SPATIAL DISTRIBUTION OF CANCER DISEASE, A CASE OF FAISALABAD CITY, PAKISTAN

M. Kareem[1], M. N. Minallah[2], and N. Parveen[3]

[1,3] Department of Geography, GC University, Faisalabad, Pakistan

[2] Department of Geography, Govt. Postgraduate College Gojra, Pakistan

Corresponding author: nasarbhalli@yahoo.com

ABSTRACT*: With the passage of time cancer is becoming dangerous disease, spreading fast in the world especially in developing countries like Pakistan. The present research aimed at different cancer related diseases affecting citizens of the Faisalabad city. Temporal data on all cancer cases registered in 2012 was collected from the Allied and PINUM local health centers of Faisalabad city where a total of 400 cancer cases were officially registered. The most common types of cancer found in the study area are breast, liver, lungs, hepatocellular and bone. This major health issue affects 5.47 per 100,000 people of Faisalabad. This crude incidence ratio of all cancer types is constantly increasing, however disproportionately among the citizens. Spatial locations of all cancer patients have been presented with the help of maps by using GIS techniques. The problem of cancer is increasing rapidly and therefore affecting the health of citizens of the city. The specific objective of this study is to determine the spatial distribution of various types of cancer prevailing in Faisalabad city, to identify badly affected areas with cancer diseases and to calculate the crude incidence rate of various cancers among the males and females of the city, Faisalabad.*

Key words: Cancer, Disease, Spatial distribution, Faisalabad, Pakistan

1. INTRODUCTION

Health Scientists and researchers are becoming proficient in analyzing the spatial patterns of cancer disease data and relating to other variables such as health, socio-economic and environmental factors using high quality maps and the advanced tools of geographic information system [1]. Presently the world is affected by the most pestilent health phenomenon, i.e. cancer, due to the high mortality rate, disabilities and costly medicated treatment due to which our economy is badly affected [2]. Prediction estimated 15 million cancer patients and 10 million deaths will occur annually by 2020 [3]. In 2008, 12.7 million people and 7.6 million cancerous related deaths occurred all over the world, the most malignant cancers in both developing and developed countries are lung (1.6 million cases, 1.4 million expires), liver (748,300 cases, 659.900 expires) breast cancer (1.38 million cases, 458,400 expiries) in females [4]. The raising breast cancer among women is a major health issue in the whole world due to physical inactivity, fleshiness after the age of 18, late marriages, genetically, use of alcohol, but this incline should be reduced by adopting physical activities, maintaining a healthy physique, mammography, early marriages, childbearing, breast feeding, lessening the use of alcohol and tamoxifen and raloxifene [5]. The most common reason of lung cancer is smoking; World health organization inquired 5.6 trillion cigarettes have been annually consumed till the end of the twentieth century and the ratio will cause 10 million human deaths per year by 2030 [6]. The worldwide annual cases are not less than 564,000 of Hepatocellular Carcinoma and out of this 398,364 are men and 165,972 are women [7]. The bone cancer frequency is not as common as other cancer related diseases in the whole world; approximately less than 1% patients of bone cancer are treated in UK and this cancer disease is more common in males than females [8]. The geographical variation of dominant cancers among males is lung cancer, mostly found in Asia and Eastern Europe, prostate cancer in North America, Australia, Western and Northern Europe, and South America, liver cancer in some areas of West Africa. Breast cancer is the most rapidly spreading disease among females in Australia, Western Asia, North Africa, North America and some countries of South America. Cancer is also spreading in Asia, having the ratio of 3 million incident rate and 2 million deaths occurred in 2000 in whole of the Asian countries [9]. Nearly 4.7 million women are affected by breast cancer annually all over the world. In Asia, the ratio of breast cancer is low in most of the region, but Southern Karachi and Manila have a high frequency rate more than 50/100,000 ASR. This occurrence rate has also been observed to be increasing in Singapore (3.6% in 1968 & 1992), Malays (4.4%) and India (1.4%), [10] In Shanghai (China) AS rate is 26.5, in Miyagi (Japan) 31.1 and Mumbai (India) 28.2 per 100,000 [11]. Males Lung cancer is the second major cancer that is highly observed in East Asia, South Europe and North America and Arabs countries has low rate 2.8 and 3.1 AS rate per 100,000 [12]. The lung cancer occurrence rate between males and females range from 39.41 to 15.01 in Eastern Asia, from 31.21 to 4.80 in Western Asia, from 11.61 to 2.33 in South Central Asia and from 27.83 to 9.07 in South Eastern Asia [13]. The fifth most common liver cancer is approximated to be 437,000 cases in 1999 commonly occurred in the developing countries with the highest risk in East Asia. The risk factors are hepatitis B & C, inhaling and exhaling smoke from cigarettes, alcoholic drink, HBV & HCV infections and chronic diseases [14]. From 1995 to 1997, out of total 4268 cancer cases, 2,160 are males and 2,108 are females in South Karachi of Pakistan. Lung cancer (12.6%) was mostly recorded in males and breast cancer (33.1%) in females [15] and 50/100,000 women sufferer of breast cancer in Pakistan [16]. In both the genders, the lung cancer cases are (84.9% males & 15% females), breast cancer (0.97% males & 99% females) and liver cancer (63.6% males & 36.3% females) in KIRAN, Karachi from 2000 to 2008 [17]. Faisalabad city is located in the province of Punjab, Pakistan, extending from the latitudes of 30°42' to31°47' north and the longitudes of 72°40' to 73°40' east. Faisalabad covered the area of 213 square kilometers.

Table 1: Gender-wise population of Faisalabad

Gender	Population	Percentage
Male	3582239	49%
Female	3728452	51%
Both Sexes	7310691	100%

Source: [18]

2. MATERIALS AND METHODS

The data related to all cancer related diseases, registered in the health centers of Faisalabad city, has been analyzed. The temporal base research was conducted by taking the data from the PINUM and Allied Hospital of the year 2012. This data are comprised of the cancer patients, their gender, age, and the residential address. This data integrated with Arc GIS 10.1 software and the Geospatial mapping have been done to locate the cancer cases on a map by spatial statistical tools. Satellite image of Faisalabad city was digitized, geo-referenced and the attribute data joined with map. Cancer density map has been developed by Geo statistical tools and the different cancer patients have been shown with different density symbols. Distribution of major risky Cancers are also presented on cancer maps. The Graphs of cancer frequency rate have been derived by comparing the variables of cancer, gender and age of the patient. The study area map depicts the spatial location of all cancer patients in Faisalabad city. Cancer patients are highly observed in Ghulam Muhammad Abad in Northwestern part, Southeastern, Southwestern region on the Jhang road and Northeastern part of the city, covering Madina Town, Fateh Abad and the towns located on the Satayana road.

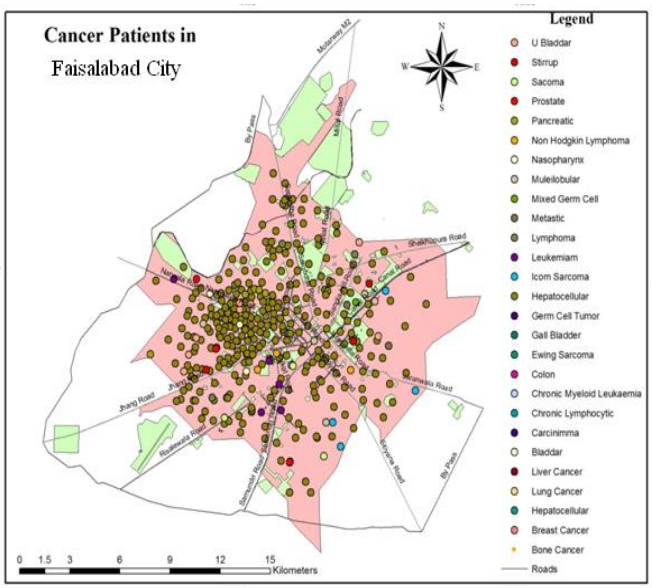

Fig. 1: Map of the study area in Faisalabad city.

3. RESULTS AND DISCUSSION

The results drived by this research clearly depict the cancer condition as a fatel disease spreading and subjecting the whole population of Faisalabad city. The survey has been conducted in PINUM and Allied hospitals of Faisalabad and the estimated registered cancer cases in 2012 are four hundred.

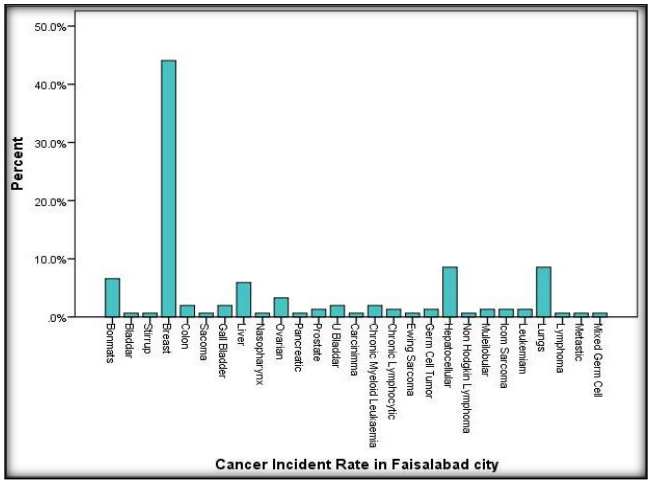

Fig. 2. Cancer incidence ratio in Faisalabad city

The Fig. 3 clearly manifests all types of cancers and occurrence cases genderwise in Faisalabad city. The citizens of Faisalabad suffered mostly from breast (44.7%), lung (8.7%), Hepatocellular (9.3), liver (6%) and bone mat (6.7%) cancers. In Faisalabad city, the most prominent cancer in females is breast cancer and lungs cancer in males.

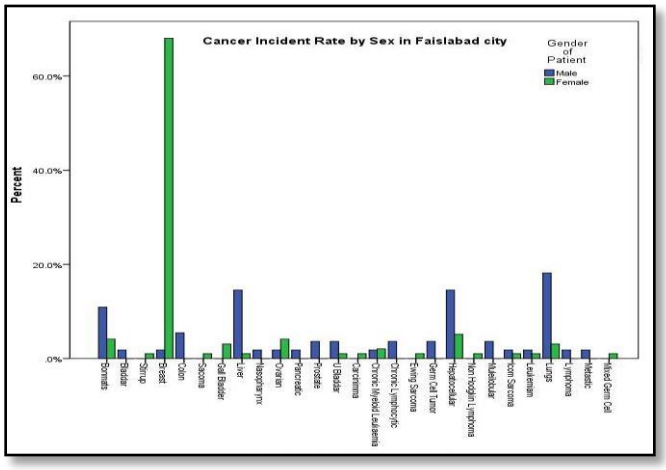

Fig. 3. Cancer incidence ratio in males and females.

Breast cancer is mostly found in females (43.8%) than males (.7%). Breast cancer is commonly higher in younger women between the age groups of 15 to 34 years. Female breast cancer is becoming a fatal and terrible disease in Pakistan and has the highest rate in Asia. Almost 40,000 women die every year due to breast cancer. The most important reason of breast cancer is the excessive use of fatty food and being physically less active. Fleshiness increases the risk of postmenopausal breast cancer [20]. The occurrence ratio of lung cancer is also highly observed, especially in males (6.5% males, 2% females). Smoking is becoming a major reason of lung cancer. In Pakistan, lung cancer kills 274 people daily and 100,000 annually [21]. Others major cancer cases are liver (5.2% males, .7% females), Hepatocellular (5.2% males, 3.3% females) and bone mat (3.9% males, 2.6% females) among the citizens of Faisalabad. Some of the

reasons of liver and hepatocellular carcinoma are fleshiness, overweight, hepatitis B and C, congenital disorder, use of drug and chronic infection [22].

Maps locate the spatial pattern of breast, lung, liver and hepatocellular cancer in Faisalabad city. The breast cancer is highly identified at Southeastern and western region in the areas of Ghulam Muhammad Abad, 8 Bazars and Rehmat Abad of the Faisalabad. In Faisalabad, out of 245 patients of breast cancer 244 are females and 1 is male. The observed occurrence rate of breast cancer in females is 150 out of every 1 [23]. Lung cancer patient are mostly found in Northwestern part, hepatocellular carcinoma patients in northeastern and western side and bone mats in the central and southwestern part of the city.

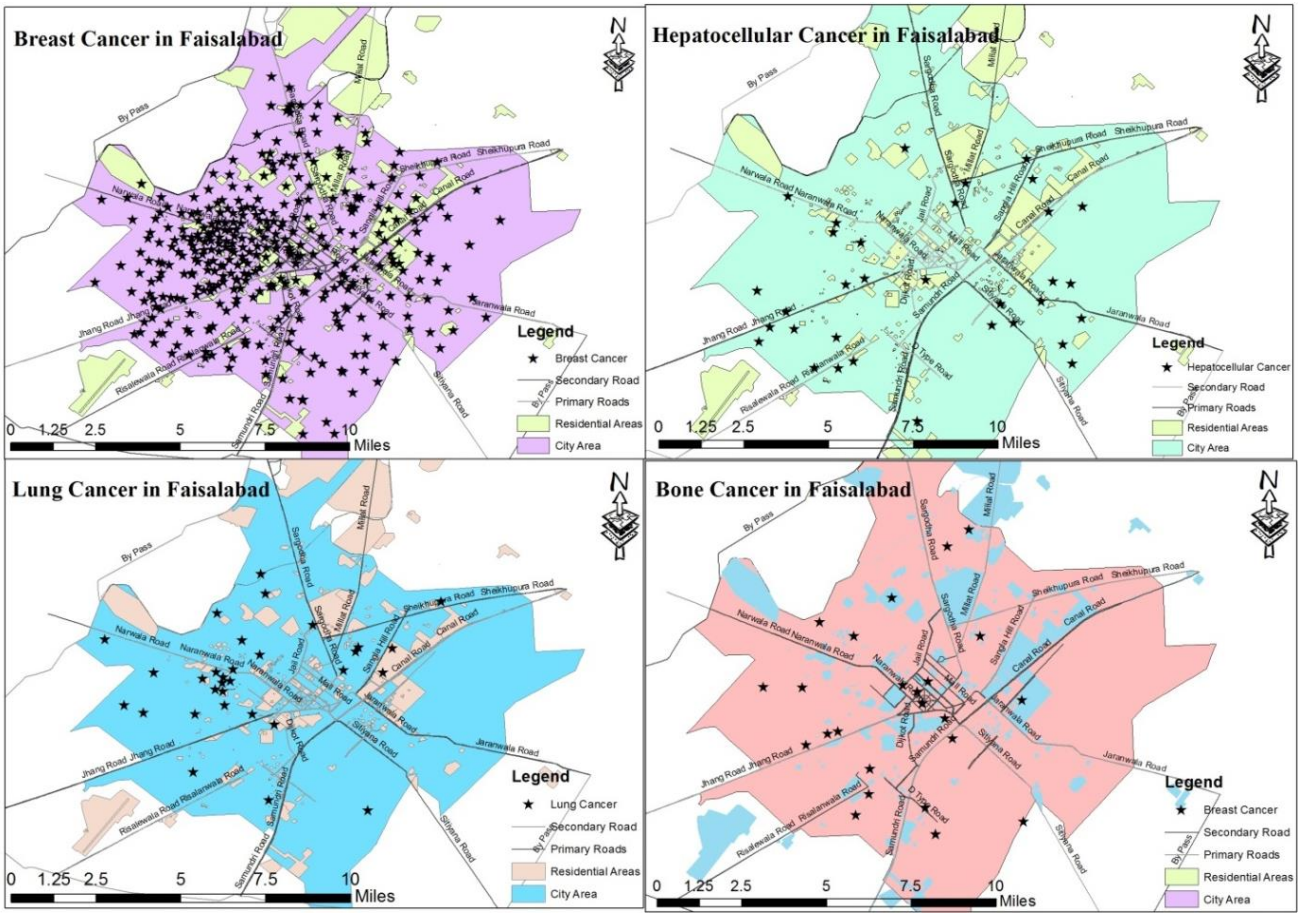

Fig. 4. Spatial distribution of major cancers' incidence in Faisalabad city.

Cancer occurrence rate is the ratio of cancer cases of a specific site/region in a specific time period. This can be shown by the total number of cancers per 100,000 population at risk and calculated by the total number of cancer cases during a specific time divided by the total population of the selected region multiplied by the 100,000 [24]. The incidence rate of all cancer cases in Faisalabad city is also calculated by the total no of cancer cases during 2012 divided by the total population of Faisalabad city multiplied by 100,000. Breast cancer is the highest, lungs and hepatocellular are the second highest and the bone mat is the fourth and liver falls in fifth category. The breast is the top highest cancer in the females of Faisalabad city with the age standardized rate of 3.35 cases per 100,000 persons. Lung cancer is higher in males with the ASR of 0.75 cases per 100,000 persons than female 0.02, hepatocellular cancer, 0.47 patients per 100,000 and liver cancer is also higher in males (5.2%) than females (0.7%) and the age standardized rate is 0.34 per 100,000 persons. Globally the trend of liver cancer rate is observed to be the highest in Asia than any other.

Liver cancer is higher in males than females and the worldwide variation among males and females liver cancer is from 0.9 to 5.0. Among most common primary liver cancer, hepatocellular carcinoma is highly detected almost from 75% to 90% [25]. In Faisalabad city, Bone mat is mostly observed in males than females with ASR of 0.31 per 100,000 persons. Bone cancer is also found in the northwestern part of Pakistan considered the 10th most common cancer. Males have the highest percentage than females as males are ranked in the fifteenth and females in nineteenth in bone cancer ratio [26].

Table 2: Cancer Rate of Cancer cases and their Percentage

Cancer rate per 100,000 persons and their percentage among the gender of Faisalabad city						
Cancer	Males		Females		Total	
	ASR	%	ASR	%	ASR	%
Bonmats	.41	3.9	.21	2.6	.31	6.5
Bladdar	.02	.7	0	0	.01	.7
Stirrup	0	0	.02	0.7	.01	0.7
Breast	.02	0.7	6.54	43.8	3.35	44.4
Colon	.08	2.0	0	0	.04	2.0
Sacoma	0	0	.02	0.7	.01	0.7
Gall Bladder	0	0	.08	2.0	.04	2.0
Liver	.58	5.2	.02	0.7	.34	5.9
Nasopharynx	.02	0.7	0	0	.01	0.7
Ovarian	.02	0.7	.10	2.6	.06	3.3
Pancreatic	.02	0.7	0	0	.01	0.7
Prostate	.05	1.3	0	0	.02	1.3
U Bladdar	.05	1.3	.02	0.7	.04	2.0
Carcinimma	0		.02	0.7	.01	0.7
Leukaemia	.02	0.7	.05	1.3	.04	2.0
Lymphocytic	.05	1.3	0	0	.02	1.3
Sarcoma	0		0	0.7	.01	0.7
Germ Tumor	.05	1.3	.02		.02	1.3
Hepatocellular	.58	5.2	0	3.3	.47	8.5
Non Hodgkin	0	0	.37	0.7	.01	0.7
Muleilobular	.05	1.3	.02	0	.02	1.3
Icom Sarcoma	.02	0.7	0	0.7	.02	1.3
Leukemiam	.02	0.7	.02	0.7	.02	1.3
Lungs	.75	6.5	.02	2.0	.47	8.5
Lymphoma	.02	0.7	.21	0	.01	0.7
Metastic	.02	0.7	0	0	.01	0.7
Mixed Germ	0	0	.02	0.7	.01	0.7
Total	4.05	35.9	6.83	64.1	5.47	100

4. CONCLUSIONS

It is an alrming situation that cancer, a fatal and deadly disease, is rapidly increasing and affecting the health of the citizens. Different cancer density map and graphical presentation of different cancers and their variation among gender clearly depict the miserable condition of the whole region. Cancer ratio is subsequently doubled in females (64.1%) than males (35.9%). Breast cancer is highly determined in females due to fat, late marriages, late mammography and post-menopausal activities. Males are suffered by lungs, hepatocellular, bone mat and liver cancer with higher frequency than females. Lungs and liver cancer are caused by the use of cigarettes, infections, chronic diseases and Hepatitis C. The ASR of all cancers in Faisalabad city was found to be 5.47 cases per 100,000 persons. Some measures such as campaigns highlighting the disastrous affects of smoking, use of healthy and proper diet, proper physical exercises, early detection of cancer, and non-polluted environment should be implemented.

5. REFERENCES

1. Brewer, C. A. Basic mapping principles for visualizing cancer data using geographic information systems (GIS). *American Journal of Preventive Medicine* 30(2S): S25-S36 (2006).
2. Yomralioglu, T., E. H. Colak & A. C. Aydinoglu. Geo-relationship between cancer cases and the environment by GIS: A case study of Trabzon in Turkey. *International journal of environmental research and public health* 6: 3190-3204 (2009).
3. Bhurgri, Y. Karachi Cancer Registry Data -- Implications for the National Cancer Control Program of Pakistan. *Asian Pacific Journal of Cancer Prevention* 5: 77-82 (2004).
4. Jemal, A., F. Bray, M. M. Center, J. Ferlay, E. Ward & D. Forman. Global Cancer Statistics. *CA: A Cancer Journal for Clinicians* 61(2): 1-22 (2011).
5. Society, A. C. Cancer Facts & Figures 2012. *Report* 1-68 (2012).
6. Proctor, R. N. Tobacco and the global lung cancer epidemic. *Nature Reviews Cancer* 1: 82-86 (2001).
7. Méndez-Sánchez, N., A. R. Villa, G. Vázquez-Elizondo, G. Ponciano-Rodríguez, & M. Uribe. Mortality trends for liver cancer in Mexico from 2000 to 2006. *Annals of Hepatology* 7(3): 226-229 (2008).
8. Cancer Research UK. (2013). *Risks and Causes of Bone Cancer*. Cancer Help, UK. http://www.cancerresearchuk.org/cancer-help/type/bone-cancer/about/risks-and-causes-of-bone-cancer. (Last accessed 10 Nov 2013)
9. Mackay, J., A. Jemal. & N. C. Lee. *The Cancer Atlas*. American Cancer Society (2006).
10. Bray, F., P. Mc Carron. & D. M. Parkin. The changing global patterns of female breast cancer incidence and mortality. *Breast Cancer Research* 6(6): 229-239 (2004).
11. Yeole, B. B. & A. Kurkure. An epidemiological assessment of increasing incidence and trends in breast cancer in Mumbai and other sites in India, during the last two decades. *Asian Pacific Journal of Cancer Prevention* 4: 51-56 (2003).
12. Salim, E.I., A.R. Jazieh. & M. A. Moore. Lung Cancer incidence in the Arab league countries: Risk factors and control. *Asian Pacific Journal of Cancer Prevention* 12: 17-34 (2011).
13. WHO. *Gender in Lung Cancer and Smoking Research*. Department of Gender, Women and Health

Family and Community Health, World Health Organization. http://www.who.int/gender/documents/en/lungcancerlow.pdf (2004). (Last accessed 30 April 2014)

14. Bosch, F. X., J. Ribes & J. Borràs. Epidemiology of primary liver cancer. *Seminars Liver Disease* 19(3): 271-285 (1999).
15. Bhurgri, Y., A. Bhurgri, A. Rahim, S. Hassan, H. Zaidi, S. H. M. Sankaranarayanan, & R.D.M. Parkin. Cancer incidence in Karachi, Pakistan: First results from Karachi Cancer Registry. *International Union against Cancer* 85:325-329 (2000).

16. Naeem, M., N. Khan, Z. Aman, A. Nasir, A. Samad, & A. Khattak. Pattern of breast cancer: Experience at Lady Reading Hospital, Peshawar. *Journal of Ayub Medical College* 20(4): 22-25 (2008).
17. Hanif, M. P. Zaidi, S. Kamal, & A. Hameed. Institution-based cancer incidence in a local population in Pakistan: Nine-year data analysis. *Asian Pacific Journal Cancer Prevention* 10:227-230 (2009).
18. GOP. Punjab Development Statistic 2013, Bureau of Statistic, Govt. of Punjab, Lahore Pakistan (2013).
19. Ferlay, J., H. R. Shin, F. Bray, D. Forman, C. Mathers. & D. M. Parkin. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *International Journal of Cancer* 127(12): 2893-2917 (2010).
20. Anderson, G. L. & M. L. Neuhouser. Obesity and the risk for premenopausal and postmenopausal breast cancer. *Cancer Prevention Research* 5(4):515-521 (2012).
21. The Nation. *5000 admitted to hospitals in Pakistan daily.* Available: http://www.nation.com.pk/islamabad/01-Jun-2012/5000-admitted-to-hospitals-in-pakistan-daily (2012) [accessed 20 April 2014].
22. Webmd. (2013). Liver Cancer Causes, Survival Rate, Tumor Types, and More. Available: http://www.webmd.com/cancer/understanding-liver-cancer-basic-information. (Last accessed 10 Nov, 2013).
23. Hill, T.D., H.J. Khamis, J.E. Tyczynski & H.J. Berkel. Comparison of Male and Female Breast Cancer Incidence Trends, Tumor Characteristics and Survival *Annals of epidemiology* 15(10): 773-780. (2005).
24. Surveillance.cancer.gov. *Cancer Incidence Statistics - Surveillance Research Program*. [Online] Retrieved from: http://surveillance.cancer.gov/statistics/types/incidence.html [accessed: 4 Dec 2013].
25. Center, M.M. & A. Jemal. International trends in liver cancer incidence rates. *Cancer Epidemiology Biomarkers Prevention* 20(11): 2362-2368 (2011).
26. Khan, S.M., J. Gillani, S. Nasreen, and S. Zai. Cancer in north-west Pakistan and Afghan refugees. *Journal of Pakistan Medical Association* 47:122-124 (1997).