countries, health systems are often struggling with the dual burden of infectious and chronic diseases alongside suboptimal resources, poor data and inadequate surveillance of risk factors (Dans et al., 2011). Correcting this inequity requires a restructuring of health-care to maximize resources and attain a balance between interventions for infectious and non-communicable diseases. In Lao PDR, failure to address prevention, treatment and care of cancer patients means that those who can afford to do so are likely to continue to travel overseas for healthcare, perpetuating in-country inequalities. Further, the on-going recurrent cost of patient travel abroad is likely to be unsustainable and potentially catastrophic over the long-term especially for those on lower incomes (Kangas, 2010). Seeking cancer care abroad may also create a lack of trust in the domestic health care system, fracture the continuum of care and provide a distorted picture of health care needs for policy makers. As such, Lao PDR cannot await control of communicable diseases before it begins to deal with cancer and other non-communicable diseases.

As with all studies, our study has some limitations. Considerable caution is required in generalizing the findings this study as they based only on those patients in Vientiane who wanted and were able to go to Khon Kaen for treatment. While accurate data on the incidence of cancer in Vientiane are unavailable, data derived from the registration of new cases at Srinagarind Hospital in Thailand can only provide a very crude underestimate as it does not capture the number of new cases who remain within Lao PDR or those who travel to other places outside of the country for treatment.

In conclusion, this study highlighted the increasing burden of cancer in Vientiane Capital City, Lao PDR, and the limited cancer treatment health facilities available in the country as a whole. The unfavorable pattern of late stage of cancer diagnosis among male and female patients suggests a need for improved cancer control interventions, the establishment of a nation-wide system of cancer registration and the development of a modern array of cancer treatment options. Lao PDR needs to adopt a stepwise approach starting with the control of the most common risk factors and education to increase awareness of the early signs and symptoms of common cancers. These initiatives should be coupled with quality treatments and palliative care for advanced cases.

The health-care system has evolved to deal with the acute infectious diseases. Health care providers and health infrastructure have not been designed to deliver chronic care services required for treatment and control of non-communicable diseases such as cancer. To respond appropriately, accurate data are required. The issue of inadequate incidence data must be addressed alongside improving surveillance for risk factors, and outcomes. Lao PDR has begun to respond with the Cancer Center but to progress cancer control and care, national leadership, political will and financing are needed. The global recognition of the increasing burden of non-communicable diseases provides an opportunity for the international community and the ASEAN leadership support national will. Without action, premature death will continue and hinder or even reverse economic progress. In addition, those who cannot afford to seek care overseas will be further disadvantaged and remain invisible in the public health system.

Acknowledgements

We would like to thank Cancer Unit staff, Srinagarind Hospital, Thailand and the Hospital-based Cancer Registry (pathology), Faculty Medicine, University of Health Sciences, Lao PDR, for giving us permission to access the data used in this study. We are deeply indebted to Dr. Bandit Thinkhamrop for his support and assistance data analysis and his comments on the study. We also gratefully acknowledge the assistance of Peter Bradshaw for his comments, suggestions and the English revision of the manuscript.

References

Attasara P (2005). Hospital-based cancer registry 2005. Bangkok. National Cancer Institute, Department of Medical Services, Ministry of Public Health, Thailand.

Cancer Registry (2009). Cancer incidence data: Sri Lanka Year 2001-2005. National Cancer Control Programme. Sri Lanka.

Dans A, Ng N, Varghese C, et al (2011). The chronic non-communicable diseases in southeast Asia: time for action. *Lancet*, **337**, 680-9.

Drain PK, Holmes KK, Hughes JP, Koutsky LA (2002). Determinants of cervical cancer rates in developing countries. *Int J Cancer*, **100**, 199-205.

Ferlay J, Shin HR, Bray F, et al (2010). Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer*, **127**, 2893-917.

Gyorki DE, Muyco AK, Brennan AL, Murray F, Kingham TP (2012). Cancer surgery in low-income countries: an unmet need. *Arch Surg*, **147**, 1135-40.

Hertz RP, McDonald M, Kulig K (2005). The burden of cancer in American adults. Facts. USA

IARC (2008). GLOBOCAN 2008. IARC: Lyon France.

Kamnerdsupaphon P, Srisukho S, Sumitsawan Y, Lorvidhaya V, Sukthomya V (2008). Cancers in Northern Thailand. *Biomed Imaging Interv J*, **4**, 46.

Kangas B (2010). The burden of pursuing treatment abroad: three stories of medical travelers from Yemen. *Global Social Policy*, **10**, 306-14.

Kimman M, Norman R, Jan S, Kingston D, Woodward M (2012). The burden of cancer in member countries of the Association of Southeast Asian Nations (ASEAN). *Asian Pac J Cancer Prev*, **13**, 411-20.

Lua NT, Chinh ND, Hue NT, et al (2011). Survey-based cancer mortality in the Lao PDR, 2007-2008. *Asian Pac J Cancer Prev*, **12**, 2495-8.

McDonald M, Hertz RP, Lowentha WP (2008). The burden of cancer in Asia. Pfizer Medical Division. Pfizer Incorporation, USA.

Mutuma G, Rugutt-Korir A (2006). Cancer incidence report Nairobi 2000-2002. Nairobi Cancer Registry Kenya Medical Research Institute.

National Cancer Registry Ireland (2006). Trends in Irish cancer incidence 1994-2002 with projections to 2020.

Remontet L, Esteve J, Bouvier AM, et al (2003). Cancer incidence and mortality in France over the period 1978-2000. *Rev Epidemiol Sante Publique*, **51**, 3-30.

Sathian B, Bhatt CR, Jayadevan S, et al (2010). Prediction of cancer cases for a hospital in Nepal: a statistical modelling. *Asian Pac J Cancer Prev*, **11**, 441-5.

Sriplung H, Wiangnon S, Sontipong S, Sumitsawan Y, Martin N (2006). Cancer incidence trends in Thailand, 1989-2000. *Asian Pac J Cancer Prev*, **7**, 239-44.

Stevens W, Stevens G, Kolbe J, Cox B (2008). Comparison of New Zealand cancer registry data with an independent lung cancer audit. *J NZ Med Assoc*, **121**, 1276.

Tracey E, Kerr T, Dobrovic A, Currow D (2010). Cancer in NSW: incidence and mortality report 2008. Sydney: Cancer Institute NSW.

Tuncer M, Moore M, Qiao LY, et al (2010). Asian Pacific Organization for Cancer Prevention. New Hope in Health Foundation.Turkey.

Utah Cancer Registry and Utah Department of Health. (2012). Cancer in Utah 1981-2000.

World Health Organization (WHO). (2003). Global cancer rates could increase by 50% to 15 million by 2020.

World Health Rankings Live Longer Live Better (2011). Health profile Laos, 2010. World Life Expentancy.

WHO/ICO (2010). HPV Information Centre. Human Papillomavi and related cancers in Laos. Summary Report 2010. Summary Report 2010.