

## **Epidemiological indicators of Cancer in North Saudi Arabia: A population-based Survey**

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### **Abstract**

**Objective:** The objective of the present study was to find out the approximate epidemiology of cancer burden in the adults' population of Hail region, North KSA.

**Methodology:** A cross-sectional survey among 3326 Saudi civilians was conducted. A purposeful form was used to obtain cancer-related data.

**Results:** About 3281 participants had responded. Of the 3281(100%), respondents, 1057/3281 (32.2%) had relatives with cancer. The most common stated cancers were breast, leukemia, each (lung and stomach), colon, and cervix, representing, 261/1057 (24.7%), 198/1057 (18.7%), (101/1057 (9.6%)), 94/1057 (8.9%), and 79/1057 (7.4%), respectively.

**Conclusion:** The prevalence of cancer was higher among adults population in Hail Region, North KSA. The full burden of cancer in KSA still shadowy, since there no unique cancer registry.

**Keywords:** Cancer, Saudi Arabia, Relatives, Breast, Leukemia.

### **1.Introduction**

Cancers estimates amongst the leading causes of morbidity and mortality worldwide, with about 14 million new cases and 8.2 million cancer related deaths in 2012. [1] Lung, female breast, colorectal, stomach and cervical cancers were the most commonly diagnosed cancers, accounting for more than 40% of all cases. About 70% of all cancer deaths occurred in low- and middle-income countries.[2] More than 60% of world's total new annual cases occur in Africa, Asia and Central and South America.[1]

There are more than 12,000 new cancer cases per year in the kingdom of Saudi Arabia (KSA), with incidence rate of 52.3 per 100,000 and the overall age-standardized incidence is 82.1 per 100,000 populations. The most prevalent cancers among males are colorectal followed by non-Hodgkin lymphoma, leukemia, lung and liver, hence among females; breast cancer is most prevalent,

followed by thyroid, colorectal, non-Hodgkin lymphoma and leukemia. Most of these cases present with advanced stages of the disease, with regional or distant spread. [3,4]

Cancer can be reduced and controlled by implementing evidence-based strategies for cancer prevention, early detection of cancer and management of patients with cancer. Many cancers have a high chance of cure if detected early and treated adequately.

However, due to the lack of data on the geographic distribution of cancer among Saudi civilian in different regions of KSA, our aim in this study was to investigate and describe the relatively non-specific burden of cancer by providing an observational epidemiological analysis of cancer depending on virtual individual reporting.

## 2. Materials and Methods

### 2.1 Study Design

This is a prospective descriptive study which was conducted in Hail region, KSA, to investigate and describe the relatively non-specific burden of cancer.

### 2.2 Methodology

In this community-based cross-sectional survey, data were collected as a part of cancer awareness companion that conducted during one year activity in Hail Region, north KSA. People were assembled in different centers (Health centers, Educational centers etc.), for the delivery of the program, they were then asked to fill a form about cancers, which approximately affected one of their first, second or third degree relatives (Cancer confirmation was based on previous cancer treatment at known cancer treatment center. A first-degree relative is defined as a close blood relative who includes the individual's parents, full siblings, or children. A second-degree relative is defined as a blood relative who includes the individual's grandparents, grandchildren, aunts, uncles, nephews, nieces or half-siblings. A third-degree relative is defined as a blood relative who includes the individual's first-cousins, great grandparents or great grandchildren.

### 2.3 Statistical analysis

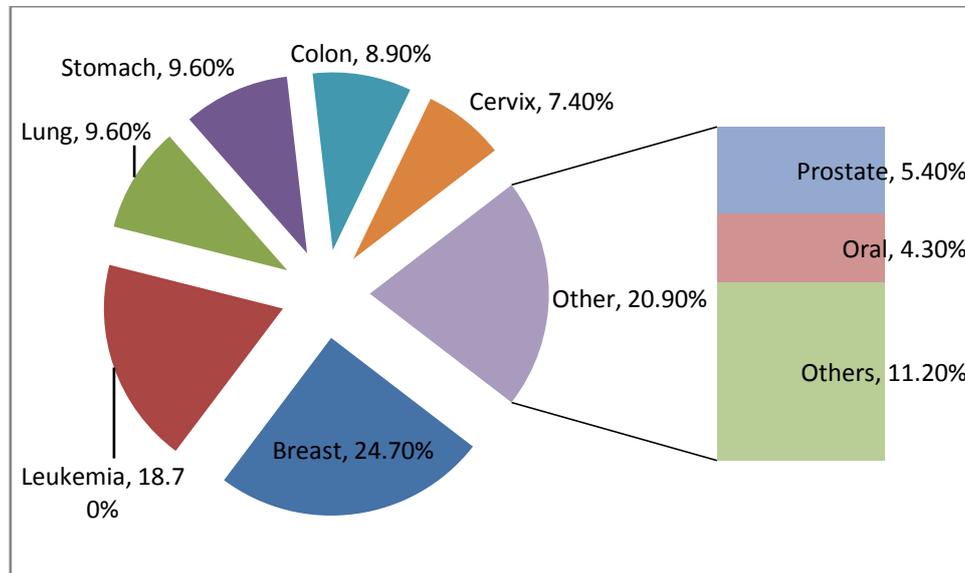
Statistical analysis was performed by proportion. SPSS software (version 16) was used for statistical analysis.

### 2.4 Ethical Consent

A written informed consent was obtained from each respondent, ensuring strict anonymity. The Ethical Committee of the Department of Clinical Laboratory Science, at College of Applied Medical Science, University of Hail, has approved the study protocol.

## 3. Results

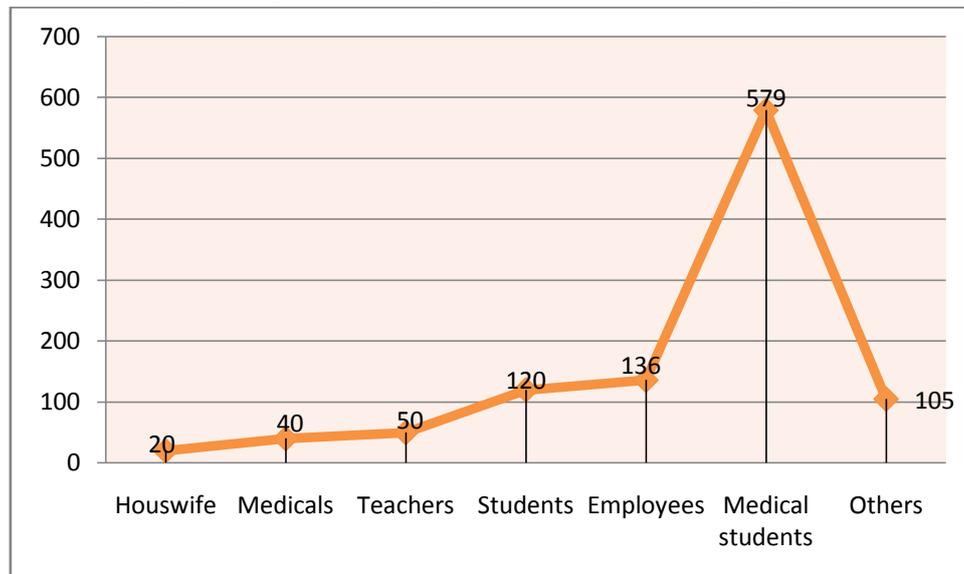
The preset study involved 3326 Saudi volunteers of whom 3281/3326 (98.6%) have responded to participate in the survey. Of the 3281 respondents, 1057/3281 (32.2%), have appealed that they have relatives with history of cancer. History of specific cancer was available for 947 specific types of cancer. The most encountered stated cancers were breast, leukemia, each (lung and stomach), colon, cervix, prostate, oral and other scattered cancers representing, 261/1057 (24.7%), 198/1057 (18.7%), (101/1057 (9.6%)), 94/1057 (8.9%), 79/1057 (7.4%), 57/1057 (5.4%), 45/1057 (4.3%) and 121/1057 (11.2%), respectively.



**Figure1:Description of the history of cancer by specific cancer type**

Of the 1050 participants with positives pointers, 450 were males and 600 were females. Furthermore, 579/1050 (55%) were medical students, 136/1050(13%) were employees, (120/1050(11.4%) were students, 50/1050 (4.8%) were teachers and 40/1050(3.8%) were medicals as indicated in Figure 2.

However, when we asked these people what does cancer mean, 950/1050 (90.5%), have answered the question. Of the 950 participants, 397/950(41.8%), have answered that cancer means death, 169/950 (17.8%) means depression and the remaining 384/950(40.4%) have varying answers.



**Figure 2: Description of the study population by Occupation and report of a history of relative with cancer**

#### 4. Discussion

The complete burden of cancer in KSA still need more consideration due to the lack of enough data in the literature regarding the matter, particularly in the regions that don't possess oncology centers like the situation in Hail. This leads to the fact that, data was only available at the centers that offer oncology services. Therefore, in the present study we tried to find out the approximate burden of cancer, during community based survey aiming at raising public awareness towards cancer. The overall percentage of those with relatives having cancer is terrifyingly showing gigantic burden of cancer in Hail and might be the same in the other parts of the country. However, cancer prevalence greatly varies for the different countries, according to the presence of particular risk factors, such as environmental exposure to carcinogens and the mode of life style practiced. It is well well-known that, more than 30% of cancer deaths could be prevented by modifying or avoiding certain risk factors, such as, tobacco and alcohol use, being overweight or obese, unhealthy diet with low fruit and vegetable intake, lack of physical activity, sexually transmitted viral infections, urban air pollution, and indoor smoke from household use of solid fuels.[5-7]In view of that, and due to the absence of such study that evaluated the burden of cancer likewise, we can only say that the prevalence of cancer is expected to be very high according to our general judgment. The discussion within inside each cancer type may be more effective, since these cancers to some extent were individually studied. However, possibility of specific changes in molecular signature among cancer patients of diverse ethnic groups remains largely unexplored.

Breast cancer is a major cause of morbidity and mortality in women worldwide. In this study, the highest percentage was registered for the breast cancer (24.7%), which was previously reported in several studies as a female leading cancer [8,9] and as the most commonly diagnosed cancer in KSA due to the lack of breast screening in a country where health services are provided free of charge to the population.[10]Breast cancer incidence rates are increasing at a worrying speed among Saudi females. Most molecular genetic discoveries on breast cancer and other cancers have risen from studies investigating European and American patients. Earlier reports have showed that patients with breast cancer who are from the Eastern Province of Saudi Arabia have a different gene expression profile from that known for their age-matched North American population. In a study, breast tumor samples from Canadian and Saudi patients were screened for known and unknown mutations within BRCA1 and BRCA2 as well as 21 additional genes, which have been involved in breast and ovarian cancer predisposition. A total of 129 non-synonymous mutations were identified by Ion Torrent amplicon sequencing. Forty-one mutations in 18 genes were unique to the Canadian population and 59 mutations in 20 genes were unique to the Saudi population. A total of 55/129 unique mutations in 22 genes were not formerly reported in the database. Twenty-nine mutations in 16 genes were shared to both populations; one of these mutations was not previously reported in the database. The most repeatedly mutated gene in both populations was the BRCA2 gene, followed by BRCA1 and TP53. Exclusive in these results is that the identification of mutations frequently found in the Saudi populations that are rare in the Canadian population.[11]

The second most frequent cancer encountered in this study with high percentage is leukemia (18.7%). Leukemias are a common malignancy of blood cells evolving from different cell types.[5,12]

Acute lymphoblastic leukemia (ALL) is the most common cancer frequently diagnosed in children which represents about 25% of cancer diagnoses among those younger than 15 years of age.[13]The most common cancers in the West (lung, colon, and prostate) were found to be considerably less frequent in KSA while leukemia, lymphoma and thyroid cancers were more common. Non-Hodgkin Lymphoma (NHL) categorized as 3<sup>rd</sup>most common cancer with age-adjusted incidence of 6/100,000. The estimated age adjusted mortality was 4/100,000 in KSA. There was a peak increase in incidence of lymphoma in 1997-2007. Most common NHL was diffuse large B cell lymphoma at King Faisal Specialist Hospital and Research Centre (KFSH&RC). A total of 434 cases were diagnosed in 5 years with 55% of them at advanced stage and 35% representing massive disease and high risk. KFSH&RC registered 35% of Hodgkins and 21% of total NHL identified in the whole Saudi Cancer Registry, 2009.[14]

However, all other figures mentioned in these studies have a particular indication within certain population. There are other means of such non-specific judgment of the relationship between a disease and a particular population with definite geographical or ethnical entities. Studies of the geographic variations in cancer epidemiology have confirmed valuable for creating and evaluating etiologic hypotheses regarding cancer causation.[15,16] One method that has been chiefly useful in medical geographic research is spatial autocorrelation. Spatial autocorrelation can be defined as a state in which the value of a variable at an identified geographic setting depends on its values at adjacent locations.[17]

However, little is known about the geographic distribution of the commonest cancers in KSA. In a study explored the spatial incidence patterns of the commonest cancers in KSA using spatial autocorrelation analyses, employing the global Moran's *I* and Anselin's local Moran's *I* statistics to identify non-random incidence patterns. Global ordinary least squares (OLS) regression and local geographically-weighted regression (GWR) were used to inspect the spatial correlation of cancer incidences at the city level. Population-based records of cancers diagnosed between 1998 and 2004 were employed. Male lung cancer and female breast cancer displayed positive statistically significant global Moran's *I* index values, indicating a leaning toward

clustering. The Anselin's local Moran's *I* analyses exposed small significant clusters of lung cancer, prostate cancer and Hodgkin's disease among males in the Eastern region and significant clusters of thyroid cancers in females in the Eastern and Riyadh regions. Moreover, both regression methods found significant links among various cancers. For example, OLS and GWR showed significant spatial associations among NHL, leukemia and Hodgkin's disease ( $r^2 = 0.49-0.67$  using OLS and  $r^2 = 0.52-0.68$  using GWR) and between breast and prostate cancer ( $r^2 = 0.53$  OLS and  $0.57$  GWR) in KSA cities. These findings may help to generate etiologic hypotheses of cancer causation and ascertain spatial anomalies in cancer incidence in KSA. These findings should stimulate further inquiries on the potential causes underlying these clusters and associations.[18]

## References

- [1] WHO. World Cancer Report 2014. Available at: <http://www.who.int/mediacentre/factsheets/fs297/en/>
- [2] GLOBOCAN 2008. Cancer facts sheet. Prostate Cancer Incidence and Mortality Worldwide in 2008. Available at: <http://globocan.iarc.fr/factsheets/cancers/prostate.asp>
- [3] Al-Zahrani A, Baomer A, Al-Hamdan N, Mohamed G. Completeness and validity of cancer registration in a major public referral hospital in Saudi Arabia. *Ann Saudi Med.* 2003; 23(1-2):6-9.
- [4] Ministry of Health. Cancer incidence and survival report, Saudi Arabia. Riyadh: Ministry of Health, National Cancer Registry; 2007. Available at: [www.scr.org.sa/reports/SCR2007.pdf](http://www.scr.org.sa/reports/SCR2007.pdf). Accessed March 28, 2012.
- [5] Ahmed HG, Osman SI, Ashankyty IM. Incidence of Epstein-Barr virus in pediatric leukemia in the Sudan. *Clin Lymphoma Myeloma Leuk.* 2012; 12(2):127-31.
- [6] Ahmed HG. Etiology of oral cancer in Sudan. *J Oral Maxillofac Res* 2013; 4(2):e3.
- [7] Ahmed HG and Rezgalla TM. A Study of Lung Epithelial Atypia in Regard to the Effect of Smoking and Traffic-Related Air Pollution in Sudan. *The Open Lung Cancer Journal*, 2010; 3:1-6.
- [8] Ahmed HG, Musa RM, Eltybe MM and Hussein MOM. Role of Some Risk Factors in the Etiology of Breast Cancer in the Sudan. *The Open Breast Cancer Journal*, 2010; 2:71-78.
- [9] Elnour AM, Elderbery AY, Mills J, Mohammed BA, Elbiabdelaal D, Mohamed AO, et al.

- BRCA 1 & 2 mutations in Sudanese secondary school girls with known breast cancer in their families. *Int J Health Sci (Qassim)*. 2012; 6(1):63-71.
- [10] El Bcheraoui C, Basulaiman M, Wilson S, Daoud F, Tuffaha M, AlMazroa MA, et al. Breast Cancer Screening in Saudi Arabia: Free but Almost No Takers. *PLoS One*. 2015; 10(3): e0119051.
- [11] Amemiya Y, Bacopulos S, Al-Shawarby M, Al-Tamimi D, Naser W, Ahmed A, et al. A Comparative Analysis of Breast and Ovarian Cancer-related Gene Mutations in Canadian and Saudi Arabian Patients with Breast Cancer. *Anticancer Res*. 2015; 35(5):2601-10.
- [12] TapioManninen, HeikkiHuttunen, PekkaRuusuuvuori, and MattiNykter. Leukemia Prediction Using Sparse Logistic Regression. *PLoS One* 2013; 8(8): e72932
- [13] Yacoub HA, Mahmoud WM, El-Baz HA, Eid OM, El-Fayoumi RI, Mahmoud MM, et al. New haplotypes of the ATP synthase subunit 6 gene of mitochondrial DNA are associated with acute lymphoblastic leukemia in Saudi Arabia. *Asian Pac J Cancer Prev*. 2014; 15(23):10433-8.
- [14] Rauf MS, Akhtar S, Maghfoor I. Changing Trends of Adult Lymphoma in the Kingdom of Saudi Arabia - Comparison of Data Sources. *Asian Pac J Cancer Prev*. 2015; 16 (5):2069-2072.
- [15] Glick B. The spatial autocorrelation of cancer mortality. *Soc. Sci. Med. Med. Geogr*. 1979; 13:123–130.
- [16] Mayer JD. The role of spatial analysis and geographic data in the detection of disease causation. *Soc. Sci. Med.* 1986; 17:1213–1221.
- [17] Rosenberg MS. The bearing correlogram: A new method of analyzing directional spatial autocorrelation. *Geogr. Anal.* 2000; 32:267–278.
- [18] Al-Ahmadi K and Al-Zahrani A. Spatial Autocorrelation of Cancer Incidence in Saudi Arabia. *Int J Environ Res Public Health* 2013; 10(12): 7207–7228.